Soil Regolith Stability Classification for State Forests in Eastern New South Wales

Technical Report No. 41

Casey Murphy[1]
Peter Fogarty[2]
Philip Ryan[3]

[1]NSW Department of Land and Water Conservation, Gosford
[2]NSW Department of Land and Water Conservation, Queanbeyan
[3]CSIRO Forestry and Forest Products, Canberra

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Department of Land and Water Conservation
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Phone: 02 9228 6415 email: infocentre@dlwc.nsw.gov.au

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Section 1: The Classification and Mapping of Soil Regolith Stability

Introduction

This report documents the results of a project to map the *soil regolith stability* classes in State forests of eastern NSW. Soil regolith stability is an expression of combined soil and substrate erodibility and sediment delivery potential. It is required as one of the input variables to the soil erosion and water pollution hazard assessment for the Environment Protection Authority (EPA) 1998/99 Pollution Control Licence for State Forests' logging operations. The hazard assessment framework has been cooperatively developed by the EPA, the Department of Land and Water Conservation (DLWC) and NSW State Forests.

The concept of soil regolith stability was proposed by Ryan (1996) to focus the classification of soils and parent materials into classes that relate directly to hazard associated with logging operations. This classification system incorporates knowledge about the erosive response of soils to logging operations derived from both field experience and from research, with data on soil regolith properties and distribution.

Background

In December 1996, EPA convened an expert panel[1] to review and if appropriate, revise the existing soil erosion and water pollution hazard assessment system which was based on the Universal Soil Loss Equation (USLE) (Rosewell and Edwards 1993). The expert panel developed a new system comprising a set of matrices which combine the principal variables that influence the erosion and sediment delivery process. These are rainfall energy, slope gradient, soil stability and the nature of disturbance associated with a particular operation. The soil regolith stability classification as proposed by Ryan (1996) feeds directly into the matrices for assessing erosion and water pollution hazard.

The need for a new classification of soil stability reflects the lack of an appropriate quantitative predictor of forest soil erodibility. The USLE soil erodibility factor, K, has been shown by field experience in many situations to relate poorly to the behaviour of forest soils. The K factor relates specifically to the detachment of soil through sheet and rill erosion and not other processes of erosion, most notably gully erosion. The K factor also does not account for susceptibility of soil material to transport and delivery to receiving waters. The new concept of soil regolith stability overcomes these shortcomings by using expert assessment to relate the soil regolith stability classes to observed soil behaviour in the field. The concept has two components, coherence and sediment delivery potential, to reflect the duel requirement of the system to assess both soil erosion and water pollution hazard.

A further advantage of the soil regolith stability approach is to change the scale of the initial determination of erosive resistance and sediment delivery potential from that of a soil sample to broader scales more appropriate for planning. It is equivalent in scale to the landform pattern of Speight (1990). In the previous USLE based hazard assessment system, considerable effort was frequently expended in field sampling and/or laboratory analysis on a theoretically representative set of samples in an attempt to determine a K value at the compartment scale. The new approach permits an initial, broader scale assessment which incorporates experience and knowledge of soil behaviour for the particular landscape unit from a range of similar sites. Subsequent site assessment at the harvest planning stage will verify the accuracy of the broader scale soil regolith stability classification for particular logging compartments and describe significant variability at a more localised scale.

[1] see appendix 1 for a listing of the membership of the expert panel

The soil regolith stability classification and the mapping program described below draws on concepts and field experience of Laffan *et al.* (1985; 1996); Brown and Laffan (1993); and Turner *et al.* (1990) who have adopted a similar broadscale stratification approach to the assessment of soil erosion and water pollution hazard associated with logging operations. The classification also incorporates knowledge derived from more detailed research into soil erosion and sediment delivery associated with logging. This includes a rainfall simulator-based study in south-east NSW (Croke *et al.*1997), instrumented hillslope studies in northern NSW (Lacey 1997) and modelling of gully erosion in plantations in south-east Queensland (Costantini *et al*. 1993).

Concepts

Table 1 presents the conceptual framework for the classification and broadly outlines the various soil regolith types that fall into each class. The table shows that the classification is a two by two matrix, giving four possible classes of soil regolith stability. This level of detail corresponds with that of the other input variables for the hazard assessment matrices and the overall requirement to ensure the practicality of the matrix approach.

Table 1: Conceptual framework of soil regolith stability classes

	Low sediment delivery	**High sediment delivery**
High Coherence	R1 High ferro-mangnesium soil regolith eg basalt, dolerite; Fine- grained argillaceous soil regolith with high gravel content eg siltstones, metasediments; Highly organic soil regolith eg peats.	R3 Fine-grained argillaceous (clay) soil regolith with low/no gravel contents; Fine-grained massive soil regolith.
Low coherence	R2 Unconsolidated sands; Medium to coarse-grained felspathic-quartzose soil regolith eg adamellite, quartz sandstone.	R4 Unconsolidated deposits of silt and clay; Unconsolidated fine-grained weathered soil regolith (saprolite).

Soil Regolith

There are numerous definitions of soil regolith in geological references. For the purposes of this classification, the simple, more inclusive definition of Speight and Isbell (1990) is considered suitable: "The mantle of earth and rock including rocks and sediments altered or formed by land surface processes is called *regolith*" (p164).

This includes both the soil as well as weathered parent materials and substrates down to hard bedrock. This is appropriate for forested land as large areas of forest are on steep slopes where the mantle conventionally regarded as soil is shallow, while the material with which forest operations is interacting may be considerably deeper.

For this classification and survey, soil regolith stability has been assessed to a depth of one metre. This depth is considered to include most of the material likely to be exposed in a logging operation.

Soil Regolith Coherence and Sediment Delivery Potential

Soil regolith stability comprises two components: i) coherence; and ii) sediment delivery potential.

Soil regolith coherence refers to the ability of the soil regolith to resist detachment due in particular to the erosive power of running water. Soil properties which have a strong influence on coherence are particle size composition, aggregate and matrix strength, penetration resistance and to some extent, matrix density. Soils which lack coherence are typically sandy soils in which there is low aggregate strength due to the lack of bonding agents or highly dispersive clay soils, such as solodics, in which both surface and subsoils are prone to physical collapse when wet.

Soil regolith sediment delivery refers to the potential for soil regolith to yield fine-grained (silt and clay) sediment that can be transported to receiving waters. Key physical properties influencing sediment delivery potential are particle size composition (including coarse fragment content), aggregate stability and the thickness of soil regolith with a high proportion of fine material.

Mapping Procedure

The mapping procedure reported here has been broadscale and has generated a set of maps to cover all of the state forests of eastern NSW. Field verification at the compartment level will still be required during the harvest planning stage, but it is anticipated that the information provided by the maps and this report will facilitate more effective use of resources in this field checking. This process contrasts with the previous USLE-based hazard assessment system which required a significant data collection exercise at the compartment scale before any assessment could be made. There have been three principal steps in the mapping and classification of soil regolith stability:

1. collation of existing soil and geology data and preliminary determination of the soil regolith stability class according to the classification guide (table 2). Approximately 50% of eastern NSW State forests are covered by soil landscape surveys or other detailed surveys with the remainder covered by soil surveys from Environmental Impact Statements or geological survey maps.

2. review of the preliminary soil regolith classification by local agency personnel with knowledge of field behaviour of the soils in their regions. This involved consultation with staff from State Forests, DLWC and EPA, and researchers from CSIRO and academic institutions. This step was crucial in order to incorporate knowledge of the erosive response of soils to forest operations, including harvesting, log dump and snig track construction and roading. It also permitted the incorporation of knowledge about soils derived from previous more intensive soil sampling and investigation such as has been carried out in softwood areas and for soil characterisation during the preparation of previous harvest plans. This step involved consultations in the office and some field inspection of compartments, road batters and any other sites which yielded evidence of soil behaviour.

3. final revision by field operatives of the collated set of maps of soil regolith stability classes for each management area.

The mapping has been greatly facilitated by geographic information system (GIS) technology which has permitted the rapid collation and interpretation of existing surveys into soil regolith stability maps and subsequent incorporation of changes resulting from consultations, field inspections and review.

Information Sources

This report is a compendium of existing information and data. The surveys on which the classification has been based include soil landscape surveys, soil surveys from Environmental Impact Statements for State forests and geological mapping.

Soil Landscape Surveys

Soil landscape surveys have been carried out by the soil survey unit of DLWC. The surveys are subject to close quality control and present a considerable amount of data which can be used in the soil regolith classification. This includes soil texture and structure, stone and gravel content,

aggregate stability, dispersion percentage and comments about erosion. Soil landscape surveys are generally carried out at the scale of 1:100 000 which provides a relatively high resolution of data for this broadscale classification project. In a few instances, the relevant soil landscape surveys have been completed at the scale of 1:250 000, meaning that the landscape units are more broadly defined and the level of data accuracy is less than for the 1:100 000 scale surveys. Soil landscape surveys are documented by both a published, internally refereed report and a map. In a number of instances, although the relevant surveys covering State forest are in draft form, they have still been utilised for this project.

Environmental Impact Statement Soil Surveys

Most State forests included in this report have been covered by Environmental Impact Statements undertaken since 1993. These assessments generally utilised existing soil data where it was available at the time of EIS preparation, but in a number of areas, new survey data was also collected. This was generally done at a scale of 1:250 000 and as a result, have larger, more variable map units than soil landscape maps. These maps vary in quality as controls and standards common to the DLWC soil landscape mapping program were not necessarily followed; however, most of these surveys include valuable data on soil texture, structure and colour as well as limited data on aggregate stability and dispersion percentage. They also usually describe existing erosion and provide an assessment of soil behaviour associated with logging operations.

Geology Maps

Geological surveys have been used to classify soil regolith stability where there was no form of soil survey available. This is a valid approach because soil properties are very strongly controlled by the parent material on which they have developed and soil landscape boundaries are often closely aligned with geological boundaries. The disadvantage of using geology mapping is that it lacks the specific details on soil properties desirable for classifying soil regolith stability. Table 2 provides guidance for interpreting likely soil regolith stability classes from geology.

In a number of areas, Parent Rock Code (Turner *et al*. 1990) mapping has been carried out at detailed scales which permit more accurate delineation of soil regolith stability classes. In the Tumut area in particular, where soil surveys are lacking, PRC maps have been developed at a scale of 1:25 000 and have been extensively ground-truthed in State forest areas.

Soil Regolith Classes and Field Behaviour

In order to determine the soil regolith stability class for each map unit derived from the data sources outlined above, the survey methodology required the incorporation of expert knowledge about the field behaviour of soils. Table 2 defines the four soil regolith classes in terms of field behaviour and details the range of key morphological properties that correspond to each class. The table indicates that no single soil property can be linked specifically to soil regolith stability, but rather a suite of properties influence or indicate soil behaviour including texture, stone and gravel content, soil structure, aggregate stability, depth, colour and drainage.

Class RI, low sediment delivery and high coherence soil regolith, represents stable soils and includes the strongly structured, freely drained, generally reddish and darkly coloured soils developed on basic volcanic lithology and, in higher rainfall zones, on many siliceous parent materials such as granodiorite, microgranite and sedimentary geologies. It also includes a range of soils in which high stone and gravel content greatly reduces sediment delivery potential and susceptibility to detachment. Class R1 soils show few signs of erosion and sediment movement. They are not prone to rill and sheet erosion on exposed surfaces and gully erosion is not generally evident. Regrowth of protective vegetation on exposed surfaces occurs within relatively short periods.

Class R2, low sediment delivery and low coherence soil regolith, includes materials which are sandy and weakly structured throughout, typically developed on coarser grained granites and adamellite, coarse-grained sedimentary rocks and some depositional materials. It also includes a small number of

soils which are fine textured with very strong structure, but weak inter-aggregate strength. These soils are characteristic of a number of ultrabasic volcanic rocks such as serpentenite and are comparable to the sandy soil regoliths in terms of field behaviour. The low inter-particle or inter-aggregate bonding strength means that detachment occurs readily when exposed; however sediment transport only occurs over relatively short distances and most sediment is retained near-source and not delivered to drainage lines.

Class R3, high sediment delivery and high coherence soil regoliths, has been applied to soils which have developed on a range of siliceous, medium to fine-grained volcanic and sedimentary rocks and also medium to fine-grained colluvial and alluvial material in some instances. These soils are weakly to moderately strongly structured with fine to medium-grained textures and include Yellow, Brown and Grey Podzolic Soils, and Red and Yellow Earths. The presence of higher clay content compared to Class R2 soils means that they have a higher degree of coherence and hence, greater resistance to detachment, but that erosion will generate material that is susceptible to transport well beyond the source and potentially into receiving waters. Class R3 soil, where exposed, may display common rilling, minor gully development in drainage lines and moderate incision along road gutters.

Class R4, high sediment delivery and low coherence soil regoliths, are highly unstable material formed commonly on unconsolidated medium to fine-textured colluvium and alluvium and on some highly weathered siliceous lithologies. These soils are generally sodic and highly dispersive and, therefore, lack coherence when wet. Soil detachment generates readily transportable sediment. Class R4 soil typically displays severe rill and sheet erosion on exposed surfaces such as road batters and snig tracks, and moderate to severe gullying in drainage lines.

It is important to note that the soil regolith stability classification assumes that, when assessing field behaviour, prescribed management practices are in place. Thus, differences between the field behaviour of the various soil regolith classes can be attributed to soil properties and not external factors such as uncontrolled runoff caused by poorly sited drainage control measures. Soil regolith stability should, therefore, be assessed from a range of sites and exclude soil behaviour which is directly attributable to inappropriate management practices.

Presentation

The outputs of the project are a set of maps of soil regolith stability classes that will be used for soil erosion and water pollution hazard assessments and in particular as part of the EPA 1998/99 Pollution Control Licence. The maps are supported by the compendium of soil data in Section 2 of this report, detailing the soil and/or geology units used to derive the soil regolith stability mapping.

The maps have been prepared at a scale of 1:100,000 and are stored on State Forests' GIS. At this scale, they show the underlying soil or geological unit boundaries. The maps have been reproduced at 1:300,000 scale for inclusion in this report. At this broad scale, however, it is not possible to show the underlying soil and geological map unit boundaries.

In order to account for significant variability within the mapped units, sub-dominant classes are shown in the accompanying compendium in brackets, such as 1(4) indicating that within the particular map unit, the soil regolith is predominantly stable (Class R1), but there are some areas which are highly unstable (Class R4) as might occur along drainage lines or be associated with particular bands of lithology. This designation provides important guidance for the site inspection and verification stage indicating that unstable soils may be present within the overall unit. At the broad level of survey carried out for this report, it is also likely that there will be localised occurrences that differ from the main soil regolith stability category. This variability should be accounted for during the site inspection associated with harvest plan preparation.

Section 2 of this report presents a compendium of the soil and geology units which make up the various soil regolith stability classes and briefly outlines the basis for allocating each soil or geology

unit into either of the four soil regolith stability classes. This data is presented under the following headings:

Map Unit: the code which describes the map unit in its source document or survey;

Reference: the source of the map unit which represents the most up-to-date mapping available. In some cases, this may refer to material which is yet to be published;

Summary: a short description of the unit in terms of the features which are most important for determining soil regolith stability. This includes, where possible, texture, structure, aggregate stability, dispersibility, soil type and any other relevant properties;

Comments: observations on field behaviour and distribution, mostly from the field operatives, that support the classification into one of the four soil regolith stability classes;

Soil Regolith Stability Class: the Soil Regolith Stability Class most applicable to the map unit, as indicated by Tables 1 and 2 of this Report. Where there is significant local variability, a dominant and sub-dominant class is shown thus: 1(4). While this latter grouping cannot be shown on broadscale maps which are in this report, they will be shown on the more detailed maps to be used for harvest planning.

A glossary of the technical terms used in the report is presented in Appendix 2. The terminology used to describe soil types in this report is that of the Great Soil Groups (Stace *et al*. 1972) as it is the most widely used in the surveys upon which this report is based. Table 2 indicates equivalent Australian Soil Classification (Isbell 1996) terminology.

Table 2: Soil Regolith Stability Classification Guide

Soil Regolith Stability Class	Soil Field Behaviour	Soil Regolith Criteria	Soil Types[2]
Class R1 High coherence soils with low sediment delivery potential	Stable soils with no appreciable erosion. Generally well-drained, permeable soils. Earth batters stable. No or little general evidence of coarse or fine sediment movement.	Extensive rock outcrop. Very stony or very gravelly well-armoured soils, well-drained, often occurring on ridgelines and steep slopes. Variety of soils including fine-grained sediments and metasediments, fine grained volcanics. Strongly structured, freely draining soils, generally non-slaking and non-dispersible. Generally reddish coloured subsoils without a pronounced A2 horizon. Includes iron-rich soils from sedimentary and mafic volcanic rocks and highly weathered granodiorites and microgranites in high rainfall areas. Highly organic soils, very resistant to erosion and generally associated with swamps.	Lithosols (Tenosols, Rudosols). Lithosols (Tenosols, Rudosols), stony and gravelly Podzolic Soils (Kurosols). Krasnozems (Red Ferrosols), Xanthozems (Dermosols), Chocolate Soils (Brown Ferrosols), Red Podzolic Soils (Red Kurosols), Structured Red Earths (Dermosols). Peats (Organosols, Tenosols).
Class R2 Low coherence soils (when wet) with low sediment delivery potential	Sandy soils which, when exposed, commonly exhibit sheet wash and evidence of coarse sediment movement such as sediment fans at drain outlets and in gutters. Little sediment transport into drainage network.	Coarse sandy soils often derived from coarse-grained and quartz-rich sandstones, conglomerates, volcanics, granites and adamellites. High sand content and little clay and silt content throughout profile. Sandy or earthy fabric. Unconsolidated coastal and aeolian sands and sandy colluvium.	Siliceous Sands (Rudosols, Tenosols), Podzols (Podosols), Earthy Sands (Tenosols), some sandy Yellow Earths (Kandosols) and sandy, Yellow Podzolic Soils with stable clay subsoils (Kurosols). As above.
Class R3 High coherence soils with high sediment delivery potential.	Clayey and silty soils which are liable to sheet erosion. Typically slowly permeable and drainage generally impeded. Earth batters and exposed surfaces subject to minor to moderately extensive rilling and minor slumping. Minor gully erosion may develop in drainage lines and incision may occur along road drains. Localised films of fine sediment at drain outlets and in drainage lines.	Soils formed on fine grained acid volcanics, metasedimentary and sedimentary rocks. Duplex soils with clay or silty B horizon, slowly permeable, weakly to moderately structured, often with a pronounced A2 horizon. B horizons usually yellow or grey to light brown colours, commonly mottled. Tendency to slake but not highly dispersible. Weakly to moderately structured soils, with silty to clay textures and gradational to uniform texture profiles. Tendency to slake but not highly dispersible. Hardsetting when dry but often boggy when wet. Developed on colluvial/alluvial surfaces, range of fine grained highly weathered siliceous rocks and some basic and intermediate volcanic lithologies such as trachyte.	Brown, Yellow and Grey Podzolic Soils and non-dispersible Soloths (Kurosols). Red Earths and Yellow Earths (Kandosols).
Class R4 Low coherence soils (when wet), with very high fine sediment delivery potential.	Unstable, dispersible soils which are prone to severe sheet and rill erosion and to gully erosion. Rilling and/or slumping common on batters and gully erosion common in drainage lines and along road drains. Snig tracks display frequent rill erosion. Drainage lines show extensive fine sediment films.	Clay or silt textured soils, highly dispersible. Massive to coarsely structured, frequently sodic. Often have bleached surface horizon. May include duplex soils with sandy non-coherent surface over unstable clay subsoil. Generally found on lower slopes and low undulating terrain associated with weathered colluvium and alluvium or siliceous rocks.	Soloths, Solodic and Solodized Solonetzic (Sodosols), some No Suitable Group (eg sodic deep silty soils).

[2]Great Soil Groups (Stace *et al*. 1972) with Australian Soil Classification (Isbell 1996) in brackets.

References

Abraham, S.M. and Abraham, N.A. (eds) 1996, *Soil Data System Site and Profile Information Handbook*, 2nd edn, Dept. of Conservation and Land Management, Sydney.

Atkinson, G. (in prep) *Soil Landscapes of the Kempsey-Korongoro Point 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Barnes, R.G. and Herzberger, G.A. 1975, *Bega 1:250 000 Metallogenic Map,* Geological Survey of NSW, Sydney.

Abel, R. (in prep.) *Part Yarrangobilly 1:100,000 Geological Map*, AGSO, Canberra.

Basden, H. and Smart, K.G. 1990, *Tumut 1:100,000 Geological Map*, Department of Minerals and Energy, Sydney.

Bates, R.L. and Jackson, J.A. (eds) 1984, *Dictionary of Geological Terms*, 3rd edn, prep. by American Geological Institute, Anchor Press, New York, USA.

Brown, M. and Laffan, M. 1993, *Forest Soils Conservation Manual*, Forestry Commission of Tasmania.

Bureau of Mineral Resources, 1964, *Canberra 1:250 000 Geological Map*, Bureau of Mineral Resources, Canberra.

Costantini, A., Dawes, W., O'Loughlin, E. and Vertessey, R. 1993, 'Hoop Pine Plantation Management. 1. Gully Erosion Prediction and Watercourse Classification', *Aust. J. Soil and Water Cons.* 6: pp35-39.

Croke, J., Hairsine, P., Fogarty, P., Mockler., and Brophy, J. 1997, *Surface Runoff and Sediment Movement on Logged Hillslopes in the Eden Management Area of Southeastern NSW*, Report 97/2, CRC for Catchment Hydrology.

Emerson, W.W. 1967, 'A Classification of Soil Aggregates Based on Their Stability in Water', *Aust. J. Soil Res*. 5: pp47-57.

ERM Mitchell McCotter Pty. Ltd., 1995, *Soils Report, Walcha/Nundle and Styx River Management Areas EIS, Supporting Document No. 5*, State Forests of NSW, Pennant Hills.

ERM Mitchell McCotter, 1995, *Morisset Forestry Environmental Impact Statement, Soils Report, Morisset Forestry District EIS, Supporting Document No. 1*, State Forests of NSW, Pennant Hills.

Geological Survey of NSW, 1966, *Newcastle 1:250 000 Geological Map*, Department of Mines, Sydney.

Geological Survey of NSW, 1966, *Wollongong 1:250 000 Geological Map*, Department of Mines, Sydney.

Geological Survey of NSW, 1966, *Wagga Wagga 1:250 000 Geological Map*, Department of Mines, Sydney.

Geological Survey of NSW. 1998, *Wagga Wagga 1:250,000 Geological Map (Provisional),* NSW Department of Mineral Resources, Sydney.

Gilligan, L.B., Brownlow, J.W., and Cameron, R.G. 1987, *Tamworth-Hastings 1:250 000 Metallogenic Map*, NSW Geological Survey, Sydney.

Gilligan, L.B., Brownlow, J.W., Cameron, R.G. and Henley, H. 1992, *Dorrigo-Coffs Harbour 1:250 000 Metallogenic Map*, NSW Geological Survey, Sydney.

Hazelton, P.A. 1992, *Soil Landscapes of the Kiama 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

Henderson, L.E. (in prep.) *Soil Landscapes of the Dungog 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Hird C. 1991, *Soil Landscapes of the Goulburn 1:250 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Hird and Associates, 1994, 'Classification of Soils and Erosion Hazard and Description of Soil Landscapes', in *Environmental Impact Statement, Eden Management Area, Appendix 11*, State Forest of NSW, Pennant Hills.

Hird and Associates, (unpub) *Soil Regolith Stability Classification Coffs Harbour-Urunga Soil Landscapes*, Consultancy for State Forests of NSW, Pennant Hills.

Houghton, P. and Charman, P.E.V. 1986, *Glossary of Terms used in Soil Conservation*, Soil Conservation Service of NSW, Sydney.

Isbell, R.F. 1996, *The Australian Soil Classification,* Australian Soil and Land Survey Handbook Series, CSIRO Publishing, Collingwood.

Jenkins, B. R. 1993, *Soil Landscapes of the Michelago 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

Jenkins, B. R. 1996, *Soil Landscapes of the Braidwood 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

King D.P. 1993, *Soil Landscapes of the Wallerawang 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

King D.P. 1994, *Soil Landscapes of the Katoomba 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

Kovac, M. and Lawrie, J.W. 1991, *Soil Landscapes of the Singleton 1:250 000 Sheet,* Soil Conservation Service of NSW, Sydney.

Kovac M., Murphy B.M. and Lawrie J.W. 1990, *Soil Landscapes of the Bathurst 1:250 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Lacey, S.T. 1997, 'Soil Erosion and Runoff Measurement on Steep Forest Sites in Northern NSW', *Proc. Erosion in Forests Workshop, Bermagui, NSW*, CRC for Catchment Hydrology.

Laffan, M., McQueen, G.J., Churchman, G.J. and Joe, E.N. 1985, 'Soil Resources of the Marlborough Sounds and Implications for Exotic Pine Production', *New Zealand J. Forestry* 30: pp70-86.

Laffan, M.D. 1996, 'A Methodology for Assessing the Erodibility of Tasmanian Forest Soils', *Aust J. Soil and Water Cons.* 9: pp16-22.

Matthei, L. E. 1995, *Soil Landscapes of the Newcastle 1:100 000 Sheet,* Department of Land and Water Conservation, Sydney

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. 1990, *Australian Soil and Land Survey Field Handbook*, 2nd edn, Inkata Press, Melbourne.

McIlveen, G. 1973, *Ulladulla 1:250 000 Metallogenic Map*, Geological Survey of NSW, Sydney.

Milford, H.B. 1996, *Soil Landscapes of the Dorrigo 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Milford, H.B. (in prep) *Soil Landscapes of the Coffs Harbour 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney

Murphy, C.L. 1993, *Soil Landscapes of the Gosford-Lake Macquarie 1:100 000 Sheet*,. Department of Conservation and Land Management, Sydney.

Murphy, C.L. 1995, *Soil Landscapes of the Port Stephens 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney

Murphy, C.L. (in prep.) *Soil Landscapes of the Bulahdelah/Forster 1:100 000 Sheets*, Department of Land and Water Conservation, Sydney.

Morand, D.T. 1994, *Soil Landscapes of the Lismore-Ballina 1:100 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Morand, D.T. 1996, *Soil Landscapes of the Murwillumbah-Tweed Heads 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Northcote, K.H. 1979, *A Factual Key for the Recognition of Australian Soils*, 4th edn, Rellim Technical Publications, Glenside, SA.

Owen, M., Wyborn, D. and Salter, J. 1979, *Brindabella 1:100 000 Geological Map*, Bureau of Mineral Resources, Canberra.

Regional and Resource Conservation Assessment Council, 1996, 'Geological Units of the Upper North East Region' in *Volume 2, Physical Attributes, Regional Report of Upper North East New South Wales*, Regional and Resource Conservation Assessment Council, Sydney

R.L. Newman and Partners, 1995, *An Assessment of the Soils of the Queanbeyan and Badja Management Areas, Queanbeyan and Badja Management Areas EIS, Supporting Document 1*, State Forests of NSW, Pennant Hills.

Rosewell, C.J. and Edwards, K. 1993, *SOILOSS - A Program to Assist in the Selection of Management Practices to Reduce Soil Erosion*, Technical Handbook No. 11, Soil Conservation Service of NSW, Sydney.

Ryan, P.J. 1990, *State Forests 1:25,000 Parent Rock Code Mapping*, Forestry Commission of NSW, Pennant Hills[3].

Ryan, P.J. 1996, *A Review of Land Evaluation and Other Procedures to Assess Soil Erosion and Water Pollution Hazard for Logging Operations*, Consultancy Report for NSW Environment Protection Authority.

Speight, J.G. 1990, 'Landform', in R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker, and M.S. Hopkins, *Australian Soil and Land Survey Field Handbook*, 2nd edn, Inkata Press, Melbourne.

Speight, J.G. and Isbell, R.F. 1990, 'Substrate', in R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker, and M.S. Hopkins, *Australian Soil and Land Survey Field Handbook*, 2nd edn, Inkata Press, Melbourne.

Stace, H.C.T., Hubble, G.D., Brewer, R., Northcote, K.H., Sleeman, J.R., Mulcahy, M.J. and Hallsworth, E.G. 1968, *A Handbook of Australian Soils,* Rellim Technical Publications, Glenside, SA.

Tulau, M. J. 1994, *Soil Landscapes of the Cooma 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

Tulau, M.J. 1997, *Soil Landscapes of the Bega-Goalen Point 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Cobargo 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Eden-Green Cape 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Narooma 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Turner, J., Thompson, C.H., Turvey, N.D., Hopman, S.P. and Ryan, P.J. 1990, 'A Soil Technical Classification for Pinus radiata Plantations 1. Development of the Classification', *Aust. J. Soil Res.* 28: pp797-811.

Veness and Associates Pty Ltd, 1992, 'Soil Report', in Minidis Roberts Consultants (compliers), *Glen Innes Forestry Management Area, Environmental Impact Statement Supporting Papers*, State Forests of NSW, Pennant Hills.

[3]parent rock code mapping is derived from all of the other geological references for the region.

Veness and Associates, 1992, 'Soil Landscape Mapping and Erosion Report' in Truyard Pty Ltd (complier) *Environmental Impact Statement Vol 2 - Appendices, Wingham Management Area, Proposed Forest Management*, Forestry Commission of NSW.

Veness and Associates Pty Ltd, 1993, 'Soil Report', in Truyard Pty Ltd (compiler) *Environmental Impact Statement Vol 2 - Appendices, Kempsey/Wauchope Management Areas*, Forestry Commission of NSW.

Veness and Associates, 1994, *Soils Report, Casino and Murwillumbah Management Areas EIS, Supporting Document No. 8*, State Forests of NSW, Pennant Hills.

Veness and Associates Pty Ltd, 1994, *Soils Report, Grafton Management Area EIS, Supporting Document No. 3*, State Forests of NSW, Pennant Hills.

Veness and Associates Pty Ltd, 1994, *Soil Report, Tenterfield Management Area EIS, Supporting Document No. 1*, State Forests of NSW, Pennant Hills.

Veness and Associates, 1994, *Soil Report, Urbenville Management Area EIS, Supporting Document 1*, State Forests of NSW, Pennant Hills.

Veness and Associates Pty Ltd, 1995, *Soils Report, Gloucester and Chichester Forest Management Areas EIS Study, Supporting Document No.1*, State Forests of NSW, Pennant Hills.

Wood, J.E.T. 1994, *Urunga - Coffs Harbour Forestry Land Resources Study, Coffs Harbour-Urunga Management Area EIS Supporting Document 2,* (3 Volumes), State Forests of NSW, Pennant Hills.

Wyborn, D., Owen, M. and Wyborn, L. 1990, *Geology of the Kosciusko National Park-1:250,000 Map*. Bureau of Mineral Resources, Canberra.

Appendix 1: Membership of EPA Expert Panel on Forest Erosion and Water Pollution Hazard Assessment

Joanne Walsh	Environment Protection Authority
Steve Beaman	Environment Protection Authority
Col Rosewell	Department of Land and Water Conservation
Peter Fogarty	Department of Land and Water Conservation
Steve Lacey	State Forests
Rob Towler	State Forests
Steve Dodds	State Forests
Phil Ryan	CSIRO, Division of Forestry and Forest Products
Neil McKenzie	CSIRO, Division of Land and Water
Peter Hairsine	CSIRO, CRC for Catchment Hydrology
Jacky Croke	CSIRO, CRC for Catchment Hydrology
John McGarity	Independent Soil Scientist
Cathy Hird	NSW Agriculture
Tony Costantini	Queensland Department of Primary Industry, Forestry Research Unit

Appendix 2: Glossary of Technical Terms

For more extensive definitions of soil science terms, see Abraham and Abraham (1996), Houghton and Charman (1986) and McDonald *et al* (1984) and Northcote (1979). ASC names follow Isbell (1996) and GSG names follow Stace *et al* (1968). For more extensive difinitions of geological terms see Bates and Jackson (1984).

A horizon-- The original top layer of mineral soil divided into A_1 (typically from 5 to 30 cm thick; generally referred to as topsoil with a high content of organic matter, dark colour and maximum biological activity) and A_2 horizons (usually 5 to 70 cm thick; similar texture to A_1 but paler in colour, poorer in structure and less fertile).

Acid Peats-- GSG classification-- These soils show little horizon development, their main feature being the accumulation of a surface horizon of almost black, strongly acid, peaty organic matter which is maintained near saturation with water. The peat is generally well decomposed and sticky, but significant amounts of fibrous roots and partly decomposed plant remains occur near the surface. The lower part is commonly clayey or gravelly grading into the underlying mineral material.

acid sulfate soils-- Pyrite-rich marine clays, muds and sands that have become extremely acid following exposure or drainage as sulfur compounds are oxidised and converted to sulfuric acid.

acid volcanics-- General term for volcanic igneous rocks that contain more that 66% silica (SiO_2), (e.g., rhyolite), or more generally, composed predominantly of light-coloured minerals.

acidic -- Descriptive geological term for igneous rocks that contain more that 66% silica (SiO_2), abundant free quartz and feldspar, common muscovite mica, low levels of iron and magnesium and moderately low levels of calcium, (e.g., granite), or more generally, composed predominantly of light-coloured minerals. (cf: intermediate, basic, ultrabasic).

adamellite-- Coarse-grained, acidic igneous rock composed of plagioclase feldspar, orthoclase feldspar (in roughly equal amounts) and quartz, with minor biotite and hornblende. Also known as quartz monzonite.

aggregate (soil)-- A unit of soil structure consisting of primary soil particles held together by cohesive forces or by secondary soil materials such as iron oxides, silica or organic matter. Aggregates may be natural, such as *peds,* or formed by tillage, such as *crumbs* and *clods.*

Alluvial Soils-- GSG classification-- Soils developed from recently deposited alluvium, normally characterised by little or no modification of the deposited material by soil forming processes, particularly with respect to soil horizon development.

alluvial plain-- Level landform pattern with extremely low relief and either active erosion and aggradation by channelled and over-bank stream flow, or relicts from these processes.

alluvium-- Sediment mass deposited from transport by channelled or over-bank stream flow.

Alpine Humus Soils-- GSG classification-- Characterised by a marked accumulation of well-humified organic matter that is intimately incorporated in the mineral soil to form thick surface horizons of profiles otherwise showing little horizon development.

amphibolite-- Crystaline-textured metamorphic rock composed primarily of amphibole (horneblende) and plagioclase fledspar.

andesite-- Dark-coloured, fine-grained, intermediate igneous rock composed of andesine (plagioclase feldspar) with one or more mafic (pyroxene/hornblende/biotite) constituents. Volcanic equevelent of diorite.

argillaceous regolith-- Fine-grained regolith consisting mainly of silt and clay sized particles.

armour-- A protective surface that is resistant to erosion.

ASC-- Australian Soil Classification-- It is a multi-category scheme with classes defined on the basis of diagnostic horizons or materials and their arrangement in vertical sequence as seen in an exposed soil profile (see Isbell, 1996).

B horizon-- The layer of soil below the A horizons, usually of finer texture (ie, more clayey), denser and stronger in colour. Thickness ranges from 10 cm to 2 m thick and is divided into B_1 and B_2 horizons.

basalt-- Dark-coloured, fine- grained, basic igneous rock composed primarily of calcic plagioclase feldspar and pryoxene. Volcanic equivalent of gabbro.

basic-- Descriptive geological term for igneous rocks that contain 45 -52% silica (SiO_2), high levels of iron, magnesium and calcium, abundant ferro-magnesium minerals (olivine/pyroxenes /horneblende/biotite mica), common plagioclase feldspar and quartz absent, (e.g., gabbro), or more generally, composed predominantly of dark-coloured minerals. (cf: acidic, intermediate, ultabasic)

batter-- The excavated or constructed face of a dam wall, embankment or cutting.

bench-- A strip of relatively level earth or rock breaking the continuity of a slope. Usually separated by a rock scarp. *Inside* refers to the upper slope component. *Outside* refers to the lower slope component above the scarp.

Black Earths-- GSG classification-- Black, heavy clay, alkaline to neutral soil with wide, deep cracks when dry.

breccia-- Poorly-sorted, coarse-grained, clastic sedimentary rock composed of angular broken rock fragments in a fine-grained matrix or held together with mineral cement. Often consists of volcanic material.

Brown Clays-- GSG classification-- see *Grey, Brown and Red Clays*.

Brown Earths-- GSG classification-- Uniform yellowish, reddish or brown, moderately acid to neutral light loams to clay with a crumb or fine sub-angular blocky structure, showing little profile differentiation.

Brown Podzolic Soils-- GSG classification-- Acid, predominantly brownish to yellowish soils, lacking or with a weak A_2 horizon and generally having weakly to moderately differentiated profiles with merging horizons.

Carboniferous--Geological period 345 - 280 million years ago.

C horizon-- Layers below the B horizon which may be weathered, consolidated or unconsolidated parent material little affected by biological soil-forming processes.

Chernozems-- GSG classification-- Similar to Black Earths, but of lower clay content and more friable, having porous structural units. The profile shows weak horizon differentiation with gradual boundaries. Soil reaction is neutral to alkaline.

chert-- Hard, dense, micro or cryptocrystaline sedimentary rock composed of interlocking quartz crystals. Occurs primarily as bands or layers of nodules in limestone and shales. Also called flint.

Chocolate Soils-- GSG classification-- Brownish, acid, friable, moderately pedal to fine blocky structured, clay loam soils with weak to moderate horizon differentiation.

clay-- Soil particles less than 0.002 mm in diameter.

claystone-- Detrital sedimentary rock having the composition of shale but lacking the fine lamination or fissility.

coal-- Dark-coloured, carbonaceous (carbon rich) sedimentary rock composed of variously lithified plant remains.

coherent-- In relation to soil regolith, refers to the ability of the soil regolith to resist detachment due in particular to the forces of running water.

colluvium-- Sediment mass deposited from transport down a slope by gravity, but not by stream flow, eg, scree or sheet flow deposit.

conglomerate-- Poorly sorted, detrital sedimentary rock composed of rounded to subangular fragments which are larger than 2 mm, cemented in a much finer matrix.

Dermosols-- ASC Soil Order classification-- Other soils with B_2 horizons that have structure more developed than weak throughout the major part of the horizon.

Devonian-- Geological period 395 - 345 million years ago.

diorite-- Coarse grained, intermediate igneous rock composed of sodic plagioclase (oligoclase or andesine), ferromagnesian minerals (horneblende, biotite or pyroxene) and sometimes a little quartz. Plutonic equivalent of andesite.

dolerite-- Medium-grained, basic igneous rock with the same composition as basalt and with lath-shaped plagioclase feldspar crystals inbedded in a mass of pyroxime.

DP-- Abbreviation for dispersibility percentage which is the measure of soil dispersibility, representing the proportion of clay and fine sand which is dispersible, expressed as a percentage.

dispersible soils-- Structurally unstable soil which readily disperses into its constituent particles in water. Highly dispersible soils are normally highly erodible. Dispersible soils are determined by use of the soil dispersibility test outlined in State Forests' 1998-1999 EPA Pollution Control Licence.

dispersion-- The process whereby soil aggregates break down and separate into their constituent particles (clay, silt, sand) in water due to deflocculation. The process is differnet from but offen associated with slaking.

drainage plain-- General term for landform element or pattern that is generally level and characterised by active sheetwash, channelled or over-bank stream flow processes.

Duplex soil-- Soil in which there is a sharp change in soil texture between the A and B horizons.

Earthy Sands-- GSG classification-- A predominantly sandy soil with an earthy fabric and little texture differentiation from topsoil to subsoil.

EAT-- Abbreviation for Emerson Aggregate Test which is an eight class classification for soil aggregate coherence (slaking and dispersion) in distilled water (Emerson 1967).

Euchrozems-- GSG classification-- Red, strongly structured clay soils with a somewhat lower clay content near the surface. They resemble but are more alkaline than Krasnozems.

fan-- A low cone of alluvial materials. The central point lies at the mouth of a gully or ravine and the material is spread out onto the adjoining plain.

felsic-- A mnemonic term derived from *fe*ldspar, *l*enads and *si*lica and applied to these light coloured minerals (quartz, feldspar, feldspathoids, muscovite), or rocks containing an abundance of them. (cf: mafic)

felspar *or* **feldspar**-- Group of minerals that are aluminosilicates of potassium, sodium and calcium, and characterised by two cleavages at nearly right angles. They are among the most important constituents of igneous rock. Includes orthoclase, microcline, plagioclase, and celsian.

Ferrosols-- ASC Soil Order classification-- Soils with B_2 horizons in which the major part has a free iron oxide content greater than 5% Fe in the fine earth fraction (<2 mm). Soils with a B_2 horizon in which at least 0.3 m has vertic properties are excluded.

floodplain-- An alluvual plain characterised by frequently active erosion and aggredation by channelled or over-bank stream flow.

gabbro-- Dark-coloured, coarse grained, basic igneous rock consisting of calcic plagioclase feldspar, pyroxene and clino-pyroxine, with or without ortho-pyroxine and olivine. Plutonic equivalent of basalt.

gley-- The grey or greenish-grey colouration found in soils. It is often produced under conditions of poor drainage, giving rise to chemical reduction of iron and other elements.

Gleyed Podzolic Soils-- GSG classification-- Poorly drained acid soils with strongly differentiated profiles, including a bleached A_2 overlying greyish or yellowish B horizons.

granite-- Light-coloured, coarse-grained, acidic igneous rock composed of quartz (20 -40%), alkali felspar (orthoclase) and a mica (biotite &/or muscovite) with one or more other accessory minerals. Plutonic equivalent of rhyolite.

granodiorite-- Coarse-grained, acidic igneous rock composed of quartz (20 -40%), calc-alkali felspar (oligoclase/andesine/orthoclase) and various ferromagnesium minerals (biotite/hornblende). Plutonic equivalent of rhyodacite.

gravel-- Coarse fragments and segregations of pedogenic origin in the 2 - 60 mm size range. For the purposes of the soil regolith stability classification, gravelly soils are generally soils which

have > 20% gravel content. Recent research has shown that gravelly soils tend to be well armoured against erosion.

Grey, Brown and Red Clays-- GSG classification-- These form a broad group of soils whose common properties are determined by their high clay contents. Typically, they are moderately deep to very deep soils with uniform colour and texture profiles, weak horizonation mostly related to structure differentiation and some carbonates and/or gypsum in their subsoils. They crack deeply on drying.

Grey-brown Podzolic Soils-- GSG classification-- Duplex soil with a clayey brownish blocky B horizon. A bleached A_2 horizon may be present.

GSG-- Great Soil Groups of Australia (as defined by Stace *et al* 1968), described in terms of morphology, genesis and land use.

gully erosion-- A complex of processes whereby the removal of soil is characterised by large incised channels in the landscape.

Holocene-- Present geological epoch which commenced 8 000 years before present. Also referred to as Recent.

horizon-- A layer within the soil profile with morphological characteristics and properties different from layers below and/or above it.

Humic Gleys-- GSG classification-- Soils that are acid to neutral, predominantly mineral soils with significant but widely varying organic matter contents intimately incorporated in the dark A horizons. These grade into subsoils marked by rusty and ochreous streaks and mottles on a pale grey matrix. Below this mottled horizon, the soil is typically grey to bluish-grey and permanently waterlogged, but the watertable fluctuates, periodically rising almost to the surface.

Humus Podzols-- GSG classification-- These soils have a dark A_1 horizon of organic accumulation, a light grey or whitish A_2 horizon and a dark grey to black, dominantly humic B horizon overlying water-saturated and weakly mottled mineral soil.

hypabyssal-- Igneous rocks formed by a moderate cooling rate at medium depths below the earth's surface (e.g., dykes, sills, volcanic necks). Characterised by medium-grained crystals and are often porphyritic. (cf: plutonic, volcanic, pyroclastic)

intermediate-- Descriptive geological term for igneous rocks that contain 52-66% silica (SiO_2), abundant feldspars, common micas and hornblende and little or no quartz (e.g., diorite). (cf: acidic, basic, ultrabasic)

igneous-- Rocks formed from hot molten magma which originates from the earth's interior. Generally classified by mode of formation (plutonic/hypabyssal/volcanic/pyroclastic) and chemical composition (acidic/intermediate/basic/ultabasic). (cf: sedimentary, metamorphic)

jasper-- Variously coloured form of chert, most commonly red, due to iron-oxide impurities.

Jurassic-- Geological period 190 - 135 million years ago.

Kandosols-- ASC Soil Order classification-- Other soils that (i) have well-developed B_2 horizons in which the major part is massive or has only a weak grade of structure, *and* (ii) have a maximum clay content in some part of the B_2 horizon which exceeds 15%.

Krasnozems-- GSG classification-- Deep, red strongly structured clays soils with clay content gradually increasing with depth and weak horizon differentiation.

Kurosols-- ASC Soil Order classification-- Soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B_2 horizon (or the major part of the entire B_2 horizon if less than 0.2 m thick) is strongly acid.

landform element-- Unit of land used to describe, classify and map landform at a site scale, up to 40 metres or more across. Slope and toposequence are key attributes of landform elements.

landform pattern-- Unit used to describe, classify and map landform at a broadscale level. Such patterns may be described by the attributes of relief, modal slope, stream channel occurrence, mode and status of geomorphological activity, geomorphological agent and component landform elements. An example of landform pattern is undulating low hills, with its

component landform elements including crest, hillslope, lower slope and drainage depression.

Lateritic Podzolic Soils-- GSG classification-- Strong texture contrast with thick, sandy A horizons overlying mottled yellow-brown and red clay B horizons, an horizon of nodular pisolitic, or massive ironstone in the base of the A_2 and upper B horizon, a thick zone of coarsely mottled white, red and yellow clay below the B horizon grading into dominantly white clay above the kaolinised parent rock, and acid reaction throughout the profile.

leucoadamellite/leucogranite-- Light-coloured forms of adamellite/granite. Containing <30% mafic minerals.

limestone-- Sedimentary rock composed of carbonate minerals (calcite, dolomite). May be organic, detrital or chemically precipitated.

lithic-- Descriptive geological term applied rocks containing abundant fragments of previously formed rocks.

Lithosols-- GSG classification-- A shallow soil showing minimal profile development and dominated by the presence of weathering rock and rock fragments. Lacking horizons other than an A_1 (one layer only).

loam-- A medium, textured soil of approximate composition 10 - 25% clay, 25 - 50% silt and <50% sand.

mafic-- A mnemonic term derived from *ma*gnesium and *fe*rric and applied to those dark coloured ferromagnesian minerals (olivine/pyroxines/horneblende/biotite mica) and igneous rocks containing an abundance of them. (cf: felsic)

massive-- 1. Soil (or layer/horizon) that occurs as a coherent or solid mass having no observable peds. 2. Rock of any origin that is more or less homogeneous in texture or fabric, having no observable features, such as layering, cleavage or jointing.

meta-- Geological prefix used to denote metamorphism of the rock so qualified (e.g., metabasalt).

metamorphic-- Rocks formed from existing igneous or sedimentary rocks within the earth's crust, in responce to marked changes in temperature, pressure, sheer stress and chemical environment. Generally classified by degree of metamorphism (regional/contact). (cf: sedimentary, igneous)

metamorphism-- The processes of mineralogical, chemical and structural adjustment of solid rocks which occurs within the earth's crust in responce to marked changes in temperature, pressure, sheer stress and chemical environment.

metasediments-- Sediments or sedimentany rocks that show evidence of having been subjected to metamorphism.

microgranite-- Fine or medium-grained form of granite.

monzonite-- A group of coarse-grained igneous rocks, ranging from acidic (quartz bearing) to basic olivine-bearing varieties, and containing about equal amounts of alkai feldspar and calc-alkai feldspar.

mottled horizon-- A horizon in which mottle abundance is greater than 10% (visual abundance estimate) and contrast between colours is distinct and prominent.

mottling-- The presence of more than one soil colour in the same soil horizon, not including different nodule or cutan colours.

mudstone-- Fine-grained, dark coloured, detrital sedimentary rock in which the proportions of silt and clay are approximately equal. Composed of lithified mud. Similar to shale but nonfissile and more massive. (cf: shale, siltstone)

Non-calcic Brown Soils-- GSG classification-- Very similar to Red-brown Earths but without an A_2 horizon. They have a carbonate-free solum and a neutral to slightly alkaline (with lower base saturation) B horizon; and are also generally thinner soils, varying from about 40-80 cm deep.

Ordovician-- Geological period 500 - 440 million years ago.

Organosols-- ASC Soil Order classification-- Soils that are not regularly inundated by saline tidal waters and have more than 0.4m of organic materials in the upper 0.8 m either extending down from the surface or cumulatively; or have organic materials extending from the surface to a minimum depth of 0.1 m directly overlying rock or other hard layers.

Peat-- Soil material that is clearly dominated by organic matter. Classified according to the degree of decomposition and distinctiveness of plant remains.

ped-- An individual, natural soil aggregate, separated from adjoining peds by surfaces of weakness.

ped shape-- Refers to the shape of natural soil aggregates. Descriptive terms used are:

platy-- peds are flat or plate-like with accomodation to the faces of surrounding peds (interlocking);

lenticular-- peds are interlocking and elliptical with curved faces and acute, angular edges;

prismatic-- peds are interlocking and prism-shaped with well defined flat surfaces;

columnar-- similar to prismatic but the peds are larger and their tops are domed;

angular blocky-- peds are interlocking and roughly cubic with 6 relatively flat, equal faces, angular edges and few re-entrant angles between adjoining faces;

sub-angular blocky-- similar to angular blocky, but with limited accomodation to the faces of surrounding peds and the faces and edges of peds are rounded.;

polyhedral-- interlocking peds with more than 6 relatively flat, unequal, dissimilar faces, angular edges and many re-entrant angles between adjoining faces;

granular-- peds are spheroidals or polyhedrons with planar or curved surfaces and slight or no accomodation to the faces of surrounding peds. Peds are relatively non-porous;

crumb-- similar to granular but more porous and usually less than 5 mm in diameter;

round-- particles arranged in a spheroidal shape with no planar faces or accomodation between peds.

pedal-- Describes a soil in which some or all of the soil material occurs in the form of peds in the moist state.

pedality-- Refers to the relative proportion of peds in the soil [*strongly* pedal, *moderately* pedal, *weakly* pedal or *apedal* (single grained or massive)]. See also structure.

Permian-- Goelogical period 225 - 280 million years ago.

phyllite-- Fine-grained low-grade metasedimentary rock intermediate in metamorphic-grade between a slate and a schist.

plastic-- Describes soil materials which are in a condition that allows them to undergo permanent deformation when force is applied without appreciable volume change or elastic rebound or without rupture.

Pleistocene-- First geological epoch of the Quaternary period, from 2 million years ago to 10 000 years ago.

plutonic--Igneous rocks formed by slow cooling below the earth's surface. Characterised by coarse-grained crystals. (cf: hypabyssal, volcanic, pyroclastic)

Podosols-- ASC Soil Order classification-- Soils with B horizons dominated by the accumulation of compounds of organic matter, aluminium and/or iron.

Podzols-- GSG classification-- Acid sandy soils with strongly differentiated horizons including a bleached horizon above a coffee coloured pan and coloured subsoil.

porphyry-- Igneous rock that contains conspicuous phenocrysts (large crystals) in a fine-grained groundmass.

Prairie Soils-- GSG classification-- Moderately deep, mildly acid to mildly alkaline soils with thick, dark, moderately structured topsoils.

profile-- The face of soil exposed in a vertical section.

pyroclastic-- Igneous rocks formed from the accumulation of material (e.g., ash, fragments of country rock) explosively or aerially ejected from a volcanic vent. May display distinct layering. (cf: plutonic, hypabyssal, volcanic)

Quaternary-- Current geological period which commenced about 2 million years ago and includes the Holocene and Pleistocene epochs.

quartzite-- Crystalline-textured metamorphic rock, composed of quartz, formed by recrystallisation of sandstone.

Red Clays-- GSG classification-- See Grey, Brown and Red Clays.

Red Earths-- GSG classification-- Massive, reddish sandy profiles with a gradual increase in clay content with depth.

Red Podzolic Soils-- GSG classification-- Strongly differentiated duplex soils with light to medium textured A_1 horizon over a pale or bleached A_2 over a reddish, firm to friable B horizon with generally polyhedral structure.

Red-brown Earths-- GSG classification-- The characteristic features of these soils are grey-brown to red-brown loamy A horizons, weakly structured to massive, an abrupt to clear boundary between A and B horizons, and brighter brown to red clay B horizons with well-developed medium prismatic to blocky structure.

regolith-- Mantle of earth and rock including rocks and sediments altered or formed by land surface processes. For the purposes of the soil regolith stability calssifaction, the dominant material within the top one metre from the surrface is described and classified

Rendzinas-- GSG classification-- Shallow to very shallow soils formed from limestones and marls; typically they are black, very dark brown or dark grey clay loams or light clays of strong, very fine crumb to granular structure and lose, soft consistence which usually continues throughout their thin sola.

rhyolite-- Fine-grained, acidic igneous rock. Volcanic equivalent of granite.

rill erosion-- Removal of soil by run-off from the land surface whereby numerous small channels, up to 30 cm deep, are formed.

Rudosols-- ASC Soil Order classification-- Soils with negligible pedologic organisation. They are usually young soils in the sense that the soil forming factors have had little time to pedologically modify parent rocks or sediments. The component soils can vary widely in terms of texture and depth; many are stratified and some are highly saline.

sand-- Soil particles in the size range 2.0 - 0.02 mm.

sandstone--Detrital sedimentary rock composed of sand-sized particles, cemented in a finer matrix. Quartz sandstone is composed predominantly of quartz particles with little matrix. Lithic sandstone comprises fragments of rock, quartz and feldspar set in a finer grained matrix.

scarp/cliff-- Landform element that is a steep to precipitous maximal slope (ie. steeper than above or below it) eroded by gravity, mass movement or sheet flow.

schist-- Coarse-grained, regionally metamorphosed rock characterised by pronounced, fine-scale foliation (parallel arrangement) of laminar minerals, such as micas.

sediment-- Material transported and deposited, or being transported by wind, water, gravity or ice, chemically precipitated from solution, or secreted by organisms, generally forming unconsolidated layers.

sedimentary-- Rocks formed by the consolidation (lithification) of sediment into layers, including organic accumulations and chemical precipitates. (cf: igneous, metamorphic)

shale-- Fine-grained, detrital sedimentary rock that is finely laminated and easily split into layers. (cf: mudstone, siltstone)

sheet erosion-- The removal of the upper layers of soil by raindrop splash and/or runoff.

Siliceous Sands-- GSG classification-- Deep profile of sands to clayey sands, with no horizon differentiation except for a darker A1.

silt-- Fine soil particles in the size range 0.02 - 0.002 mm.

siltstone-- Fine-grained, detrital sedimentary rock in which silt predominates over clay. Composed of lithified silt. (cf: mudstone, shale)

Silurian-- Geological period 440 - 395 million years ago.

skeletal soils-- Thin soils.

slaking-- The partial breakdown of soil aggregates in water due to the swelling of clay and the expulsion of air from pore spaces. It does not include the effects of dispersion.

slate-- Compact, fine-grained, regionally metamorphosed rock characterised by slaty cleavage (splits into slabs or thin plates), formed from shale.

sodic-- Term used to describe a soil which contains high levels of exchangeable sodium which adversely effects soil stability, plant growth and/or landuse. A non-sodic soil has an exchangeable sodium percentage (ESP) of < 6; a sodic soil has an ESP of 6 - <14 and a strongly sodic soils has an ESP of > 14.

soil regolith-- Mantle of earth and rock including rocks and sediments altered or formed by land surface processes. It includes both the soil and weathered parent material down to bedrock. For the purposes of the soil regolith stability classification the dominant material within the top one metre of soil regolith was classified.

soil regolith coherence-- The ability of the soil regolith to resist detachment by erosive agents, in particular running water.

soil regolith sediment delivery potential-- The potential for soil regolith to yield fine-grained (silt and clay) sediment which can be transported to receiving waters.

Sodosols-- ASC Soil Order classification-- Soils with strong texture contrast between A horizons and sodic B horizons, which are not strongly acid.

Solodic Soils-- GSG classification-- See Solodised Solonetz and Solodic Soils.

Solodised Solonetz and Solodic Soils-- GSG classification-- Soils with strong texture contrast, well-developed bleached A_2 horizon over an alkaline medium to coarse angular blocky structure of typically strong consistency.

Solonchaks-- GSG classification-- Soils dominated by salt accumulation and which show one or more of the following; salty encrustations; surface flaking; polygonal cracking of the surface; powdery structure; lack of normal plant growth except salt tolerant species.

Solonetz Soils-- GSG classification-- Soils with prominent texture differentiation between neutral to slightly alkaline, loamy topsoils and strongly alkaline, clay subsoils.

Solonised Brown Soils-- GSG classification-- Soils characterised by large amounts of calcareous material in the profile both in the fine earth fraction and as soft and hard segregations consisting of calcium and magnesium carbonates, but usually the calcium is predominant.

Soloths -- GSG classification-- Acid soils with strong texture contrast between pale topsoil and clay subsoil with coarse blocky or columnar structure.

structure-- Describes with the arrangement of all soil particles and refers to the distinctness, size, shape and condition of the peds. The degree of structural distinctness is referred to as grade of *pedality*. Descriptive terms used are:

single-grained-- soil occurs as a loose, incoherent mass of individual particles (as in sands);

massive-- soil occurs as a coherent mass with no distinct arrangement of soil particles;

weak pedality-- peds are barely observable in an undisturbed soil;

moderate pedality-- peds are well formed and evident, although not distinct;

strong pedality-- peds are quite distinct in an undisturbed soil.

sub-plastic-- A soil which appears to become more clayey with prolonged kneading. They are usually red, well structured and well-drained.

Tenosols-- ASC Soil Order classification-- Soils with generally only weak pedologic organisation apart from the A horizons.

Terra Rossa Soils-- GSG classification-- Dominantly red soils formed on limestone or highly calcareous parent materials.

terrace (alluvial)-- A landform pattern that is a former flood plain on which channelled and overbank stream flow is barely active or inactive because to level of flooding has been lowered.

Tertiary-- **G**eological period 65 - 2 million years ago.

texture-- Determined by the size distribution of mineral particles finer than 2 mm. It is based on the behaviour of a small handful of soil when moistened and kneaded into a ball and then pressed out between the thumb and forefinger.

tonalite-- A quartz-rich form of diorite.

trachyte-- Fine-grained, intermediate igneous rock composed of alkali feldspar and minor mafic minerals (boitite/hornblende/pyroxene). Often exhibits a parallel alignment of lath-like feldspar crystals due to flow in the molten rock.

topsoil-- A part of the soil profile, typically the A_1 horizon, containing material which is usually darker, more fertile and better structured than the underlying layers.

Triassic-- Geological period 225 - 190 million years ago.

USLE-- Universal Soil Loss Equation. A mathematical erosion model developed in the United States and designed to predict the long term average soil losses in run-off from specified field areas under specified cropping and management systems (Wischmeier and Smith 1978).

tuff-- Volcanic rock composed of compacted pyroclastic (formed by volcanic explosion) material.

ultabasic/ultramafic-- Descriptive geological term for igneous rocks that contain <45% silica (SiO_2) and is composed entirely of ferro-magnesium minerals (olivine/pyroxenes/hornblende/biotite mica), (e.g., dunite). (cf: acidic, intermediate, basic).

Vertosols-- ASC Soil Order classification-- Clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates. Although many soils exhibit gilgai microrelief, this feature is not used in their definition.

volcanic-- Igneous rocks derived from volcanic activity at or near the earth's surface. Characterised by fine-grained or glassy crystal size. (cf: plutonic, hypabyssal, pyroclastic)

Wiesenboden-- GSG classification-- Dark clay to clay loam soils with uniform to gradational texture profiles and varying development of gley features in the deeper subsoil due to intermittent partial saturation associated with seasonal seepage and perched water.

Xanthozems-- GSG classification-- Predominantly yellow, friable, strongly-structured clay soils with moderate horizon differentiation and gradational texture profiles.

Yellow Earths-- GSG classification-- Yellow equivalent of Red Earths.

Yellow Podzolic Soils-- GSG classification-- Strongly differentiated duplex soils with light to medium textured A_1 horizon over a pale A_2 over a yellowish, firm to friable B horizon with generally polyhedral structure.

Section 2: Soil Regolith Summary Tables

Murwillumbah and Casino Management Areas

References/data sources

Morand, D.T. 1994, *Soil Landscapes of the Lismore-Ballina 1:100 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Morand, D.T. 1996, *Soil Landscapes of the Murwillumbah-Tweed Heads 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Veness and Associates, 1994, *Soils Report, Casino and Murwillumbah Management Areas EIS, Supporting Document No. 8*, State Forests of NSW, Pennant Hills.

Field operatives

Dave Morand, Soil Surveyor, Department of Land and Water Conservation (DLWC), Casino.
Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Bob Attwood, Vegetation Manager, DLWC, Grafton.
Ron Fussell, District Forester, State Forests, Casino.
Andrew Whitfield, Harvest Planner, State Forests, Casino.
Ross Sigley, Marketing Forester, State Forests, Casino.
Peter St Clair, Marketing Forester, State Forests, Casino.
Steve Beaman, Forest Practices Specialist, Environment Protection Authority (EPA), Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
A	Casino-Murwillumbah EIS soil unit A	Soils formed on Alluvials. Yellow Podzolic Soils and Structured Plastic Clays. Subsoil EAT 2(1), 3(1), low DP < 17%.	Soils can be split up readily in field into sandy (class 2) upper drainage lines draining Kangaroo Sandstone and cracking clays (class 1) on lower broader floodplains.	2 (1,3)
B	Casino-Murwillumbah EIS soil unit B	Soils formed on basalts. Steep hills with Structured Clays, Krasnozems and Chocolate Soils. Subsoil EAT 5, 3(1), 3(3), Low DP(< 36%).	High Fe content soils, slight DP Predict stable soils. Some sandy soils present.	1(2)
C	Casino-Murwillumbah EIS soil unit C	Soils formed on metasediments. Steep hills with Structured Clays and Krasnozems. Subsoil EAT 2(1), 2(2), 3(2), 3(1). DP 3%,11%, 12%, 70%.	Generally stable soils but with some unstable subsoils. EIS results indicate subsoil moderate erodibility class based on EATs. Red and Yellow Podzolic Soils also occur.	1(3)
D	Casino-Murwillumbah EIS soil unit D	Soils formed on granitoids. Steep to very steep hills with Structured Clays, Krasnozems and Yellow Podzolic Soils - sandy. Subsoil EAT 2(1), 3(1), 3(2), DP< 36%.	Generally high sand content but not all granite country and stable soils occur.	2(1)
E	Casino-Murwillumbah EIS soil unit E	Soils formed on Grafton Formation sandstone, lithic sandstone, siltstone and claystone. very gently to gently undulating hillslopes with highly variable soils including: Yellow Earths, Chocolate Soils, Euchrozems, Red and Yellow Podzolic Soils, Lateritic Podzolic Soils and minimal Prairie Soils. EAT 2(1), 2(3). DP 54% for subsoil.	Often sandy but highly variable soils including stable red soils, partially unstable Yellow Podzolic Soils and unstable Soloths. Gleyed Podzolic Soils also occur.	2 (1,3,4)

F	Casino-Murwillumbah EIS soil unit F	Soils formed on Kangaroo Creek Sandstone, quartz and felspathic quartz sandstones. Moderately steep sided plateau with Earthy Sands, Red and Yellow Earths, Red and Yellow Podzolic Soils. Gravel <20%. Subsoil EAT 2(1), 2(2), 8. Generally very sandy soil.	Generally sandy soils but localised stable and unstable soils occur.	2 (1,3)
G	Casino-Murwillumbah EIS soil unit G	Soils formed on Walloon Coal Measures, sandstone siltstone and shale. Moderate hillslopes with Structured Clays, Krasnozems, Xanthozems and Red and Yellow Podzolic Soils. Subsoil EATs 2(1) or 2(2). DP to 59% for subsoil.	EIS indicates unstable EATs, moderate to high DP. Soil sampling indicates generally stable soils but with some localised dispersible soils. Includes Gleyed Podzolic Soils and the unit has been over mapped by geologists.	3(1,2)
H	Casino-Murwillumbah EIS soil unit H	Soils formed on Marburg Formation, conglomerates, sandstone, shale, siltstone and claystone. Rises, low hills and hills. Yellow Earths and Yellow Podzolic Soils. Subsoil EATs generally 2(1) or 2(2), DP to 61%.	Commonly sandy topsoils, occasionally sandy subsoils.	1(3)
I	Casino-Murwillumbah EIS soil unit I	Soils formed on volcanics. Moderate to steep hillslopes with Structured Clays, Krasnozems and Red and Yellow Podzolic Soils. Subsoil EAT 5, 6, 2(1), 3(1), 3(3), with DP < 36%.	EIS indicates low to moderate erodibility. Generally stable some localised Yellow Podzolic Soils.	1(3)
bc	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Brown, massive, sandy clay loams and well structured sandy clay (Alluvial Soils, Prairie Soils). EAT 3(1), 3(2).	Generally class 2. Localised areas of stable soils.	2(1)
bi	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Rolling hills on metamorphics with Red Podzolic Soils on crests and Yellow Podzolic Soil on slopes. Subsoil EAT 2(1), DP 63%, 0%.	Lithosols and Red Podzolic Soils are stable, but Yellow Podzolic Soils can be unstable.	1(3)
cab	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Steep basalt caps with Krasnozems.	Stable soils.	1
ge	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Rolling to steep basalt with well structured moderate to deep Prairie Soils and Chocolate Soils.	Stable soils.	1
ko	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Basalt with shallow to deep Chernozems and Chocolate Soils.	Stable soils. Lot of rock outcrop.	1
mb mba	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Steep hills (mb) and rolling lower slopes (mba) on basalt with Krasnozems and Chocolate Soils intergrades, Prairie Soils and Chernozems.	Stable soils.	1
pu	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Rolling hills on Walloon Coal Measures with Red Podzolic Soils, Krasnozems, Red Earths and Dark Podzolic Soils.	Stable soils.	1
ni	Lismore-Ballina 1:100k Soil Landscapes	Steep mountains with Krasnozems on Basalt and Brown Earths on Andesite. EAT 6, 8. Low DP.	Relatively stable coherent soils.	1
nr nra	Lismore-Ballina 1:100k Soil Landscapes	Cliffs and scarps on Rhyolite. Various soils includes Brown Podsolic Soils on colluvial footslopes and Krasnozems on tuff and basaltic colluvium.	Stable soils with localised rock outcrop.	1
nrc	Lismore-Ballina 1:100k Soil Landscapes	As above but rolling footslopes.	Generally stable.	1
ox	Lismore-Ballina 1:100k Soil Landscapes	Alluvial plain with Alluvial Soils, Prairie Soils and dark Alluvial Clays.	Generally stable soils.	1

pi	Lismore-Ballina 1:100k Soil Landscapes	Precipitous escarpment and cliffs on predominantly basalt and some rhyolite and other lithologies with shallow stony Lithosols.	Stable soils.	1
wo	Lismore-Ballina 1:100k Soil Landscapes	Gently undulating rises on Lismore Basalt with Krasnozems.	Stable soils.	1
bu bua	Lismore-Ballina 1:100k Soil Landscapes	Rolling hills on metasediments (phyllites, minor quartzite's and siliceous sandstones and shales). Lithosols on crests, Yellow Podzolic Soils on quartzite's and phyllites, Yellow and Red Podzolic Soils on fine grained sediments and deep Red Earths and Red Podzolic Soils on footslopes. EAT 8, 3(1), 3(3), DP 54% in subsoil.	Lithosols and Red Podzolic Soils are stable, but Yellow Podzolic Soils can be unstable.	1(3)
by	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Rolling hills on Walloon Coal Measures, mixed includes: volcano lithic sandstone, siltstone, shale and mudstone with complex soils. Predominantly Red Podzolic Soils, Dark Podzolic Soils, Grey Brown Podzolic Soils, Brown Clays, Krasnozems and Structured Earths. EAT >3(1), low DP.	Generally stable soils. Grey Brown Podzolic Soils are more unstable. Soils can change over short distances.	1(3)
fh	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Very steep hills on rhyolitic tuff and claystone with Brown Podzolic Soils and Brown Earths on ridges and upper slopes, with Red Podzolic Soils and Red Clays elsewhere. Stable EAT, low DP.	Soils are stable.	1
gp gpa	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Steep hills and mountains on basalts and rhyolites with Krasnozems and Chocolate Soils. High Fe soils.	Generally stable soils.	1
ku kua	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Undulating to rolling hills on sandstone siltstone, claystone and conglomerate with Yellow Podzolic Soils on ridges and upper slopes, Yellow and Red Podzolic Soils on slopes. EATs >3(1), low DP.	Generally stable. Localised Yellow Podzolics are more unstable and some sandy soils occur in Nulum SF.	1(2,3)
ro	Lismore-Ballina 1:100k Soil Landscapes	Rolling hills on plateau basalts with Krasnozems. Stable Fe rich soils.	Stable soils.	1
wl	Murwillumbah-Tweed Heads 1:100k Soil Landscapes	Radiating long ridges on sandstone, conglomerate, siltstone and shale with Red and Yellow Podzolic Soils. EATs >3(1), low DP.	Stable soils but Yellow Podzolic Soils are class 3.	1(3)
mi mic	Lismore-Ballina 1:100k Soil Landscapes	Rhyolite plateau with Red and Brown Podzolic Soils and Krasnozem intergrades. EAT >3(1), low DP.	Generally stable soils.	1
me	Lismore-Ballina 1:100k Soil Landscapes	Scarp footslopes on basalt with Prairie Soils, Chocolate Soils, Chernozems and Brown Earths. EAT stable 3(1), low DP.	Generally stable. May contain some areas of by soil landscape and more unstable soils.	1(3)

Tenterfield Management Area

References/data sources

Veness and Associates Pty Ltd, 1994, *Soil Report, Tenterfield Management Area EIS, Supporting Document No. 1*, State Forests of NSW, Pennant Hills.

Field operatives

Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Patric Millar, Catchment Advisory Manager, DLWC, Glen Innes.
David Jones, Acting District Forester, State Forests, Glen Innes.
Peter Newbury, Operations Forester, State Forests, Glen Innes.
Rob Young, Marketing Forester, State Forests, Glen Innes.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
A	Tenterfield EIS	Soils formed on metamorphosed sediments Chocolate Soil, Krasnozems, Xanthozems, Red Podzolic Soils. Subsoil EAT more unstable than 3(1) but low DP <20%.	Soils stable. EIS indicates unstable EATs but low DP.	1 (3)
B	Tenterfield EIS	Soils developed on sediments. Very stony, No Suitable Group, Krasnozems and Yellow Podzolic Soils. Subsoil EAT 5 or 2(1), low to moderate DP.	Soils are very stony and generally stable. Localised areas of unstable soils.	1(3)
C	Tenterfield EIS	Soils developed on volcanics. No Suitable Group, Minimal Prairie Soils, Chocolate Soils, Brown Earths and Yellow Podzolic Soils. Often gravel >20%. Subsoil EATs commonly 2(1) or 2(2), DP moderate to high but clay content < 37%.	Upperslopes and crests are often stable Red Podzolic or Lithosols but lower slopes are more unstable with Yellow Podzolic Soils.	3(1)
D	Tenterfield EIS	Soils developed on coarse grained granites. No Suitable Group, Sands, Yellow Earths, Yellow Podzolic Soils, Krasnozems and Chocolate Soils.	Generally coarse sandy granites that wash but also contains some stable Red Granite country (1) and some highly unstable Soloths (4) on lower slopes and drainage plains.	2 (4,1)
E	Tenterfield EIS	Soils developed on fine grained granites. Krasnozems, Xanthozems, Red Podzolic Soils. Subsoils EATs 2(1) but DP < 23%.	EIS indicates high Fe content well structured soils. Stable soils in field with possibility of some sandy wash along drainage lines.	1(2)

Urbenville Management Area

References/data sources

Veness and Associates, 1994, *Soil Report, Urbenville Management Area EIS, Supporting Document 1*, State Forests of NSW, Pennant Hills.

Field operatives

Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Paul Sharpe, District Forester, State Forests, Urbenville.
Kevin Petty, Forest Assistant, State Forests, Urbenville.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
A	Urbenville EIS	Soils formed on fine grained volcanics: Krasnozems, Xanthozems, Euchrozems, Minimal Prairie Soils, Prairie Soils, Chocolate Soil; EAT more stable than 3(1), low DP.	Generally stable soils.	1
B	Urbenville EIS	Soils developed on sandy volcanics with NSG (GSG) Well structured Uniform, Gradational and Duplex Soils. Often stony surface. EAT more stable than 3(1), very low DP.	Generally stable soils.	2(1)
C	Urbenville EIS	Soils developed on fine grained sediments. Generally moderate to well structured Brown Earths and No Suitable Group. EAT 2 (1) common in subsoil but low DP, < 31%.	Generally unknown but Walloon Coal Measures on Casino sheet are class 3(1).	3(1)
D	Urbenville EIS	Soils formed on medium to coarse grained sediment with Red and Yellow Earths and Yellow and Red Podzolic Soils. Often 2(1)EATs on subsoil but generally slight DP.	Fairly large areas in north are stable and non-sandy.	2(1)
E	Urbenville EIS	Soils formed on granites. Earthy Sands. EAT 2(1), DP 40%.	Generally sandy soils but localised gullies on lower slopes with Soloths.	2(4)

Glen Innes Management Area

References/data sources

Regional and Resource Conservation Assessment Council, 1996, 'Geological Units of the Upper North East Region' in *Volume 2, Physical Attributes, Regional Report of Upper North East New South Wales*, Regional and Resource Conservation Assessment Council, Sydney. (NB: Department of Mineral Resources supplied base map unit linework in digital format).

Veness and Associates Pty Ltd, 1992, 'Soil Report', in Minidis Roberts Consultants (compliers), *Glen Innes Forestry Management Area, Environmental Impact Statement Supporting Papers*, State Forests of NSW, Pennant Hills.

Field Operatives

Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton
Patric Millar, Catchment Advisory Manager, DLWC, Glen Innes.
David Jones, Acting District Forester, State Forests, Glen Innes.
Peter Narberry, Operations Forester, State Forests, Glen Innes.
Rob Young, Marketing Forester, State Forests, Glen Innes.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
Ccox	Geology and EIS soil unit E	Coffs Harbour Association: Coffs Harbour Beds and Coramba and Brooklana Beds: Metasediments: foliated metaclaystone, metasiltstone, turbidite, lithic wacke, minor conglomerate, chert, jasper, altered mafic volcanics, tuffaceous argillite, ironstone. EIS soil unit E: steep to very steep with Chocolate Soils, Krasnozems, Xanthozems, Structured Plastic Clays, No Suitable Group. EATs > 3(1) DP < 38%, Gravel often > 20%.	Stony stable red soils.	1
Cpsx	Geology and correlated Soil Units Glen Innes EIS Map unit E	Coffs Harbour Association: Sara Beds, Metasediments, metasiltstone, metaclaystone and orthoconglomerate rare chert, metabasalt and felsic volcanics. EIS soil unit E: steep to very steep with Chocolate soils, Krasnozems, Xanthozems, Structured Plastic Clays, No Suitable Group. EATs > 3(1) DP < 38%, Gravel often > 20%.	Predominantly stable red soils.	1
Cpx	Geology and EIS soil unit E	Unnamed metasediments, metasiltstone, metasandstone and lithic wacke. EIS soil unit E (see above).	Stable red soils.	1
Pc	Geology, not identified in EIS	Unnamed Permian conglomerate. Lithic sandstone and conglomerate.	Very small area, predict sandy soils.	2
Ph	Geology and EIS soil unit B	Unnamed silexite rock. Quartz topaz (silexite) formed by hydrothermal alteration of granite and sediments.	Very small area, predict granitic type soils.	2
Phkg	Geology and EIS soil unit B	Kookabookra Granite, coarse grained monzogranite with metasedimentary inclusions. EIS soil unit B: undulating with some locally steeper sections with Yellow Podzolic Soils and No Suitable Group, and Structured Loams. High coarse and fine sand content, Gravel often < 20%, EAT 8 or 6, DP < 30%.	Sandy soils.	2

Phyg	Geology and EIS soil unit C	Henry River Granite, fine grained, biotite monzogranite. EIS soil unit C: fine grained granites; very gently undulating with occasional small granite outcrops on hilltops and along drainage lines. Chocolate Soils, Yellow Podzolic Soils, No Suitable Group. EATs 5, 6.	Predominantly sandy soils. EIS indicates generally moderately clayey soils but some sandy soils and some moderately unstable soils occur.	2 (1,3)
Po	Geology, not identified in EIS	Unnamed mafic intrusive bodies with diorite, gabbro.	Generally unknown. Predict stable soils high in iron.	1
Prllu	Geology and EIS soils unit B	Glen Garry Microleucogranite. Medium to coarse grained granite. EIS soil unit B: undulating with some locally steeper sections with Yellow Podzolic Soils and No Suitable Group, and Structured Loams. High coarse and fine sand content, Gravel often < 20%. EAT 8 or 6, DP < 30%.	Generally unknown.	2(1)
Prlou	Geology and EIS soil unit A	Oban River Leucogranite, very coarse grained granite. EIS soil unit A: undulating, frequent granite outcrops in higher topographical locations and drainage lines with Leached Sands, Sands, Yellow Podzolic Soils and no Suitable Group. Stable EATs. Low to medium dispersion.	Granite outcrops, coarse sandy.	2
Prmig	Geology and EIS soil unit B	Mount Mitchell Monzogranite, medium to coarse grained granite. EIS soil unit B: undulating with some locally steeper sections with Yellow Podzolic Soils and No Suitable Group, and Structured Loams. High coarse and fine sand content, Gravel often < 20%, EAT 8 or 6, DP < 30%.	Predominantly sandy but localised very unstable Soloths on some lower slopes.	2(4)
Prmiga	Geology and EIS soil unit B	As above but Red Granite Country with red structured soils.	Field checked area. Stable red soils with possibility of some sandy wash along drainage lines.	1(2)
Pruwg	Geology and EIS soils unit B	Wards Mistake Ademellite: Medium to coarse grained monzogranite to granodiorite. EIS soil unit B: undulating with some locally steeper sections with Yellow Podzolic Soils and No Suitable Group, and Structured Loams. High coarse and fine sand content, Gravel often < 20%, EAT 8 or 6, DP < 30%.	Small area, generally unknown Predict sandy soils.	2
Pwdr	Geology, not identified in EIS	Does not show up at 1:100 000 (2.7 ha on map). Wandsworth Volcanic Group/Dundee Rhyodacite/Unnamed. Ignimbritic Rhyodacite.	Unknown. Predict stable soils. 2.7 ha in size.	1
Pwev	Geology and EIS soil unit F	Wardsworth Volcanic Group Emmavilla Volcanics equivalent Undifferentiated felsic volcanics, rhyolite and Rhyodacite, minor dacite, andesite, and minor interbedded sediments. EIS soil unit F: volcanics, steep to very steep with Yellow Podzolic Soils Chocolate Soils Xanthozems and Structured Plastic Clays. DP< 22, EAT 8,6, or 5. Gravel often > 20%	Generally stable red clays but some sandy soils in Brother SF.	1(2)
Px	Geology and soil unit E	Wardsworth Volcanic Group, unnamed sediments, metasediments, metasiltstones. EIS soil unit E: fine grained metasediments, generally steep to very steep with Chocolate Soils, Krasnozems, Xanthozems, Structured Plastic Clays and No Suitable Group. EATs more stable than 3(1) DP < 38%.	Predominantly red stable soils.	1
Pxg	Geology and soils unit B	Unnamed granitoids, granite, biotite granite, microgranite, aplite. EIS soil unit B: undulating with some locally steeper sections with Yellow Podzolic Soils and No Suitable Group, and Structured Loams. High coarse and fine sand content, Gravel often < 20%, EAT 8 or 6, DP < 30%.	Predict generally sandy soils.	2
Pzg	Geology	Unnamed hypabyssal rocks, pink quartz-felspar granitic porphyry in dykes and plugs. Very small area not identified in EIS.	Very small area generally unknown, predict sandy soils.	2
Qa	Geology	Not identified in EIS. 2 ha on map. Alluvium draining granite and Coffs Harbour Association.	This unit will not show up at 1:100 000 scale. Generally unknown soils on edge of	2(4)

			State Forest.	
Rldu	Geology	Dandarhra Creek Leucogranite, very coarse biotite granite. Not identified in EIS.	Very thin area (approx 20 ha) running along boundary edge of State Forest. Predict sandy soils.	2
Rlku	Geology and EIS soil unit A	Kingsgate Leucogranite, very coarse grained granite. Soil unit A: undulating, frequent granite outcrops in higher topographical locations and drainage lines with Leached Sands, Sands, Yellow Podzolic Soils and no Suitable Group. Stable EATs. Low to medium dispersion.	Small area predict sandy granitic soils.	2
Rlmu	Geology, not identified in EIS	Area too small to pick out at 1:100 000. Coarse grained leucogranite, Mole Granite. Coarse grained granite with microgranite.	Very small area, predict sandy soils on coarse grained granites. Micro granites have been observed to produce generally more stable soils in other MAs.	2(1)
Rlru	Geology	Red Range leucogranite (fine to very fine grained).Geology not identified in EIS possibly due to small area.	Very small area predict stable soils.	1

Grafton Management Area

References/data sources

Veness and Associates Pty Ltd, 1994, *Soils Report, Grafton Management Area EIS, Supporting Document No. 3*, State Forests of NSW, Pennant Hills.

Field operatives

Humphry Milford, Soil Surveyor, DLWC, ex Grafton.
Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Bob Attwood, Vegetation Manager, Grafton, DLWC.
Bob Williams, District Forester, State Forests, Grafton.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
A	Grafton EIS soil unit A	Soils formed on Alluvials. Yellow Podzolic Soils. EAT 8, 2(1), 2(1), low DP (< 21%).	These alluvial soils are coherent but EIS indicates EATs are less stable than 3(1).	3(1)
B	Grafton EIS soil unit B	Soils formed on basalts. Krasnozems. EAT 8, 2(1), 3(3), low DP (< 23%).	High Fe content soils, low DP.	1
C	Grafton EIS soil unit C	Soils formed on metasediments. Structured plastic and sub-plastic clays, Krasnozems, Xanthozems, Chocolate Soils, Structured Loams. EATs subsoils 2.(1), 2(2), 2(3), 3(1). DP up to 67%.	Generally stable but some localised areas of unstable soils.	1(3)
D	Grafton EIS soil unit D	Soils formed on granites, granites, granodiorite and leucoadamellite. Red Podzolic Soils - sandy. Subsoil EATs 2(3), 2(2), DPs < 53%, clay content < 27%.	High sand content.	2
E	Grafton EIS soil unit E	Soils formed on Grafton Formation. Sandstone, lithic sandstone, siltstone and claystone. Structured plastic clays, Yellow Podzolic Soils and Gleyed Podzolic Soils. EATs high with fine and coarse sand in topsoil. EAT 2(1), DP 32% for subsoil, clay content 37%.	This unit is highly variable. eg Bom Bom and Divines SFs is 3(1,4) whilst adjacent Glenue SF has all four classes. Southgate SF also varies, generally 2 or 3.	2 (1,3,4)
F	Grafton EIS soil unit E	Soils formed on Kangaroo Creek Sandstone, quartz and feldspathic quartz sandstones. Chocolate Soils, Yellow Podzolic Soils. Gravel > 20%, Subsoil EAT 5, DP 5%. Very sandy in A1 and A2, low sand in B.	Predominantly sandy soils often with sst rock outcrop. Localised stable and unstable soils occur.	2 (1,3)
G	Grafton EIS soil unit G	Soils formed on Walloon Coal Measures, sandstone siltstone and shale. Yellow Earths and Red Podzolic Soils. EATs 2(1), DP 32% subsoil.	Generally unstable class 3 soils. Localised areas are stable. Same soil unit in Casino area is well known and has been given 3(1).	3(1)
H	Grafton EIS soil unit H	Soils formed on Marburg Formation, conglomerates, sandstone, shale, siltstone and claystone. Yellow Earths and Yellow Podzolic Soils. Lab results indicate 2 separate soils: i) very stony, very sandy topsoil and subsoils, subsoil EATs n/a, DP 44%. ii) sandy topsoils overlying clayey subsoils, Subsoil EAT 3(1), DP 16%, sandy, low clay content.	Complex soils. Generally stable soils, but with localised sandy and Yellow Podzolic Soils. Some class 4 country on conglomerates in Nymboida SF.	1 (2,3,4)
I	Grafton EIS soil unit I	Soils formed on coarse grained conglomerates, with some sandstone, shale and siltstone. Krasnozems or No Suitable Group. Topsoils sandy but subsoils clayey. Subsoil EAT 5, 8 or 2(1), DP subsoils < 36%. Gravel often < 20%.	Generally soils are unknown but predict sandy soils on conglomerates and sandstones and some unstable soils on fine grained sediments.	2 (3)

Coffs Harbour and Urunga Management Areas

References/data sources

Hird and Associates, (unpub.) *Soil Regolith Stability Classification Coffs Harbour-Urunga Soil Landscapes*, Consultancy for State Forests of NSW, Pennant Hills.

Milford, H.B. 1996, *Soil Landscapes of the Dorrigo 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Milford, H.B. (in prep), *Soil Landscapes of the Coffs Harbour 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Wood, J.E.T. 1994, *Urunga - Coffs Harbour Forestry Land Resources Study, Coffs Harbour-Urunga Management Area EIS Supporting Document 2,* (3 Volumes), State Forests of NSW, Pennant Hills.

Field operatives

Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Steve Bishop, District Forester, State Forests, Kempsey.
Steve Dobbins, Planning Forester, State Forests, Kempsey.
Bill Horton, Planning Forester, Urunga.
Glenn Atkinson, Manager Resource Assessment, DLWC, Kempsey.
Humphry Milford, Soil Surveyor, DLWC, ex Grafton.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
ag	Urunga-Coffs Harbour Study and Dorrigo 1:100k Soil Landscapes	Very steep precipitous slopes on Jurassic Sandstone Plateau with Earthy Sands and Yellow Podzolic Soils.	Predict sandy wash from these soils and possible higher sediment delivery if subsoils exposed to erosion.	2(3)
ar	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Moderately deep Yellow Podzolic Soils with Red Podzolic Soils in sheltered locations on deformed and highly fractured siliceous mudstone, lithofeldspathic wacke and siltstone with minor metabasalt, felsic volcanics, chert and jasper. EAT 8, 6, gravel < 20%.	Generally stable. Dorrigo Soil Landscape report identifies this landscape has unstable soils along drainage lines thus the localised 3 category.	1(3)
as	Urunga-Coffs Harbour Study	Yellow Podzolic Soils gravel generally < 20% on micaceous slate, sandstone and minor conglomerate of the Bellingen Formation EAT 5, 5.	Stable soils.	1
at	Urunga-Coffs Harbour Study	Shallow to moderately deep gravelly Duplex Soils on fine grained metamorphosed clastic sediments. Note: little erosion is predicted from this soil landscape. EAT 8/3(1).	Stable soils.	1
av	Urunga-Coffs Harbour Study and Dorrigo 1:100k Soil Landscapes	Undulating low hills on Coffs Harbour Association with Yellow Podzolic Soils and Red Podzolic Soils in sheltered positions. EAT 8, 6.	Generally unknown, predict Red Podzolic Soils to be stable and Yellow Podzolic Soils to be higher sediment delivery.	3(1)
ba	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Deep to moderately deep Yellow and Red Podzolic Soils on slopes and Yellow Earths on footslopes on quartz lithic sandstone and quartz conglomerate. Commonly up to 50% gravel in subsoil. EAT 8/3(1), 5.	Stony soil with sandy topsoils.	2(1)
be	Urunga-Coffs Harbour Study	Up to 3 m of clayey silt and gravelly alluvial material with structured subsoils in top 1m.	Structured Brown Earths on terraces with incoherent structured loams on floodplain. Narrower than mapped.	1(2)

bg	Urunga-Coffs Harbour Study	Deep gravelly dark Earths formed on footslopes and drainage plains from Permian slates EAT 8, 5.	Stable soils.	1
bm	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Deep Yellow Earths on siltstones and structured Yellow Earths and Brown Earths on other metasediments. EAT 8/3(1), 3(1).	Generally stable but localised unstable soils occur on siltstones (see Dorrigo SL report).	1(3)
bo	Urunga-Coffs Harbour Study	Red Podzolic soils with < 20% gravel on siliceous mudstone, felsic volcanic, chert, jasper EAT 3(1), 3(1).	Generally gravelly stable soil. Localised unstable soils occur.	1(3)
br	Urunga-Coffs Harbour Study	Yellow Podzolics and Earths on granite sandy topsoils weak deep highly kaolinised soil regolith slowly porous subsoil (USCS - CH), however strongly pedal Red Podzolic Soils on crests and strongly pedal Clay Loam. EAT 8/3(1), 6.	These soils are considered to be generally unstable with erosion problems where post logging and roading practices have been poor. Very unstable when wet.	3(1,4)
bv	Urunga-Coffs Harbour Study	Loose grey sands on barrier dunes EAT not tested.	Sandy soils.	2
bw	Urunga-Coffs Harbour Study	Gravelly duplex soils on phyllite siltstones. Sheet and minor rilling on logging load-out sites. EAT 8, 3(1), 2-1.	Stony stable soils.	1
ca	Urunga-Coffs Harbour Study	Stony Earths and Podzolic Soils on siliceous mudstone, siltstone and sandstone EAT 8, 5.	Stable soils.	1
cc	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Stony Yellow Podzolic Soils, with > 20% gravel, on hailstone quartz conglomerate. EAT 8,(2/1).	Unstable subsoils.	3
ci	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Terraces, floodplain and river channel with structured Plastic Clays and Brown Podzolic Soils EAT 3(1), 5.	Generally unknown. Soil description and EAT results suggest stable soils.	1
cl	Urunga-Coffs Harbour study but named cg in Dorrigo 1:100k Soil Landscapes	Moderately deep to deep Yellow Podzolic Soils on mixed sedimentary rocks and Prairie Soils on Basalt. Up to 50 cm partly kaolinised ferruginised saprolite soil regolith. EAT 3(2), 2(1).	Subsoils highly erodible. Dorrigo report identifies unstable soils.	3
cr	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Deep very gravelly Red, Brown and Yellow Podzolic Soils on siliceous mudstone and siltstone, lithic and feldspathic sandstone and black massive siltstone. EAT 5, 5.	Very stony, generally stable EATs.	1(3)
ct	Urunga-Coffs Harbour Study	Shallow stony, granitic structural sands, with > 80% fine and coarse sand, > 10% gravel, EAT 8/3(1), 3(1).	Sandy soils.	2
da	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Deep Alluvial Soils and structured Sands. Structured Brown Earths on terraces. EAT 8, 5.	Sandy soils.	2
de	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Moderately deep to deep Yellow Podzolic Soils on mixed sedimentary rocks and moderately deep Prairie Soils on basalt. EAT 8, 2(1).	Generally stable soils but localised silty soils can be unstable.	1(3)
di	Urunga-Coffs Harbour Study	Loam/Clay Loam or gravelly structured brown clay with common gravel on slate, mudstone and minor conglomerate.	Stable, very gravelly.	1
dk	Urunga-Coffs Harbour study	Footslopes and drainage plains of Corindi Conglomerate and Marburg Formation with Red and Yellow Podzolic Soils.	Generally unknown, predict Yellow Podzolic Soils to be dominant and high sediment delivery.	3(1)
eg	Urunga-Coffs Harbour study and Dorrigo and Coffs Harbour 1:100k Soil Landscape reports	Steep, benched, common rock outcrop, mass movement evidence on Quartz arenite, quartz and lithic conglomerate, grey claystone and quartz and lithic sandstone with Yellow Podzolic Soils, Black Earths on slopes and deep Siliceous Sands on benches. EAT 8, 5.	Complex unit predominantly sandy soils. Sandy soils can be subject to gullying from concentrated flows.	2(1)
ex	Urunga-Coffs Harbour Study	Floodplains and river channels draining Walloon Coal Measures and Kangaroo Sandstone with sands. EAT 8, 8.	Generally unknown. Description fits a class 2 soil.	2

gl	Urunga-Coffs Harbourstudy and Dorrigo 1:100k Soil Landscapes	Undulating low hills footslopes and drainage plains on Conglomerate, quartz and lithic sandstone and minor siltstone with moderately deep Yellow Podzolic Soils and structured Red Earths. EAT 8, 2(1).	Unstable subsoils.	3
hk	Urunga-Coffs Harbour Study	Fine grained metasediments, mass movement prone, highly gravelly. EAT 8, 3(1), 3(1).	Generally class 1. May have localised class 3.	1(3)
ig	Urunga-Coffs Harbour Study	Deep mod well drained Earths - Loams on slaty siltstones and sandy loams (hence > 80% fine and coarse sand). EAT 8/3(1), 3(1).	Stable soils.	1
kc	Urunga-Coffs Harbour Study	Sandy Earths with < 20% gravel on quartz monzonite with other minor igneous rocks EAT 3(1), 5.	Stable soils.	2
ko	Urunga-Coffs Harbour Study	Silty red pedal Duplex soils formed on siliceous mudstone, siltstone and minor metabasalt. EAT 8, 6.	Non gravelly, stable, Red Podzolics.	1
kr	Urunga-Coffs Harbourstudy and Dorrigo 1:100k Soil Landscapes	Shallow to deep Yellow Podzolic Soils on Kangaroo Creek Sandstone - medium to coarse quartz sandstone and minor quartz and lithic conglomerate. EAT 2(1), 5.	Common rock outcrop and sandy soils which wash readily.	2(3)
ky	Urunga-Coffs Harbour Study	Krasnozems on Residual Tertiary basalt.	Stable soils.	1
lm	Urunga-Coffs Harbour Study	Steep slopes on Corindi Conglomerate with stony Yellow Podzolic Soils and Brown Podzolic Soils with sandy topsoils and bleached A2 horizons. EAT 3(1), 5.	Generally unknown. Very stony soils with sandy topsoils but hardsetting bleached A2 horizons and clayey subsoils. Very stony soils stable but some areas may be prone to sandy wash and others may be prone to subsoil erosion.	1(2,3)
lo	Urunga-Coffs Harbour Study	Deep moderately drained Brown Earths with 10-50% gravel, and weak to moderate structured subsoil. EAT 8/3(1), 5.	Stable soils.	1
me	Urunga-Coffs Harbour Study	Gravelly Yellow Duplex Soils on siliceous mudstone, metabasalts and volcanics. EAT 3(1), 5.	Generally stable soil with localised silty unstable soils.	1(3)
mg	Urunga-Coffs Harbour Study	Deep well drained Krasnozems on basalts. EAT not tested.	Stable soils.	1
ml	Urunga-Coffs Harbour Study	Shallow poorly drained potential acid sulphate soils. EAT 8.	Peaty/clayey Melaleuca swamp.	2
mm	Urunga-Coffs Harbour Study	Narrow ridge lines and colluvial sideslopes on Marburg Formation with Red Earths and Yellow Podzolic Soils on ridgelines and Yellow and Red Podzolic Soils on lithic sandstone slopes. EAT 8, 5.	Generally unknown. Red Podzolic Soils stable but Yellow Podzolic Soils more unstable.	1(3)
mo	Urunga-Coffs Harbour study and Coffs Harbour 1:100k Soil Landscapes	Gently undulating footslopes and drainage plain with Red Yellow and Brown Podzolic Soils and Structured Plastic Clays on siliceous mudstone and siltstone, lithic and feldspathic sandstone and black massive siltstone. EAT 3(1),5	Generally stable.	1
mp	Urunga-Coffs Harbour Study	Shallow gravelly loamy to clay loamy soils. EAT not tested.	Stable soils.	1
mt	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Flat footslopes and drainage plains draining quartzose conglomerate with often deep stony Brown and Yellow Podzolic Soils and Siliceous Sands. EAT 8, 5.	High gravel and EATs stable, generally stable soil. Study indicated little existing erosion apart form some localised slope wash and minor sheet erosion.	1
mu	Urunga-Coffs Harbour Study	Shallow to deep well drained Sandy Earths formed on sandstone/mudstone and pebbly sandstones. Sandy loams overlying gravelly, structured clay loams. EAT 8/3(1), 3-2.	Stable soils.	1
nb	Urunga-Coffs Harbour Study	Alluvial sandy loams described at 3 depths. Fine plus coarse sand probably > 80%. EAT 8/3(1), 8/3(2).	Class 2 soils.	2
nc	Urunga-Coffs Harbour Study	Estuarine alluvium swamp sands and clays. EAT 8/3(1), 5.	Estuarine deposits.	4
nc	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Marine sand silt and clay Yellow Podzolic Soils, Structured Loams, Yellow Earths, Humic Gleys, and Sands. EAT 8/3(1), 5. Various layers of sediment.	Often plastic unstable white clays. This unit has been over mapped and includes some undulating rises with Yellow Podzolic Soils and	3(1,4)

			Lithosols on crests in Wedding Bells SF.	
nf	Urunga-Coffs Harbour Study	Deep sandy well drained Earths overlying very firm soil regolith massive sandy clay loams. Sandy Loams and loamy sands with gravel < 20%. EAT 8/3(1), 5.	Stable soil.	2
nn	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Precipitous mountains on the Coffs Harbour Association metasediments with deep well drained structured Red Earths. EAT 3(1), 5.	Generally unknown predict stable soils from description.	1
nw	Urunga-Coffs Harbour Study	Deep well drained Red and Yellow Earths over deeply weathered phyllite. Gravel content < 20-50% in subsoil. EAT 3(1), 5.	Generally stable soils. Generally stable EATs. Occasionally EAT 3(3), 3(4) and 2(2).	1 (3)
ny	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Moderately deep structured Brown Earths with Shallow Lithosols on steepest slopes. Coffs Harbour metasediments. EAT 8, 2(1).	Generally gravelly and stable but localised areas with < 20% stones and unstable subsoils occur.	1(3)
or	Urunga-Coffs Harbour Study and Dorrigo 1:100k Soil Landscapes	Alluvial well drained brown Earths and imperfectly drained Alluvial Soils on floodplain with well drained Red Brown Earths on Terraces. EAT 8, 2(1), 5.	Generally sandy soils. Floodplain generally absent in field.	2
pc	Urunga-Coffs Harbour Study	Silty brown Duplex Soils on slate, sandstone and minor conglomerate, < 20% gravel.	Generally partially unstable high silt, content soils with localised stable soils.	3(1)
pp	Urunga-Coffs Harbour study	Domed ridge lines on grey claystone lithic sandstone and coal with Red Podzolic Soils and Earthy Sands on crests and Red Podzolic Soils and Structured Plastic Clays on upper slopes. EAT 3(1), 5.	Generally stable but localised sandy soils.	1(2)
pt	Urunga-Coffs Harbour Study	Well drained Red and Brown Earths on lithic and pebbly sandstones and mudstones subsoil pebbles > 20% coherent slightly kaolinised and moderately porous soil regolith. EAT 8, 3(2).	Generally unknown, predict stable gravelly soils from soil landscape description.	1
sh	Urunga-Coffs Harbour Study	Floodplains and river channels draining Walloon Coal Measures and Kangaroo Ck Sandstone with Sands. EAT 8, 3(2).	Unknown. likely to be sandy soils.	2
sk	Urunga-Coffs Harbour Study	Alluvial loam to light clay, predominantly gravelly.	Class 2 soils.	2
su	Urunga-Coffs Harbour Study	Loamy red and Yellow Podzolic Soils with > 50% gravel formed on siliceous mudstone, siltstone and metabasalt.	Generally stable. Localised siltstones unstable.	1(3)
sw	Urunga-Coffs Harbour study but named sh in Dorrigo SL	Undulating low hills on Jurassic quartz sandstone with Yellow Earths, Red Earths and Lithosols. Common rock outcrop. EAT 8, 5.	Predict sandy soils.	2
ta	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Deep moderately well drained Yellow and Brown Podzolic Soils upper slopes and well structured Red, Yellow and Brown Earths in lower sheltered locations on quartz conglomerate, quartz and lithic sandstone and minor siltstone. EAT 3(2), 5.	Generally stable, some gully erosion (unstable soils) along drainage lines.	1(3)
tm	Urunga-Coffs Harbour Study	Waterlogged duplex soils on alluvial sands silts and clays. EAT not tested.	Level and predominantly sandy.	2
to	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Undulating low hills and drainage plains on Nymboida Coal Measures, deep Soloths and Grey Clays. EAT 2(2).	Soil description and EAT indicate unstable dispersible soils. Predict upper slopes to be 3 and lower slopes to be class 4.	3(4)

tt	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Deep Krasnozems and Chocolate Soils on basalt. EAT 3(1), 3(2).	Stable soils.	1
ul	Urunga-Coffs Harbour Study	Loamy and silty reddish brown duplex soils with <20% gravel on siliceous mudstone, siltstone and metabasalt. EAT 3(1), 5.	Generally stable soil with localised silty unstable soils.	1(3)
va	Urunga-Coffs Harbour Study	Gravelly Red Duplex Soils formed on Ademellite. EAT 2(1), 6.	Gravelly Red Podzolics with stable subsoils and numerous crystalline fragments.	2
wc	Urunga-Coffs Harbour study and Dorrigo 1:100k Soil Landscapes	Moderately deep Earthy Sands on mixed landslip materials and mod deep to deep Red Podzolic Soils on Walloon Coal Measures. EAT 3(2), 5.	Earthy Sands predominate upper slopes and localised unstable coherent soils occur.	2(3)
wi	Urunga-Coffs Harbour Study	Alluvial, moderately pedal, loams and clays with gravel derived from a quartz conglomerate.	Predict class 2 soils. Possibly some more unstable soils in Barccongere SF.	2(3)
wy	Urunga-Coffs Harbour Study	Well drained Red and Yellow Earths (loamy sands to sandy clay loam) on Adamellite, around 20% gravel in subsoils. EAT 8/3(1), 5.	Unknown. EIS indicates sandy soils.	2
ya	Urunga-Coffs Harbour Study	Deep well drained red earths and stony shallow earths on ademellite loam topsoil over gravelly clay loams. EAT 8/3(1), 6.	Stable soils.	1
yc	Urunga-Coffs Harbour Study	Red Earths (occasionally structured sands or Brown Podzolics on conglomerates), lithic sandstones, siltstones and claystones, sandy loam to clay loam topsoils over massive to moderately structured soils. EAT 8/3(1), 3-1.	Unknown. EIS indicates sandy soils with localised clayey stable soils.	2(1)

Dorrigo Management Area

References/data sources

Gilligan, L.B., Brownlow, J.W., Cameron, R.G. and Henley, H. 1992, *Dorrigo-Coffs Harbour 1:250 000 Metallogenic Map*, NSW Geological Survey, Sydney.

Milford, H.B. 1996, *Soil Landscapes of the Dorrigo 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Milford, H.B. (in prep), *Soil Landscapes of the Coffs Harbour 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Regional and Resource Conservation Assessment Council, 1996, 'Geological Units of the Upper North East Region', in *Volume 2, Physical Attributes, Regional Report of Upper North East New South Wales,* Regional and Resource Conservation Assessment Council, Sydney.

Wood, J.E.T. 1994, *Urunga - Coffs Harbour Forestry Land Resources Study, Coffs Harbour-Urunga Management Area EIS Supporting Document 2,* (3 Volumes), Consultancy Report for State Forests of NSW, Pennant Hills.

Field operatives

Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Glenn Atkinson, Manager Resource Assessment, DLWC, Kempsey.
Humphry Milford, Soil Surveyor, DLWC, ex Grafton.
Flavio Bugno, District Forester, State Forests, Dorrigo.
Steve Bishop, District Forester, State Forests, Kempsey.
Steve Dobbins, Planning Forester, Kempsey.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
Ccbf	RACAC geology, Dorrigo-Coffs Harbour 1:250k geology and Dorrigo 1:100k Soil Landscapes	Coffs Harbour Association Brooklana Beds. See ul, me and su Dorrigo Soil Landscape units: stony where steep, structured Red and Yellow Earths, Red Podzolic Soils, Lithosols, Prairie Soils and Krasnozems.	Generally stable soils with localised unstable soils.	1(3)
Cccs	RACAC geology, Dorrigo-Coffs Harbour 1:250k geology and Dorrigo 1:100k Soil Landscapes	Coffs Harbour Association Coramba Beds See ny Dorrigo Soil Landscape: Brown Earths (structured on moist footslopes) and Lithosols.	Dorrigo report shows this small area as being stony and generally stable. Localised unstable soils may occur.	1(3)
Ccmf	RACAC geology, Dorrigo-Coffs Harbour 1:250k geology.	Coffs Harbour Association, Moonbil Siltstone see Dorrigo Soil Landscape map su, bo, me: stony structured Red and Yellow Earths, Red Podzolic Soils, Lithosols, Prairie Soils and Krasnozems.	Generally stable soils similar to hk soil landscape. Localised unstable silty soils.	1(3)
Ccox	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Coffs Harbour Association, Coffs Harbour Beds including the Coramba and Brooklana beds: metasediments including metaclaystone, metasiltstone, metaturbidite, metalithic wacke, minor conglomerate, chert, jasper, altered mafic volcanic, tuffaceous argillite, ironstone.	Stable soils.	1

Phdd	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology.	Dundurrabin Granodiorite. Biotite granodiorite and leucogranite.	Predict sandy soils.	2
Pncx	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology.	Unnamed metasediments. Steep, gravelly soils (Podzolics Lithosols) on slaty siltstone, sandstone, diamictite and minor metabasalt.	Steep gravelly predominantly stable soils.	1
Pnfm	RACAC and Dorrigo-Coffs Harbour 1:250k geology.	Unnamed phyllite. Gravelly rolling to steep Podzolics and Lithosols on phyllite, schist rare metasediments.	Gravelly stony generally stable soils similar to Pncx.	1
Pnpf	RACAC geology, Dorrigo-Coffs Harbour 1:250k geology and Dorrigo 1:100k Soil Landscapes	Pee Dee Beds. Slaty siltstone, lithic sandstone and minor diamectite. See Dorrigo Soil Landscape description su and Coffs Harbour unit hk: both landscapes are steep, gravelly and generally stable with stony Red and Yellow Earths.	These soils are generally stable and similar to hk soil landscape.	1
Pxbd	RACAC geology, Dorrigo-Coffs Harbour 1:250k geology and Dorrigo 1:100k Soil Landscapes	Billys Creek Tonalite, diorite granodiorite, monzogranite and leucogranite. See kc and bp Dorrigo Soil Landscapes: Brown Earths and well structured Red Earths.	Granitic Brown Earths.	2
Pxsp	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Sheep Station Creek Complex. Granite, gabbro and granodiorite, predict generally coarse grained incoherent with low sediment delivery.	Generally sandy soils.	2
Qu	RACAC geology	Undifferentiated Quaternary sediments including: alluvial mud, silt, sand, gravel deposits, and swamp deposits, coastal sand beaches and dunes and estuarine deposits.	Generally unknown very small isolated occurrences, generally draining Granite. Unstable (class 4) soils may be present.	2(4)
Rxcg	RACAC geology	Granitoid: unnamed or undetermined Chaelundi Complex Granite: coarse granite, leucocratic, horneblend-biotite granite.	Sandy wash, batters slip.	2
Tb	RACAC geology and Dorrigo Coffs Harbour 1:250k geology.	Xanthozems and Krasnozems on basalt, diorite, andesite, volcanic anoclastics, polymictic conglomerate and Quartz ferruginous sandstone and mudstone. See pp soil landscape: gently undulating with well drained Xanthozems.	Stable soils.	1

Kempsey and Wauchope Management Areas

References/data sources

Atkinson, G. (in prep), *Soil Landscapes of the Kempsey-Korongoro Point 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Gilligan, L.B., Brownlow, J.W., and Cameron, R.G. 1987, *Tamworth-Hastings 1:250 000 Metallogenic Map*, NSW Geological Survey, Sydney.

Gilligan, L.B., Brownlow, J.W., Cameron, R.G. and Henley, H. 1992, *Dorrigo-Coffs Harbour 1:250 000 Metallogenic Map*, NSW Geological Survey, Sydney.

Regional and Resource Conservation Assessment Council, 1996, 'Geological Units of the Upper North East Region' in *Volume 2, Physical Attributes, Regional Report of Upper North East New South Wales*, Regional and Resource Conservation Assessment Council, Sydney.

Veness and Associates Pty Ltd, 1993, 'Soil Report', in Truyard Pty Ltd (compiler) *Environmental Impact Statement Vol 2 - Appendicies, Kempsey/Wauchope Management Areas*, Forestry Commission of NSW.

Field operatives

Glenn Atkinson, Manager Resource Assessment, DLWC, Kempsey.
Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Steve Bishop, District Forester, State Forests, Kempsey.
Steve Dobbins, Planning Forester, State Forests, Kempsey.
Tanya Hoffman, Marketing Forester State Forests, Wauchope.
Ken Baldwin, Field Assistant, State Forests, Wauchope.
Steve Beaman, Forestry Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
Cb	RACAC geology & Tam-Hastings 1:250k geology. Kempsey 1:100k Soil Landscape units gm, fw, ko. Kemp-Wauchope EIS unit D	Byabarra Beds. Lithic sandstone, siltstone, mudstone, tuff, limestone. On rolling country Stony Krasnozems, Euchrozems and Lithosols. Steep land has Stony Lithosols, Yellow Earths and Podzolics.	Stony and stable with stable batters.	1
Ceb	RACAC geology & Tam-Hastings 1:250k geology. Kempsey 1:100k Soil Landscape units gm, minor ko. Kemp-Wauchope EIS map unit D	Boonanghi, Kiwarrak and Koorainghat beds and Taree Limestone. Mudstone, laminite, lithic sandstone, tuff, minor limestone and conglomerate. shallow Lithosols, Euchrozems and Krasnozems.	Stony and stable soils.	1
Clp	RACAC geology & Tam-Hastings 1:250k geology. Kempsey 1:100k Soil Landscape units cp, co, mm. Kemp-Wauchope EIS map unit D	Youldale, Kullatine, Majors Creek, Mingaletta and Cooperabung Formations. Lithic sandstone, mudstone, conglomerate, siltstone, minor limestone. Various shallow stony soils includes Lithosols, Yellow Earths, Krasnozems, Red, Brown and Yellow Podzolic Soils. Note on Kempsey mm unit - ocalised Soloths occur.	Generally shallow stony stable soils.	1

Cpk	RACAC geology & Tam-Hastings 1:250k geology. Kempsey 1:100k Soil Landscape units kg, mm, eu. Kemp-Wauchope EIS soil unit D	Kempsey Beds Lithic sandstone, mudstone, pebbly sandstone, minor conglomerate. See kg, mm, eu soil landscapes: unstable Duplex soils. Map unit D Wauchope EIS: Often stony, Krasnozems, Xanthozems, Chocolate soils, Structured plastic clays, Structured Loams, Yellow and Red Podzolic Soils (see comments).	Generally high sediment delivery unstable soils with localised stable soils restricted to upper slopes.	3(1)
Cpkx	RACAC geology & Tam-Hastings 1:250k geology. Kempsey 1:100k Soil Landscape units kg, mm, eu. Kemp-Wauchope EIS soil unit D	as per Cpk.	Field Work in Tamban SF indicate generally Red Brown and Yellow Podzolic Soils. Predict Lithosols on stony ridges some Chocolate Soils and Krasnozems (Class 1). Some unstable soils located on lower slopes and drainage lines carrying spotted gum and ironbark located in south western Tamban and Old Station State Forest (class 3).	1(3)
Cpkx1	Modified Cpk unit (has different geology)	Extensive field work undertaken in this area has identified stable metasediment soils.	Metasediments on ridges and sediments on lower slopes.	1(3)
Cpyx	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Youldale Formation: siltstone, lithic sandstone and diamictite.	Generally stable soils on plateau. Otherwise unknown.	1
Dcs	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS soil unit C	Sandon Association. Sandstone, schist, phyllite, slate, chert, jasper, basalt amphibolite with structured stony soils. See Kempsey EIS soil unit C: Krasnozems, Xanthozems, minimal Krasnozems, Structured Plastic Clays and Yellow Podzolic Soils. Subsoil EAT often 2(1), but DP generally low.	Generally stony soils. Localised Yellow Podzolic Soils with high sediment deliver occur.	1(3)
Dct	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS map unit D	Tionee, Belbora and Birdwood beds. Laminite, mudstone, lithic sandstone, tuff, andesite, breccia, tuffaceous sandstone. Often stony Krasnozems, Xanthozems, chocolate soils, structured plastic clays, structured loams, yellow and red Podzolic soil (map unit D) country predict stony soils. EIS identifies some soils with medium DP (up to 53%) and quite a few subsoil EATs of class 2.	Stable stony soils	1
Dey	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS map unit A	Unnamed. Basalt, andesite, limestone. High Fe soils Krasnozems, Xanthozems, minimal Krasnozems and structured plastic and sub-plastic clays.	Stable soils.	1
Pawx	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Warbro Formation. Grey micaceous siltstone, sandstone rare mudstone, thin conglomeritic limestone Preserved Forest.	Preserved Forest.	1
Payl	RACAC geology and Dorrigo - Coffs Harbour 1:250k geology	Yessabah Limestone. Limestone, calcareous mudstone. Geology can be correlated to Soil unit D, Soils on Sediments, Kempsey Wauchope EIS. Often stony, Krasnozems, Xanthozems, Chocolate soils, Structured plastic clays, Structured Loams, Yellow and Red Podzolic Soils.	Soils are predominantly very red stable soils and have been influenced by basalts in the area.	1
Pd	RACAC geology & Tam- Hastings 1;250K geology. Kemp-Wauchope EIS map unit A	Dolerite, gabbro, diorite, basalt, chert, jasper, tonalite, quartzfeldspar porphyry. High Fe soil. Krasnozems, Xanthozems, minimal Krasnozems and structured plastic and sub-plastic clays.	Stable soils	1
Pem	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS	Manning Group. Diamictite, conglomerate, sandstone, mudstone, felsic and intermediate volcanics, limestone. Often stony Krasnozems, Xanthozems, Chocolate soils, Structured plastic clays, Structured	Soils are stable.	1

	map unit D	Loams, Yellow and Red Podzolic Soils (map unit D). Note EIS identifies some soils with medium DP (up to 53%) and quite a few subsoil EATs of class 2.		
Pen	RACAC geology, Tam- Hastings 1:250K geology and Kemp-Wauchope EIS.	Parrabel Beds: diamictite, paraconglomerate, conglomerate, lithic sandstone, mudstone and limestone. EIS unit D. Often stony Krasnozems, Xanthozems, chocolate soils, structured plastic clays, structured loams, yellow and red Podzolic soil (map unit D) country predict stony soils. EIS identifies some soils with medium DP (up to 53%) and quite a few subsoil EATs of class 2.	Very small area in Carrai SF now mostly National Park. Predict stable stony soils.	1
Pet	RACAC geology & Tam-Hastings 1:250K geology. Kemp-Wauchope EIS map unit C	Thrumster Slate: slate, metasandstone, metaconglomerate. Krasnozems, Xanthozems, minimal Krasnozems, Structured Plastic Clays, Yellow Podzolic Soils. Subsoils stony (map unit C). EATs subsoils often 2(1), but DP generally low.	Generally stony stable soils but localised areas (generally footslopes) may be unstable as indicated by some 2(1) EATs, although DPs are not high (Wauchope EIS).	1 (3)
Pey	RACAC geology & Tam/Hastings 1:250K geology. Kempsey 1:100K Soil Landscape unit bw, co, cp. Kemp-Wauchope EIS map unit D	Macleay Group. Lithic sandstone, mudstone, limestone, felsic volcanics. Generally stable Lithosols and Red Podzolic Soils. Often stony Krasnozems, Xanthozems, Chocolate soils, Structured plastic clays, Structured Loams, Yellow and Red Podzolic Soils (map unit D).	Soils generally stable. EIS identifies some soils with medium DP (up to 53%) and quite a few subsoil EATs of class 2.	1(3)
Pncx	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Unnamed metasediments: slaty siltstone, sandstone and diamictite and minor metabasalt.	Stable gravelly, deep, yellow brown duplex soils.	1
Pnfm	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Unnamed phyllite: phyllite, schist and rare metabasalt.	Similar geology to Thumbs Ck area in Urunga MA hk soil landscape which is stable and gravelly	1
Pnpf	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Pee Dee Beds: slaty siltstone, lithic sandstone and minor diamictite.	Gravelly stable soils.	1
Pnpx	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Parrabel Beds. Lithic sandstone, siltstone, minor limestone, metabasalt. Geology can be correlated two soil units mapped in Kempsey. In the north of Carrai the area has been mapped as granite soils (unit B): minimal Krasnozems, Krasnozems, Yellow earths and Chocolate Soils. EIS has mapped metasediments (soil unit C) in the south: Krasnozems, Xanthozems, minimal Krasnozems, Structured Plastic Clays, Yellow Podzolic Soils. Subsoils stony.	Stable red soils with basalt influence.	1
Ps	RACAC geology & Tam-Hastings 1:250k geology. Kempsey-Wauchope EIS map unit C	Serpentinite, ultramafics. Krasnozems, Xanthozems, minimal Krasnozems, Structured Plastic Clays, Yellow Podzolic Soils subsoils stony (map unit C). EATs subsoils often 2(1), but DP generally low.	Stable stony, soils.	1
Pzt	RACAC geology & Tam-Hastings 1:250k geology	Watonga Formation. Slate, chert, minor slaty sst, rare metabasalt.(see map unit C soils above).	Generally stony but localised soils may be unstable.	1 (3)
Pzw	RACAC geology & Tam-Hastings 1:250k geology	Woolomin Association. Chert, jasper, slate phyllite, basalt, minor sandstone. (see map unit C soils above).	Generally stony but localised soils may be unstable.	1(3)

Qa, Qu	RACAC geology, Tam-Hastings and Dorrigo-Coffs Harbour 1:250k geology. Kempsey Soil Landscape mr unit	Alluvium.	Stable soils.	1

Qaa	Modified Qa unit based on poorer soils. Kempsey 1:100k Soil Landscape unit mr. Wauchope EIS unit E	Alluvial mud, silt, sand, gravel, coastal sands and swamp. See Kempsey Soil Landscape unit mr: Humic Gleys and Grey and Yellow Duplex Soils. Localised sodicity and high DP. Wauchope EIS unit E: Lithosols and structured plastic Clays. EAT 8, 3(4), 3(2).	Generally highly unstable soils.	4
Rbd	RACAC geology & Tam-Hastings 1:250k geology	Granitoid Diorite; Lithosols on crests and Chocolate Soils and Krasnozems on slopes.	Stable Soils.	1
Rbg	RACAC geology & Tam-Hastings 1:250k geology	Granite, granodiorite, microgranite. Krasnozems and Xanthozems.	Stable Red Soils.	1
Rec	RACAC geology. Kempsey-Wauchope EIS soil unit D	Red grey mudstone, lithic sandstone, conglomerate, tuffaceous sandstone, felsic volcanics. Map unit D: Often stony, Krasnozems, Xanthozems, Chocolate soils, Structured plastic clays, Structured Loams, Yellow and Red Podzolic Soils. EIS indicates soils are generally stable but have medium DP (up to 53%) and quite a few subsoil EATs of class 2.	Generally stable Krasnozems with sandy soils around western edge.	1(2)
Rgb	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS soil unit A	Banda Banda Monzonite. Monzodiorite. Map unit A EIS: Krasnozems, Xanthozems, minimal Krasnozems and structured plastic and sub-plastic clays.	Stable, stony red soils.	1
Rgbd	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Botumburra Range Ademellite: Horneblende -biotite granodiorite and monzogranite, biotite leucogranite.	Generally unknown. Predict stable soil as well as some sandy soils on granites and some unstable soils.	1(3,2)
Rgc	RACAC geology & Tam-Hastings 1:250k geology; Kemp-Wauchope EIS soil unit B	Cainscross Adamellite: Granitoid Adamellite. Wauchope EIS map unit B: minimal Krasnozems, Krasnozems, Yellow Earths and Chocolate soils	Generally unknown but predict class 2.	2
Rgcd	Dorrigo-Coffs Harbour 1:250k geology	Carrai Granodiorite: Hornblende-biotite granodiorite and monzogranite and alaskite.	Sandy gravelly soils (class 2).	2
Rgdu	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Daisey Plains leucoadamellite: fine to medium grained biotite leucogranite	Gravelly sandy soils (class 2).	2
Rge	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS soil unit B	Glen Esk Adamellite: Granitoid Adamellite. Wauchope EIS unit B: Minimal Krasnozems, Krasnozems, Yellow Earths and Chocolate Soils.	Sandy soils with patches of stable soils.	2(1)
Rgg	RACAC geology & Tam-Hastings 1:250k geology; Kempsey 1:100k Soil Landscape units sr, by. Kemp-Wauchope EIS soil unit B	Gundle Granite: Granitoid leucogranite and porphyritic micro granite. Kempsey Soil Landscapes: rocky Lithosols, Yellow and Red Podzolic Soils and Red Earths.	Predominantly microgranites producing stable soils, but localised sandy soils occur.	1(2)
Rgz	RACAC geology & Tam-Hastings 1:250k geology.	Undifferentiated porphyry and Adamellite.	Generally sandy soil.	2

Rgz	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS map unit B	Granitoid Porphyry and rhyolitic volcanics. Wauchope EIS map unit B: minimal Krasnozems, Krasnozems, Yellow earths and Chocolate soils.	Stable soils.	1
Rlv	RACAC geology & Tam-Hastings 1:250k geology	Unnamed, and rhyolitic volcanics: fits into fine grained acid volcanics soil regolith class 3.	Generally unknown but predict stony stable soils in steep areas but lower slopes in undulating areas may be more unstable and	1(3)

			high sediment delivery.	
Rmv	RACAC geology & Tam-Hastings 1:250k geology. Kemp-Wauchope EIS map unit A	Unnamed. Rhyolitic and rhyodacitic volcanics. Wauchope map unit A: Krasnozems, Xanthozems, minimal Krasnozems and structured plastic and sub-plastic clays.	Stable soils.	1
Tb	RACAC geology and Dorrigo-Coffs Harbour 1:250k geology	Unnamed Volcanics: basalt, dolerite, andesite trachyte, minor conglomerate, sandstone and mudstone.	Generally unknown. Predict stable Krasnozems on basalts and dolerites but other sediments when not stony are probably class 3.	1(3)
Tv	RACAC geology & Tam -Hastings 1:250k geology. Kemp-Wauchope EIS soil unit A	Basalt, dolerite, conglomerate, quartz and ferruginous sandstone and mudstone. Wauchope map unit A: Krasnozems, Xanthozems, minimal Krasnozems and structured plastic and sub-plastic clays.	Stable, red soils.	1

Taree, Coopernook, Kendall, Marsh and Wingham Management Areas

References/data sources

Geological Survey of NSW, 1966, *Newcastle 1:250 000 Geological Map*, Department of Mines, Sydney.

Gilligan, L.B., Brownlow, J.W., and Cameron, R.G. 1987, *Tamworth-Hastings 1:250 000 Metallogenic Map*, NSW Geological Survey, Sydney.

Murphy, C.L. (in prep.), *Soil Landscapes of the Bulahdelah/Forster 1:100 000 Sheets*, Department of Land and Water Conservation, Sydney.

Veness and Associates, 1992, 'Soil Landscape Mapping and Erosion Report' in Truyard Pty Ltd (complier) *Environmental Impact Statement Vol 2 - Appendices, Wingham Management Area, Proposed Forest Management*, Forestry Commission of NSW.

Veness and Associates Pty Ltd, 1993, 'Soil Report', in Truyard Pty Ltd (compiler) *Environmental Impact Statement Vol 2 - Appendicies, Kempsey/Wauchope Management Areas*, Forestry Commission of NSW.

Field operatives

Bob Walker, Soil Conservationist (Forestry), DLWC, Newcastle.
John Cooper, Forest Assistant, State Forests, Taree.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
Cb	Tamworth-Hastings 1:250k geology and correlated soils data from Kemp-Wauchope EIS	Byabbara Beds: lithic sandstone, siltstone, mudstone, tuff and limestone. See Kem-Wauchope EIS soil unit D which occurs on same geology: Stony Krasnozems, Euchrozems and Lithosols. Steep land has Stony Lithosols, Yellow Earths and Podzolics .	Very steep, stony, very stable.	1
Ceb, D	Tamworth-Hastings 1:250k geology (Ceb), Newcastle 1:250k geology (D) and correlated soils data from Kemp-Wauchope EIS	Boonanghi, Kiwarrak and Koorainghat Beds and Taree Limestone: mudstone, laminate, lithic sandstone, tuff, minor limestone and conglomerate. See Kemp- Wauchope EIS soil unit D which occurs on same geology: Shallow Lithosols, Euchrozems and Krasnozems. Field mapping of Bulahdelah area identified: on undulating country deep Red, Brown and Yellow Podzolic Soil catena with Soloths on lower slopes. On steep and hilly country stony Lithosols and stony Red and Yellow Podzolic Soils.	Generally stable on steep and undulating country. Some high sediment delivery soils on lower slopes and drainage plains in undulating country.	1(3)
Cet	Newcastle 1:250k geology and reference to Bulahdelah 1:100k Soil Landscapes	Booti Booti Sandstone: white siltstone with coal rich beds, cross bedded sandstone with white siltstone and parallel laminated quartzose sandstone. Steep country has gravelly Lithosols and stony shallow Yellow Podzolics. Rolling to undulating areas have Yellow Podzolic Soils and colluvial footslopes and drainage plains have Sodic Soloths.	Steep country is gravelly and generally stable (class 1). Undulating country is often high sediment delivery Yellow Podzolics. (class 3) Localised lower colluvial slopes with collapsing batters are sodic and dispersible (class 4).	1(3,4)
Dcs	Tamworth-Hastings 1:250k geology and Wingham EIS	Sandon Association: sandstone schist, phyllite, slate, chert, jasper, basalt and amphibolite. See Wauchope EIS soil landscape cs: steep sideslopes with narrow long ridge lines and steep footslopes with structured subplastic and superplastic clays. Subsoil EATs more stable than 3(1), and DP < 36 %.	Very stable country.	1

Dct	Tamworth - Hastings 1:250k geology and correlated soils data from Kemp-Wauchope EIS	Tinonie, Belbora and Birdwood Beds: Laminite, mudstone, lithic sandstone, tuff andesitic breccia, tuffaceous sandstone. See Kemp- Wauchope EIS soil unit D which occurs on same geology: often stony Krasnozems, Xanthozems, chocolate soils, structured plastic clays, structured loams, Yellow and Red Podzolic Soil. EIS identifies some soils with medium DP (up to 53%) and quite a few subsoil EATs of class 2.	Predominantly stable but drainage lines and lower concave slopes may be class 3.	1(3)
Pd	Tamworth-Hastings 1:250k geology	Permian Fault Zone Complexes includes Karikeree Metadolerite: dolerite, gabbro, diorite, basalt, chert, jasper, tonalite, trondhjemite and quartz felspar porphyry.	Predict stable soils.	1
Pem, Pma	Tamworth-Hastings 1:250k (Pem) and Newcastle 1:250k (Pma) geology and correlated soils data from Wingham EIS and Bulahdelah 1:100k Soil Landscapes (in prep)	Pem: Manning Group and Andersons Flat Beds: diamictite, conglomerate, sandstone, mudstone felsic and intermediate volcanics, and limestone. See Wingham EIS soil landscape unit bk: steep ridges sideslopes and footslopes with structured plastic and subplastic soils and Chocolate Soils. Predominantly subsoil EAT < 3(1) and DP < 30%. One sample had EAT 2(1) and DP 43%. Undifferentiated Permian Sediments on Bulahdelah sheet. Stony Lithosols and shallow stony Yellow Podzolics on steep slopes with Red and Yellow Podsolic on slopes and Soloths on lower slopes and drainage lines	Generally moist slopes with high organic matter and stony ridges are stable. Undulating dry country often with spotted gum and ironbark association have hardsetting horizons and are high sediment delivery. EIS indicates generally stable soils but one lab sample was unstable.	1(3)
Ps	Tamworth Hastings 1:250k geology and correlated soils data from Wingham EIS.	Serpentinite and serpentinized ultramafics. See Wingham EIS soil landscape unit tt: steep hillslopes with Structured Plastic Clays. Predominantly subsoils EAT more stable than 3(1) and DP < 6%. One sample had EAT 2(1) and DP 43%. Gravelly surface layers.	Stable, steep, gravelly, high organic matter with some cracking clays near Gloucester.	1
Pzt	Tamworth-Hastings 1:250k geological map and correlated soils data from Kemp-Wauchope EIS.	Slate, chert, minor slaty sst, rare metabasalt.(see map unit C above).	Kemp-Wauchope EIS soil unit C on same geology identifies soils as generally stony but localised soils may be unstable as indicated by common subsoil 2(1) EATs, although DPs are not generally high.	1 (3)
Pzw	Tamworth-Hastings 1:250k geology and correlated soils data from Wingham EIS	Woolomin Association: Chert jasper, slate, phyllite, basalt, minor sandstone. See Wingham EIS soil landscape unit do: steep terrain predominantly sideslopes with Structured Plastic Subplastic and Superplastic Clays and Chocolate Soils. Predominantly subsoils EATs more stable than 3(1), DP < 8% and high gravel content.	Generally steep moist and stable. Some localised high sediment delivery on waning lower slopes.	1(3)
Qa	Tamworth-Hastings 1:250k geology	Alluvial mud, silt sand and gravel deposits, coastal sand beaches and dunes, swamp deposits.	Stable, deep moist soils with Blackbutt. Compartment 110,11,12 study had EATs subsoils of 3(2),5, 8/3(1) and are generally stable. Alluvium near Knappinghat Creek have Soloth soil types.	1 (4)
Rbd	Tamworth-Hastings 1:250k geology	Granitoid Diorite; Lithosols on crests and Chocolate Soils and Krasnozems on slopes.	Stable Soils.	1
Rbg	Tamworth-Hastings 1:250k geology	Granitoid: granite, granodiorite and microgranite.	Very stable country with red well structured soils with a good groundcover.	1

Rec	Tamworth-Hastings 1:250k geology and correlated soils data from Kempsey EIS.	Camden Haven Group: red and grey mudstone, lithic sandstone, and conglomerate, tuffaceous sandstone, felsic volcanics and minor coal. See Kemp-Wauchope EIS soil unit C which occurs on same geology: often stony Krasnozems, Xanthozems, Chocolate Soils, structured plastic clays, structured loams, Yellow and Red Podzolic Soils	Coopernook SF has mostly very stable red and brown structured soils, batters stable and well grassed. Some high sediment delivery non-gravelly Yellow Podzolic Soils occur on some flat ridges and on highly weathered sandstones. Sandy soils (Class 2) occur as a thin band around the escarpment edge (western) on conglomerate.	1(2,3)
Rlv		Unnamed Volcanics in Lorne Basin: rhyolite and rhyolitic volcanics.	Predict class 1 in steep areas but lower slopes in undulating areas are likely to be more unstable.	1(3)
Sr	Newcastle 1:250k geology	Serpentine.	Generally stable, shallow, dark cracking clay soils, with good structure.	1
Ta	Tamworth-Hastings 1:250k geology	Tertiary trachyte and rhyolite plugs, sills and flows. Very steep hills with rock outcrop and shallow Lithosols.	Rocky and stony, very stable.	1
Tv	Hastings 1:250k geology and correlated soils data from Wingham EIS.	Liverpool Range Beds, Comboyne Basalt and unnamed basaltic volcanics. Krasnozems and Chocolate Soils. See Wingham EIS soil landscape unit me: gently undulating terrain with Krasnozems. Subsoil EAT 6. DP 2%.	Very stable.	1

Walcha/Nundle and Styx River Management Areas

References/data sources

ERM Mitchell McCotter Pty. Ltd., 1995, *Soils Report, Walcha/Nundle and Styx River Management Areas EIS, Supporting Document No. 5*, State Forests of NSW, Pennant Hills.

Gilligan L.B., Brownlow J.W. and Cameron R.G. 1987, *Tamworth-Hastings 1:250,000 Metallogenic Map,* NSW Geological Survey, Sydney.

Gilligan, L.B., Brownlow, J.W., Cameron, R.G. and Henley, H. 1992, *Dorrigo-Coffs Harbour 1:250 000 Metallogenic Map*, NSW Geological Survey, Sydney.

Regional and Resource Conservation Assessment Council, 1996, 'Geological Units of the Upper North East Region', *in Volume 2, Physical Attributes, Regional Report of Upper North East New South Wales,* Regional and Resource Conservation Assessment Council, Sydney.

Field operatives

Kel Christiansen, Soil Conservationist (Forestry), DLWC, Grafton.
Bob Walker, Soil Conservationist (Forestry), DLWC, Newcastle.
Justin Williams, Forest Planner, State Forests, Walcha.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
ar	Walcha/Nundle and Styx River EIS	Sandon Association (Csx): Wandsworth Volcanic Group, (Pwdc): metasediments and metabasalt. Gently undulating hills with shallow stony Yellow Podzolic Soils and Alluvial Soils. EAT 8/5, 8/3(1), 5. Gravel > 20%.	Generally unknown. EIS indicates soils are stable but some class 3 may occur.	1(3)
bd	Walcha/Nundle and Styx River EIS	Woolomin Association (Pzw): metasediments and basalt. Gently to undulating broad ridges with Krasnozems, Red Earth, Chernozems. 8/3(1), 5. Gravel < 20%.	Stable soils.	1
bh	Walcha/Nundle and Styx River EIS	Tertiary Volcanics (Tv): basalt, dolerite, polymictic conglomerate. Undulating to steep ridges and board valleys with Krasnozems and Chocolate Soil. EAT 5.	Stable soils.	1
br	Walcha/Nundle and Styx River EIS	Metasediments, basalt, amphibolite and limestone. EAT 8/3(1), 3(1), 5. Gravel < 20%.	Generally stable soils with possible some unstable soils lower slopes.	1(3)
Csx	Dorrigo-Coffs Harbour 1:250k geology	Sandon Association Metasediments and metavolcanics. Flat to undulating plateau with Lithosols and Soloths.	Generally highly unstable Soloths but localised stony stable Lithosols occur.	4(1)
DCs	Tamworth-Hastings 1:250k Geology	Undulating broad rounded hills on sandstone, schist, phyllite, slate, chert, jasper, basalt amphibolite. Prairie Soil, Gleyed Podzolic Soil and Red Earth. EAT 8,3(1). Gravel > 20%	Stable stony soils.	1
Det	Tamworth - Hastings 1:250k Geology	Tamworth Group: coarse and fine grained sedimentary rocks, basalt and dolerite.	Non-calcic Brown Soils, Red Podzolics.	1
du	Walcha/Nundle and Styx River EIS	Det (Tamworth Group): metasediments and volcanics. Steep V-shaped valleys with Lithosols, Yellow Earths, Red Earths, Prairie Soil. EAT 3(1) or 5. Gravel < 20%.	Generally stable soils.	1
em	Walcha/Nundle and Styx River EIS	Sandon Association (Csx), Coffs Harbour Association (Cgs) Metasediments and metavolcanics. Flat to undulating plateau with Lithosols and Soloths.	Generally highly unstable Soloths but localised stony stable Lithosols occur.	4(1)

en	Walcha/Nundle and Styx River EIS	Tertiary Volcanics (Tv): basalt, dolerite. Gentle to undulating broad rounded hills with Krasnozems, Euchrozems and Chocolate Soil EAT 3(1), 5, 5.	Stable soils.	1
gr	Walcha/Nundle and Styx River EIS	Very steep gorges on Nambucca, Dyanberin and Unnamed Sediments with shallow Red Earths and Prairie soils on less steep slopes. EAT 8/5, 5, 3(1). Gravel < 20%.	Stable soils.	1
mr	Walcha/Nundle and Styx River EIS	Clc: metasediments (sandstone slate, schist, minor felsic volcanics and chert); very steep V-shaped valleys with Red Yellow and Brown Earths, Red Podzolic Soils and Red Brown Earths. Subsoil EAT 2(1), Gravel < 20%.	Generally unknown. Predict unstable soils.	3
ms	Walcha/Nundle and Styx River EIS	Nundle Plutonic Suite (Phd), Uralla Plutonic Suite (Pudg), igneous intrusives, monzogranite. Low hills with Red Earths, Yellow Earths and Siliceous Sands. EAT 5, 6, 5.	Generally unknown. EIS indicates class 2 type soils.	2(4)
no	Walcha/Nundle and Styx River EIS	Woolomin Association (Pzw) metasediments and basalt. Narrow ridge lines deeply incised gorge with Yellow Earths and Lithosols. EAT 5, 5, 3(1).	Soils have high aggregate stability.	1
Pem	Tamworth Hastings 1:250k Geology	Manning Group; diamictite, conglomerate, sandstone and limestone; steeply to moderate sloping terrain with gravelly and stony Red Podzolic soils, minor Yellow Podzolic soils on lower slopes.	Yellow Podzolics prone to minor to moderate rill erosion, some wash occasionally on road batters.	1(3)
pl	Walcha/Nundle and Styx River EIS	Dyamberin beds and unnamed sediments: sediments and felsic volcanics. Undulating plateau with Yellow Earths, Lithosols, Solodic Soils and Yellow Podzolic Soils. EAT 8/3(1), 3(1).	Generally stable soils but some Solodic Soils identified in EIS.	1(4)
Pudg	Dorrigo Coffs Harbour1:250k Geology	Mount Duval monzogranite and adamellite; moderate to steeply undulating terrain, Red Podzolic Soils, strongly structured with some stone and rock; minor sandy Red Earths and Earthy Sands on adamellites.	Not exposed to forestry operations; minor rilling on batters and unsealed roads on more sandy soils.	1(2)
Pwav	RACAC geology	Wandsworth volcanics, rhyolite and pyroclastics; yellow podzolic soils with well developed light coloured A2 horizon, minor Red Podzolics on better drained locations and upper slopes.	Minor rill erosion on batters and unsealed tracks.	3(1)
Pzw	Tamworth Hastings 1:250k Geology	Woolomin Association: metasediments and basalt. Gently undulating broad ridges with Krasnozems, Red Earth, Chernozems. EAT 8, 3(1), 5. Gravel < 20%.	Stable soils.	1
Qu	RACAC geology	Undifferentiated Quaternary sediments including: alluvial mud, silt, sand, gravel deposits, and swamp deposits, coastal sand beaches and dunes and estuarine deposits.	Generally unknown, very small isolated occurrences. Unstable (class 4) soils may be present.	2(4)
ri	Walcha/Nundle and Styx River EIS	Tertiary Volcanics (Tv): basalt, dolerite, polymictic conglomerate. Gently undulating board hills with Krasnozems and Prairie Soil. EAT 5, 5, 5.	EIS indicates stable soils.	1
rk	Walcha/Nundle and Styx River EIS	Dcs geology as above, Lithosols, Red Earths, Krasnozems, Yellow Podzolic Soils. EAT 8/3(1), 5. Gravel > 20%.	Stony stable soils.	1
rm	Walcha/Nundle and Styx River EIS	Gundle Granitoid Belt (Rgru); Hillgrove Plutonic Suite, (Phkg): granites. Undulating to steep board hills with Siliceous Sands and Yellow Earths. EAT 8/5, 8/5, 3(1), 3(1), 3(1).	Non-coherent sandy soils with some localised Soloths.	2(4)
sc	Walcha/Nundle and Styx River EIS	Nambucca beds (Pnsf, Pnpf, Pncx, Pnhr) metasediments, andesitic volcanics, minor limestone, metabasalt. Very steep gorges on upper plateau with Lithosols, and Yellow Earths. EAT/subsoil EAT 8/3(1), 3(2). Gravel often > 20%.	Soils stable.	1

sr	Walcha/Nundle and Styx River EIS	Flat to gently undulating plateau on Nambucca, Dyanberin and Unnamed Sediments. Red Earths upper slopes, Lithosols steep slopes, Yellow Podzolic Soils lower slopes, few gravels, EAT 8/3(1), 3(1), 5, 5.	Stable on metasediments. Yellow Podzolics on lower slopes may have some instability.	1(3)
st	Walcha/Nundle and Styx River EIS	Dcs geology: metasediments and basalt. Steep V-shaped valleys with Yellow Earths (non-sandy) and Chocolate Soils. No lab data, field & EIS suggest stable soils.	Generally unknown. EIS indicates stable soils. Adjacent plantation in stable soils.	1
tb	Walcha/Nundle and Styx River EIS	Undulating broad rounded hills on DCs (Sandstone, schist, phyllite, slate, chert, jasper, basalt amphibolite). Prairie Soil, Gleyed Podzolic Soil and Red Earth. EAT 8/3(1), 3(1). Gravel > 20%.	Stable stony soils.	1
to	Walcha/Nundle and Styx River EIS	Dcs geology as above: undulating upper plateau with Krasnozems, Red Earths Lithosols and Alluvial Soils. EAT 8/3(1), 3(1), 6. Gravel < 20%.	Generally red stable soils.	1
tu	Walcha/Nundle and Styx River EIS	Dcs geology as above: undulating to hilly with Lithosols, Red Earths and Yellow Podzolic Soils. EAT 8/3(1), with subsoils 5, 3(2), 3(3). Gravel < 20%.	Generally stable soils.	1
Tv	Tamworth Hastings 1:250k Geology	Tertiary Volcanics, Liverpool Range Beds: basalt, dolerite. Gentle to undulating broad rounded hills with Krasnozems, Euchrozems and Chocolate Soil. EAT 3(1), 5.	Stable soils.	1
wb	Walcha/Nundle and Styx River EIS	Sandon Association (Csx): metasediments and metabasalt. Undulating to rolling plateau with Lateritic Podzolic Soils, Yellow Earths, Alluvial Soils and Krasnozems. EAT 3(1), 6.	In National Park	3(1)
wr	Walcha/Nundle and Styx River EIS	Dcs geology: metasediments and basalt. Very steep V-shaped valleys with Red and Yellow Earths. EAT 3(1), 3(1), 5. Gravel < 20%.	Generally unknown but EIS notes soils are generally stable.	1

Bulahdelah Management Area

References/data sources

Geological Survey of NSW, 1966, *Newcastle 1:250 000 Geological Map*, Department of Mines, Sydney.

Matthei, L. E. 1995, *Soil Landscapes of the Newcastle 1:100 000 Sheet,* Department of Land and Water Conservation, Sydney.

Murphy, C.L. 1995, *Soil Landscapes of the Port Stephens 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Murphy, C.L. (in prep.) *Soil Landscapes of the Bulahdelah/Forster 1:100 000 Sheets*. Department of Land and Water Conservation, Sydney

Field operatives

Bob Walker, Soil Conservationist (Forestry), DLWC, Newcastle.
Nick Luede, Forester, State Forests, Bulahdelah.
Casey Murphy, Soil Surveyor, DLWC, Gosford.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil regolith Stability Class
am	Port Stephens 1:100k Soil Landscapes	Steep strike ridge on the Permian Alum Mountain Volcanics. Slopes generally 20-50%, Crests are narrow rocky and peaked, slopes are steep and often cobble strewn and drainage lines are numerous and narrow. A gentle broad saddle is present. Soils--shallow (<50 cm) Lithosols/Yellow Podzolic Soils on slopes with moderately deep (100-200 cm), imperfectly drained Yellow Podzolic Soils on the gentle saddle. Subsoil EAT 3(2). DP 34%	Very stony, generally stable soils.	1
Clc	Newcastle 1:250k geology and reference to Bulahdelah (in prep) and Port Stephens 1 :100k Soil Landscapes	Conger Formation: thickly bedded or cross stratified lithic sandstone, conglomerate and minor sandstone, carbonaceous shale and minor dacite. Steep areas correspond to rra soil landscape and rolling country corresponds to rr soil landscape (see rra below and Port Stephens Soil Landscapes).	Predominantly low sediment delivery soils, and some high sediment delivery soils on mudstones.	1(3)
Cln, gg	Newcastle 1:250k geology and Port Stephens 1:100k Soil Landscapes	Steep hills on ignimbrites of the Nerong Volcanics. Cliffs, scarps and in situ rock outcrop are occasionally present. Soils--shallow (<30 cm), well-drained Lithosols on crests; shallow to moderately deep (<80 cm) Lithosols and imperfectly drained Soloths with deep (>200 cm), poorly drained Soloths on footslopes. Subsoil EAT 6. DP 8%.	Generally very stony but soils have high silt content. Lower slopes with Soloths can be high sediment delivery.	1(3)
Clr	Newcastle 1:250 geology and reference to Bulahdelah (in prep) and Port Stephens 1:100k Soil Landscapes	Nerong Volcanics: rhyodacitic ignimbrite, minor dacite and rhyolitic pitchstone, interbeds of tuffaceous sandstone and conglomerate. Steep Hills correspond to gg soil landscape and rolling to undulating hills correspond to nc soil landscape (see Port Stephens Soil Landscapes for more detail). Note: In addition to nc, red stable soils can occur on shoulders of ridges.	Predominantly dry forest types on undulating country with high sediment delivery Podzolics or Soloths (class 3). On steep moist slopes soils are stable.	3(1)

Clw	Newcastle 1:250k geology and reference to Bulahdelah 1:100k Soil Landscapes (in prep)	Carboniferous Wooton Beds (has been subdivided into several different Formations in 1:100 000 map) containing siltstone, mudstone, sandstone shale, limestone lavas. Soils range form Lithosols on steep slopes, to Red, Brown and Yellow Podzolic Soils on sideslopes and Soloths on lower slopes and drainage plains.	Steep slopes are usually very gravelly and stable. Moist undulating country is generally stable apart from lower slopes with Soloths which are class 3. Dry Forest undulating country (spotted gum/ironbark) is generally prone to sheet erosion and batters are often unstable (class 3).	1(3)
cm	Port Stephens 1:100k Soil Landscapes	Steep low hills on lithic sandstones, conglomerates and minor siltstones of the McInnes Formation. Uneven surface with many cobbles, stones and occasionally boulders. Partially cleared tall open-forest. Soils--shallow (<50 cm), stony, well-drained Lithosols with minor poorly drained Soloths on sandstones with shallow well-drained Lithosols on siltstones. Subsoil EAT 3(1). DP 52%.	Predominantly stony Lithosols. Rolling country contains some high sediment delivery Soloths on lower slopes.	1(3)
Cua	Newcastle 1:250k geology and reference to Bulahdelah 1:100k Soil Landscapes (in prep)	Alum Mountain Volcanics: 1) Burdekins Gap Basalt Member: basalt with thin interbeds of conglomerate, lithic sandstone and coal seams with Predominantly Chocolate Soils. 2) Lakes Road Rhyolite Member: rhyolite with minor silicified basalt. Rock outcrop on narrow peaks, with very gravelly slopes with often red gradational soils grading into yellow gradational soils.	Predominantly stable soils.	1
Cuc	Newcastle 1:250k geology and reference to Bulahdelah (in prep) and Port Stephens 1:100k Soil Landscapes	Crawford Formation: Sandstone, conglomerate, mudstone, chert, tuff. Includes Issacs, Booral and Karuah Formations. Lithosols on steep slopes often with sandy topsoils. Yellow Podzolic Soils on rolling country.	Commonly stony stable Lithosols on steep slopes which grade into narrow moist drainage lines. Undulating country with moist forests are generally stable with organic rich surface horizons. Dry forests areas have pronounced hardsetting A2 horizons and are high sediment delivery soils.	1(2, 3)
ec	Port Stephens 1:100k Soil Landscapes	Rolling to steep low hills on sediments of the Booral Formation. Soils--shallow (<50 cm), well-drained Lithosols and minor, moderately deep (50-100 cm), imperfectly drained Yellow Podzolic Soils on siltstone/mudstones with shallow, well-drained Lithosols or moderately well-drained Yellow Podzolic Soils on sandstones. Subsoil EAT 6. DP 32%.	Predominantly stony Lithosols. Yellow Podzolic Soils can be high sediment delivery.	1(3)
gc	Port Stephens 1:100k Soil Landscapes	Undulating rises on lithic sandstone and thinner interbeds of conglomerate, siltstone, shale and coal of the McInnes Formation. Poorly drained Soloths and No Suitable Group	Soils are predominantly high sediment delivery.	3
gga	Port Stephens 1:100k Soil Landscapes	Landscape Variant--gga--steep colluvial footslopes. Soils bleached loams occasionally imperfectly drained Soloths.	Colluvial deep silty soils and Soloths which are often sodic but not dispersible.	3
mg	Port Stephens 1:100k Soil Landscapes	Steep hills on lithic sandstones, conglomerates and mudstones of the Wootton Beds. Slope gradients 20-60%. Soils--shallow (<50 cm), well-drained Lithosols and Lithosols/Yellow Podzolic Soils on sandstones and conglomerates with moderately deep (50-150 cm) moderately well-drained Soloths on mudstones and moderately deep (50-150 cm), very well-drained Structured Siliceous Sands along drainage lines. Subsoil EAT 3(3). DP 54%, 57%.	Complex soils. Generally stable but Yellow Podzolic Soils in dry forest areas are predicted to be high sediment delivery.	1(3)
mr	Port Stephens 1:100k Soil Landscapes	Floodplain on Quaternary Alluvium. Prairie Soils on levees, poorly drained Acid Peats in back swamps and poorly drained Dark Podzolic Soils on infilled channels.	Generally very boggy country with Potential Acid Sulphate Soils. Levees which are better drained	4(1)

		Potential Acid Sulphate Soils occur.	contain stable soils.	
ng	Port Stephens 1:100k Soil Landscapes	Gently inclined footslopes and drainage plains on Quaternary alluvium. Soils-deep (>300 cm), poorly drained Soloths and Solodic Soils. Subsoil EAT 2(2). DP 90%, high silt content.	High silt content, low wet strength sodic soils.	4
no	Port Stephens 1:100k Soil Landscapes	Undulating low hills on McInnes Formation. Slope gradients are <15%. Predominantly uncleared woodland with shrub understorey. Soils--discontinuous shallow to moderately deep (0-100 cm), imperfectly drained Yellow Podzolic Soils on sandstones with moderately deep (50-100 cm), imperfectly drained Yellow Podzolic Soils on siltstone parent material. Subsoil EAT 3(4), 3(2). DP 67%, 58%.	Generally hardsetting Yellow Podzolic Soils with class 3 rating. Localised areas of sandy soil may occur.	3 (2)
Pb	Newcastle 1: 250k geology and reference to Bulahdelah 1:100k Soil Landscapes (in prep)	Bulahdelah Formation: massive to thickly bedded lithic sandstone and poorly exposed siltstone and claystone. Sandstones tend to outcrop on steeper country and fine grained sediment on undulating country. Red and Yellow Podzolics Soils with Soloths on lower slopes. Some shallow Lithosols on steeper slopes often associated with sandstone outcrop.	Moist forest sites are generally stable (class 1). Dry forest sites have hardsetting high sediment delivery soils (class 3).	3(1)
pr	Port Stephens 1:100k Soil Landscapes	Undulating to rolling low hills on mudstones and minor interbeds of lithic sandstones of the Wootton Beds. Soils--shallow to moderately deep (30-70 cm), well-drained Brown Podzolic Soils and Yellow Podzolic Soils on sandstone parent material; moderately deep to deep (50-200 cm), moderately well-drained Brown Podzolic Soils and Yellow Podzolic Soils moderately deep to deep (100-200 cm), imperfectly drained Soloths in poorly drained areas. EAT 6, 2(3). DP 7%, 2%, 100%.	Predominantly dry forests with spotted gum and ironbark and Yellow Podzolic Soils. Batters prone to some instability.	3(1)
Qa	Newcastle 1:250k geology and reference to Bulahdelah 1:100k Soil Landscapes (in prep)	Undifferentiated Quaternary Alluvium and Swamp Deposits and Sand Dunes. High terraces and old alluvial deposits often have Soloths. Also incised sandy floodplains. Deep, peaty and silty Acid Sulphate Potential Soils occur on poorly drained floodplain near Myall River.	High terraces and old alluvial deposits often have Soloths (class 4). Incised floodplains are either sandy (class 2) or loamy (class 1)	4(1,2)
rra	Port Stephens 1:100k Soil Landscapes	Rolling low hills on conglomerates and lithic sandstones of the Conger Formation. Soils--shallow (<50 cm), well-drained Lithosols minor Yellow Podzolic Soils on crests and upper slopes. Moderately deep (50-150 cm), imperfectly drained Soloths and Gleyed Podzolic Soils on lower slopes and poorly drained areas. Minor mudstones in well-drained areas have shallow to moderately deep (30-100 cm) well-drained Yellow Podzolic Soils and Red Podzolic Soils.	Slopes usually stable lower slopes with high sediment delivery soils.	1(3)
sb	Port Stephens 1:100k Soil Landscapes	Pleistocene sand sheets to rolling very low dunes. Soils deep Podzols.	Deep sands.	2
sw	Port Stephens 1:100k Soil Landscapes	Gently inclined footslopes on Permian sediments of the Bulahdelah Formation. Local relief <5 m, slope gradients <10%, elevation to 20 m. Slopes are smooth and concave. Uncleared eucalypt tall open-forest. Soils--deep (>130 cm), imperfectly drained Grey Leached Earths (Gn2.94).	Sandy Earth soil.	1(2)

tr	Port Stephens 1:100k Soil Landscapes	Steep narrow ridge on sandstones and conglomerates of the Karuah Formation. Slope gradients >20%. Numerous boulders, cobble and stones. Soils shallow (<50 cm), well-drained Lithosols.	Predominantly stable stony soils. High fine and coarse sand content.	1(2)
tya	Port Stephens 1:100k Soil Landscapes	Landscape Variant--tya--deep organic muds infilling the edge of river channels and the Broadwater as well as old prior river channels of the Myall River.	Potential Acid Sulphate saturated organic muds often with a peaty surface.	4

Wallaroo Management Area

References/data sources

Matthei, L. E. 1995, *Soil Landscapes of the Newcastle 1:100 000 Sheet,* Department of Land and Water Conservation, Sydney.

Field operatives

Bob Walker, Soil Conservationist (Forestry), DLWC, Newcastle.
Nick Luede, Forester, State Forests, Bulahdelah.
Casey Murphy, Soil Surveyor, DLWC, Gosford.
Linda Henderson, Soil Surveyor, DLWC, Sydney.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
bi	Newcastle 1:100k Soil Landscapes	Rolling to steep hills on Carboniferous Sediments; Soils: moderately deep well drained Yellow Podzolic Soils and shallow Bleached Loams and Lithosols on stony ridge crests and deep Red Podzolic Soils where siltstones and polymictic conglomerates outcrop. Subsoil EAT 5, 3(3). DP 11%, 55%.	Localised class 3 on siltstones. Minor to moderate sheet erosion, minor tunnel and gully erosion, batters with moderate rill erodion in small areas.	1(3)
bia	Newcastle 1:100k Soil Landscapes	Landscape variant of bi soil landscape with similar soil landscape features except is rolling hillcrests and midslopes.	Comments as above.	1(3)
br	Newcastle 1:100k Soil Landscapes	Undulating rises to low hills on Carboniferous sediments and ignimbrites with Lithosols on and Brown Podzolic Soils on crests and Soloths on slopes.	Lithosols on crests are stable but predict lower slopes with Soloths to be susceptible to erosion Spotted Gum Ironbark country.	3(1)
cl	Newcastle 1:100k Soil Landscapes	Undulating low hills on Carboniferous Sediments. Moderately deep Soloths and Lithosols. Subsoil EAT 2(2). DP 75%.	Minor to moderate sheet erosion, gully erosion to bedrock.	3
fc	Newcastle 1:100k Soil Landscapes	Tidal flats and creeks with poorly drained saline Solonchaks.	Tidal Flats with potential acid sulphate soils.	4
gi	Newcastle 1:100k Soil Landscapes	Steep conical hills on Carboniferous lithic sandstone and ignimbrites. Soils: shallow to moderately deep Bleached Loams/Lithosols and shallow to moderately deep yellow Soloths and Grey Earths; Subsoil EAT 3(2). DP 39%.	Generally stable. Minor sheet and gully erosion (class 3) where Soloths and Grey Earths occur on midslopes and lower slopes.	1(3)
gl	Newcastle 1:100k Soil Landscapes	Rolling hills on Carboniferous sediments with Soloths and Bleached Loams.	Spotted Gum Ironbark country with hardsetting soils. Stony ridges are probably class 1 and stable but Soloths are likely to be highly erodible class 3.	3(1)
gwa	Newcastle 1:100k Soil Landscapes	Landscape variant of gw. Gently inclined footslopes and drainage plains on Carboniferous Volcanics. Imperfectly drained Yellow Podzolic Soils. Subsoil EAT 3(1). DP 30%.	Yellow Podzolic Soils. Typical class 3.	3
im	Newcastle 1:100k Soil Landscapes	Steep hills on Carboniferous sediments with Lithosols stony Yellow Earths and some moderately deep Yellow Podzolic Soils, Dy2.41, on midslopes and some crests.	Spotted Gum and ironbark country with hardsetting soils. Stony Lithosols are predicted to be stable. Yellow Podzolic Soils are predicted to be high sediment delivery.	1(3)
me	Newcastle 1:100k Soil Landscapes	Gently undulating low hills on sediments. Soils: well drained Red and Yellow Structured Loams on deeply weathered clay	Predominantly stable, minor erosion.	1

		deposits and well drained Yellow and Red Podzolic Soils and some Lithosols on sandy pebbly deposits with clay lenses. Subsoil EAT 6. DP < 4%.		
mj	Newcastle 1:100k Soil Landscapes	Steep upper slopes on Carboniferous Sediments. Moderately deep well drained Soloths, Lithosols and Bleached Loams. Subsoil EAT 2(2). DP 44%	Moderate sheet erosion, batters slump.	3
ng	Newcastle 1:100k Soil Landscapes (associated soil landscape from Port Stephens Soil Landscapes)	Gently inclined footslopes and drainage plains on Quaternary Alluvium. Deep poorly drained Soloths and Solodic Soils. Subsoil EAT 2(2). DP 89%. Very high silt content.	Deep, silty, sodic soils with very low wet strengths. Prone to gully erosion in cleared country.	4
sc	Newcastle 1:100k Soil Landscapes	Narrow alluvial plains on recent alluvium derived from Carboniferous Sediments and Volcanics. Alluvial Soils on plains with Siliceous Sands in channels. Subsoil EAT 3(1). DP 27%.	Minor to moderate streambank erosion.	2
tb	Newcastle 1:100k Soil Landscapes	Broad plains on deep Pleistocene Clay deposits. Poorly drained Soloths Subsoil EAT 2(2). DP 93%.	Soil DP varies considerably.	4(3)
tba	Newcastle 1:100k Soil Landscapes	Alluvial variant of tb soil landscape with very poorly drained Prairie Soils.	Poorly drained high sediment delivery (class 3).	3
tbb	Newcastle 1:100k Soil Landscapes	Pleistocene mangrove flat deposits with deep poorly drained Brown Podzolic Soils.	Predict this are not to be logged due to lack of timber and very poor drainage.	3
tm	Newcastle 1:100k Soil Landscapes	Undulating low hills on Carboniferous Sediments and acid Volcanics. Soloths and Bleached loams/Lithosols. Subsoil EAT 3(1). DP 35%.	Soil regolith prone to moderate gully and sheet erosion.	3
tma	Newcastle 1:100k Soil Landscapes	Landscape variant of tm with rolling low hills.	Soil regolith prone to moderate gully and sheet erosion.	3
ts	Newcastle 1:100k Soil Landscapes	Swampy floodplains and closed depressions on Quaternary Sediments. Soils Acid Peats and Humic Gleys. Potential Acid Sulphate Soils.	Peaty stable topsoils but very sodic, unstable subsoils.	1(4)

Gloucester, Chichester and Mount Royal Management Areas

References/data sources

Henderson, L.E. (in prep.) *Soil Landscapes of the Dungog 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Kovac, M. and Lawrie, J.W. 1991, *Soil Landscapes of the Singleton 1:250 000 Sheet,* Soil Conservation Service of NSW, Sydney.

Veness and Associates Pty Ltd, 1995, *Soils Report, Gloucester and Chichester Forest Management Areas EIS Study, Supporting Document No.1*, State Forests of NSW, Pennant Hills.

Field operatives

Bob Walker, Soil Conservationist, (Forestry), DLWC, Newcastle.
Linda Henderson, Soil Surveyor, DLWC, Sydney.
Brant Bailey, Marketing Forester, State Forests, Gloucester.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
A	Gloucester-Chichester EIS	Predominantly plateau and upper slopes on Tertiary Basalt with Krasnozems and Chocolate Soils. Subsoil EAT 6, DP 4%.	Very stable well drained soils.	1
B	Gloucester-Chichester EIS	Undulating to hilly mid to lower slopes on minor Volcanics with minimal Krasnozems. Subsoil EAT 2(1), 2(2). DP 50%, 53%. Clay content < 16%.	High sediment delivery Yellow Podzolic Soils with ironbark and spotted gum.	3
bg	Singleton 1:250k Soil Landscapes	Bridgelands soil landscape: Carboniferous siltstone, mudstone, lithic sandstone, limestone, rolling hills and some mountains. Lithosols on upper slopes, Red Soloths on lower slopes. On shale there are Red Earths on upper slopes and Brown Clays on lower slopes.	Stony Lithosols on ridges. Steep stony Brown Earths, Red Earths/Lithosols and Red Brown and Yellow Podzolics. (class 3) intergrades. Wide open valleys with concave lower slopes (class 3).	1(3)
C	Gloucester-Chichester EIS	Moderate to steep hills on Granodiorite with Structured Plastic Clays and Krasnozems; Subsoil EAT 2(1), 3(2). DP 4%,5%.	Red well drained, well structured soils with high organic matter in moist forest.	1
ca	Singleton 1:250k Soil Landscapes	Carrowbrook soil landscape: Carboniferous sediments mainly lithic sandstone, conglomerate, siltstone shale and mudstone. Rolling hills and mountains with Yellow Earths and Brown Earths with some Yellow Duplex Soils.	Yellow, Red and Brown Duplex Soils with odd Krasnozems on intrusions. High sediment delivery class 3 on lower slopes particularly on lithic sandstones.	1(3)
ch	Singleton 1:250k Soil Landscapes	Chichester soil landscape: Tertiary basalt and volcanic ash and Carboniferous lithic sandstone, mudstone, siltstone and shale. Yellow and Brown Podzolic Soils on upper and midslopes. Shallow Chocolate Soils/Krasnozem intergrades on steep basalt slopes with Euchrozems on less steep slopes.	Similar to map D unit soils. Various soils, occasional sandstone outcrops on sideslopes and ridges.	1(3)

D	Gloucester-Chichester EIS	Undulating to very steep hills on fine-grained sediments with Xanthozems, Krasnozems, Yellow Podzolic Soils, Structured Subplastic and Plastic Clays. Subsoil EAT 2(1), 6. DP 3 to 31%.	Predominantly stable soils. Localised imperfectly drained Yellow Podzolics Soils with hardsetting A2 horizons occur on some flatter ridges. Midslopes and lowerslopes in Fosterton, Trevor and Dungog SFs have Soloths and B horizons may be moderately dispersible.	1(3)
E	Gloucester-Chichester EIS	Undulating to hilly mid and lower slopes on Earthy Sediments with Red Earths and Yellow Earths. High gravel content; Subsoil EAT 2(1). DP 24%,11%.	Predominantly stable soils identified in field in Avon SF. Lower slopes on undulating terrain can have sandy soils (class 2).	1(2)
F	Gloucester-Chichester EIS	Metasediments with Structured Plastic Clays, Structured Loams, Chocolate Soils and Gleyed Podzolic Soils; Subsoil EAT 2(1). DP 2%,4%.	Non dispersible well structured, stable batters good drainage.	1
rt	Singleton 1:250k Soil Landscapes	Rattly Ground soil landscape: Tertiary basalt and others. Long slopes of rolling hills and mountains. Krasnozems and Xanthozems on midslope flats.	Stable soils.	1
wm	Singleton 1:250k Soil Landscapes	Wallooma soil landscape: Tertiary Basalt. Steep mountains with Krasnozems.	Stable soils.	1

Cessnock and Wyong Management Areas

References/data sources

ERM Mitchell McCotter, 1995, *Morisset Forestry Environmental Impact Statement, Soils Report, Morisset Forestry District EIS, Supporting Document No. 1*, State Forests of NSW, Pennant Hills.

Kovac, M. and Lawrie, J.W. 1991, *Soil Landscapes of the Singleton 1:250 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Matthei, L. E. 1995, *Soil Landscapes of the Newcastle 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Murphy, C.L. 1993, *Soil Landscapes of the Gosford-Lake Macquarie 1:100 000 Sheet*,. Department of Conservation and Land Mangement, Sydney.

Field operatives

Bob Walker, Soil Conservationist (Forestry), DLWC, Newcastle.
Casey Murphy, Soil Surveyor, DLWC, Gosford.
Melissa Syne, Marketing Forester, State Forests, Morisset.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
ad	Singleton 1:250k Soil Landscapes and Morisset EIS	Elevated moderately steep hills on Branxton Formation (mudstone, sandstone and conglomerate) with Chocolate Soils, Yellow Podzolic Soils and Yellow Earths. Subsoil EAT 2(1).	Predominantly high sediment delivery Yellow Podzolic Soils. Some sandy soils occur.	3(2)
aw	Gosford-Lake Macquarie 1:100k and Singleton 1:250k Soil Landscapes and Morisset EIS	Rolling low hills on predominantly Munmorah Conglomerate (conglomerate) Newcastle Coal Measures (conglomerate, sandstone, tuff, siltstone, claystone and black coal). Stony Lithosols, Soloths, Yellow Podzolic Soils and Gleyed Podzolic Soils. Subsoil EAT 2(1).	Predominantly high sediment delivery soils. Some sandy soils occur.	3(2)
be	Newcastle 1:100k Soil Landscapes and Morisset EIS	Undulating low hills and rises on Permian Coal Fields (conglomerate, sandstone, tuff, shale and coal) with Yellow, Brown, Red and Gleyed Podzolic Soils and Yellow, Brown and Red Soloths. Subsoil EAT 5, 2(1).	Predominantly high sediment delivery soils with localised sandy soils on coarser grained parent material.	3(2)
bl	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Steep sided dome shaped hills of gently undulating plateau capping on Jurassic and Tertiary Volcanics with Krasnozems and Skeletal Krasnozems on steep slopes. Subsoil EAT 6.	Stable well structured soils.	1
bx	Newcastle 1:100k and Singleton 1:250k Soil Landscapes and Morisset EIS	Undulating rises to low hills on variable geology (sandstone, mudstone, siltstone, shale, tuff and conglomerate). Subsoil EAT 4.	Predominantly high sediment delivery Podzolic Soils with dry hardwood.	3
cb	Morisset EIS	Narrow to broad crests and ridges on Narrabeen Group (sandstone, conglomerate and claystone) with sandstone outcrops forming rocky summits. Yellow Podzolic and Brown Podzolic Soils on crests and steeper slopes with Siliceous Sands and Earthy Sands on Coarse sandstones. Yellow Earths and Yellow Brown Earths on gentler slopes. Subsoil EAT 3(1).	Predominantly sandy topsoils. Localised high sediment delivery likely to occur on lower slopes.	2(3)

cc	Newcastle 1:100k Soil Landscapes and Morisset EIS	Alluvial Flats on Quaternary Alluvium with spotted gum. Yellow Soloths, Yellow Podzolics, Yellow and Grey Earths. Subsoil EAT 3(1), 6.	Predict generally high sediment delivery soils. Localised very unstable Soloths (class 4).	3(4)
ck	Morisset EIS	Flat to gently undulating on the Farley and Rutherford Formations (mudstone, sandstone, conglomerate, shale and limestone) with Yellow and Grey Brown Podzolic Soils and Solodic Soils. Subsoil EAT 2, 3.	High sediment delivery Duplex Soils with hardsetting A2 horizons.	3
do	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Undulating rises on Munmorah Conglomerate (conglomerate pebbly sandstone, siltstone and claystone) with Yellow Earths, Yellow, Red, and Gleyed Podzolic Soils, Soloths and Yellow and Grey Earths. Subsoil EAT 2(1), 5.	Predominantly sandy topsoils prone to surface wash. Localised high sediment delivery soils occur especially on fine grained parent materials.	2(3)
er	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Undulating to rolling rises and low hills on the Terrigal Formation of the Narrabeen Group. Yellow Podzolic Soils occur on fine-grained parent material and Yellow Earths occur on coarse grained parent material. Structured Loams and Yellow Earths occur on drainage lines. Subsoil EAT 4, 5.	Soils are generally stable but some Yellow Podzolic Soils on lower slopes are prone to batter collapse and are high sediment delivery (class 3).	1(3)
gk	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Undulating low hills and rises on Tuggerah Formation (lithic sandstone with minor claystone) with Soloths, Yellow, Grey Brown and Gleyed Podzolic Soils. Subsoil EAT 2(1).	Predominantly high sediment delivery soils. Lower slopes with Soloths can be highly dispersible (class 4).	3(4)
gy	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Rugged rolling hills with > 50% rock outcrop on Hawkesbury Sandstone. Lithosols/Siliceous Sands associated with rock outcrop. Earthy Sands, Yellow Earths associated with inside of benches. Yellow and Gleyed Podzolic Soils occur on minor shale lenses. Siliceous Sands and Leached Sands along drainage lines. Subsoil EAT 2(1), but clay content very low.	Sandy soils which wash readily if disturbed.	2
ha	Gosford-Lake Macquarie 1:100k and Singleton 1:250k Soil Landscapes and Morisset EIS	Rugged rolling to very steep hills with > 50% rock outcrop on Hawkesbury Sandstone. Lithosols associated with rock outcrop. Earthy Sands, Yellow Earths and some Yellow Podzolic Soils associated with inside of benches. Yellow and Red Podzolic Soils occur on minor shale lenses. Siliceous Sands and Yellow Earths along drainage lines. Subsoil EAT 5.	Predominantly coarse sandy soils prone to sheet wash of coarse sediment. Little fine sediment present. Moist sandy soils are more stable than in dry country.	2
kc	Morisset EIS	Moderately broad crests and ridges on Narrabeen Group. Yellow Earths and Siliceous Sands occur on sandstone with Yellow Podzolic Soils on fine grained bedrock. Subsoil EAT 3.	Generally unknown. Predict sandy soils on sandstone (class 2) and fine higher sediment delivery soils (class 3) on fine grained bedrock.	2(3)
ki, kia	Newcastle 1:100k Soil Landscapes and Morisset EIS	Undulating to rolling low hills with localised steep hills (kia) on Moon Island Beach, Boolaroo and Lambton Sub-groups (coal, tuff, conglomerate, sandstone and shale) of the Permian Coal Measures. Lithosols, Bleached Loams, Structured Loams, Soloths and Yellow and Gleyed Podzolic Soils. Subsoil EAT 2(1).	Predominantly high sediment delivery soils with localised highly unstable Soloths on lower slopes and drainage plains.	3(4)
la	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Benched undulating to rolling hills on Hawkesbury Sandstone (quartz sandstone with minor shale lenses) with Earthy Sands, Yellow Earths, Siliceous Sands and Leached Sands. Gleyed and Yellow Podzolic Soils occur on very minor shale lenses. Subsoil EAT 3(1).	Very small area predominantly rock outcrop and shallow sandy soils.	2
lg	Gosford-Lake Macquarie 1:100k and Singleton 1:250k Soil Landscapes and Morisset EIS	Rolling footslopes on the Narrabeen Formation (lithic quartz sandstone, siltstone, breccia, claystone and conglomerate) with Structured Loams, Yellow Earths, Soloths, Red and Yellow Podzolic Soils. Subsoil EAT 3(1).	High sediment delivery Yellow Podzolic Soils dominate.	3
ml	Gosford-Lake Macquarie 1:100k Soil Landscapes	Rolling to steep low hills and narrow crests and ridges on Patonga Claystone of the Narrabeen Group. Red, Brown and Yellow	These soils have unstable subsoils which can be dispersible. Batters prone to	3(4)

	and Morisset EIS	Podzolics on claystones predominate with minor sandier Yellow Podzolics on sandstones. Subsoil EAT 4, 5.	rilling.	
nh	Singleton 1:250 Soil Landscapes and Morisset EIS	Flat to gently undulating on the Branxton Formation (mudstone, sandstone and conglomerate) with Yellow and Grey brown Podzolic Soils and Solodic Soils. Subsoil EAT 4.	Predominantly high sediment delivery Podzolic Soils but lower slopes are often highly unstable with Solodic Soils	3(4)
of	Gosford-Lake Macquarie 1:100k and Singleton 1:250k Soil Landscapes and Morisset EIS	Hanging valleys on Hawkesbury Sandstone with occasional sandstone benches with Earthy Sands, Yellow Earths, Podzols and Siliceous Sands. Subsoil EAT 3(2).	Erodible sandy soils predominate. The soils can be prone to gully erosion if natural sheet flows are concentrated.	2
ol	Morisset EIS and Singleton 1:250k Soil Landscapes.	Steep hills and escarpments with cliffs on Narrabeen Group. Shallow Lithosols occur on upper slopes, Brown Solodics on midslopes and Siliceous Sands on lower slopes.	No Solodic Soils present wrongly classified in EIS. Predominantly sandy soils subject to sheet wash.	2
rj	Morisset EIS	Moderately broad rounded crests and ridges on Narrabeen Group. Variable soil distribution depending on type of claystone. Yellow Podzolic Soils Brown Podzolic Soils and Chocolate Soils. Subsoil EAT 3.	Predominantly sandy country but lower slopes with Podzolics can be high sediment delivery if subsoils exposed.	2(3)
ro	Singleton 1:250k Soil Landscapes and Morisset EIS	Elevated, flat to undulating on the Rutherford Formation (mudstone sandstone and shale) and Branxton Formation (mudstone, sandstone and conglomerate with Red and Yellow Podzolic Soils Yellow-Brown and Red Earths and Chocolate Soils. Subsoil EAT 2(3).	High sediment delivery soils predominate.	3
so	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Undulating to rolling rises on friable Hawkesbury Sandstone (quartz sandstone with minor shale). Deep Yellow Earths and Earthy Sands and Siliceous Sands along drainage lines. Subsoil EAT 2(1) but low clay content.	Predominantly deep well drained sandy soils.	2
st	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Moderately broad ridges and crests on Hawkesbury Sandstones and sandstones of the Narrabeen Group. Yellow Earths, Earthy Sands and Siliceous Sands occur on crests and slopes with Yellow Podzolic Soils and Gleyed Podzolic Soils associated with minor shale lenses. Subsoil EAT 2(1) but clay content low.	Predominantly coarse sandy soils prone to sheet wash of coarse sediment.	2
su, sua	Newcastle 1:100k Soil Landscapes and Morisset EIS	Rolling to steep hills on conglomerate and sandstone of the Narrabeen Group passage beds to Permian Coal Measures. Yellow Soloths, Yellow Earths and rapidly drained Bleached Loams and Lithosols occur on summit surfaces. Yellow and Red Podzolic Soils, Yellow Soloths and Yellow Earths occur on sideslopes. Subsoil EAT 3(1).	Predominantly sandy soils with localised claystone soils with hardsetting A2 horizons which are high sediment delivery.	2(3)
tw	Morisset EIS and Singleton 1:250k Soil Landscapes.	Rugged hills with rounded summits and sandstone cliffs with steep scree slopes on Narrabeen Group. Yellow, Brown and Red Podzolic Soils occur on steeper slopes with Yellow and Black Earths on moderate slopes. Alluvial soils occur along drainage lines. Subsoil EAT 2(1).	Predominantly sandy soils with sandstone terraces. High sediment delivery (class 3) soils occur on dry exposed western ridges with hardsetting A2 horizons and poor timber.	2(3)
wa	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Undulating to rolling rises and low hills on Newcastle Coal Measures. Moderately deep to deep Gleyed and Yellow Podzolic Soils with Structured Loams along drainage lines. Subsoil EAT 3(2).	High sediment delivery Yellow Podzolic Soils with hardsetting A2 horizons, can be subject to sheet wash. Subsoils prone to rill erosion if exposed.	3

wn	Gosford-Lake Macquarie 1:100k and Singleton 1:250 000 Soil Landscapes and Morisset EIS	Rolling to very steep slopes on Narrabeen Group. Lithosols and Yellow Earths occur on coarse sandstones and Yellow Podzolics Soils on fine grained bedrock. Yellow Earths, Yellow Podzolic Soils and Siliceous Sands occur along drainage lines. Subsoil EAT 5.	Generally stable soils but sandy soils on coarse sandstones (class 2) and some unstable Yellow Podzolic Soils can be high sediment delivery (class 3).	1(2,3)
wo	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Undulating rises to rolling low hills on Patonga Claystone (claystone, siltstone and some sandstone) with Red and Yellow Podzolic Soils and Soloths on lower slopes and drainage lines. Subsoil EAT 2(1).	Predominantly high sediment delivery. Subsoils prone to rilling if exposed. Lower slopes have Soloths and are likely to be highly unstable.	3(4)
wy	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Poorly drained Deltaic Floodplains and Alluvial Flats on Quaternary Alluvium with Yellow and Brown Podzolic Soils and Soloths. Subsoil EAT 8.	Predominantly high sediment delivery class 3 soils. Batters prone to some instability.	3
xx	Gosford-Lake Macquarie 1:100k Soil Landscapes	Disturbed Terrain: includes quarries and areas of fill. Variable soils.		1
ya	Gosford-Lake Macquarie 1:100k Soil Landscapes and Morisset EIS	Floodplain and associated terraces on Quaternary Alluvium with Siliceous Sands and Alluvial soils in upper tracts, Red and Yellow Earths on Terraces and Yellow and Brown Podzolic Soils on Lower Floodplain. Subsoil EAT 2(1) but very low clay content and high sand content.	Predominantly earthy sandy soils prone to sheet wash. Lower floodplain with high sediment delivery Duplex Soils.	2(3)

Moss Vale and Nowra Management Areas

References/data sources

Geological Survey of NSW, 1966, *Wollongong 1:250 000 Geological Map*, Department of Mines, Sydney.

Hazelton, P.A.1992, *Soil Landscapes of the Kiama 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

McIlveen, G. 1973, *Ulladulla 1:250 000 Metallogenic Map*, Geological Survey of NSW, Sydney.

Field operatives

Charlie Bell, Soil Conservationist (Forestry), DLWC, Bega.
Russel Cowgill, Forester, State Forests, ex Moss Vale.
Brian Furrer, Regional Manager, State Forests, ex Batemans Bay.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
Cug	Ulladulla 1:250k geology	Wandandian Granite: granite; sandy Yellow and Red Earths and Earthy Sands.	Unknown, predict low coherence if disturbed.	2
Dud	Wollongong 1:250k geology	Basalt and dolerite. Strongly structured Krasnozems and Red Podzolic soils.	Unknown, predict stable soils.	1
Duq	Wollongong 1:250k geology	Quartzite, sandstone, siltstone, shale. Very variable soils including Yellow Podzolics, medium to coarse textured Earths and Earthy Sands.	Unknown. Predict high sediment delivery soils on fine grained sediments and sandy soils on quartzite's and some sandstones.	3(2)
Dur	Wollongong 1:250k geology	Rhyolite. Generally shallow stony Red Podzolics, structured Earths and Lithosols on steeper sloping terrain. Minor Yellow Podzolics and Yellow Earths.	Unknown. Predict stable stony soils and high sediment delivery soils.	1(3)
Lat	Wollongong 1:250k geology	Laterite and lateritic bauxite. Shallow, gravelly medium textured Red Earths and Red Podzolics.	Predict high iron content laterite with gravelly soils.	1
Mmm	Ulladulla 1:250k geology	Milton Monzonite: monzonite.	Generally stable moist forest predominantly cleared, some sandy soils.	1(2)
Oa	Ulladulla 1:250k geology	Undifferentiated Adaminaby Group: quartzite, quartz phyllite, phyllite, slate.	Stable soils where stony otherwise high sediment delivery soils.	3(1)
Pi	Wollongong 1:250k geology	Illawarra Coal Measures: shale, sandstone, conglomerate, tuff, chert, coal and torbanite seams. Management Plan indicates soils are often fine yellow and red texture contrast soils or hardsetting sandy loam yellow texture contrast soils.	Various sedimentary material, high % of fine and coarse sand. Sandy soils occur on plateau area.	3(2)
Pm	Ulladulla 1:250k geology	Undifferentiated Shoalhaven Group and Clyde Coal Measures: siltstone, sandstone, shale, conglomerate, coal. Earthy Sands on coarser textured lithologies and Yellow Podzolics on siltstones.	Earthy Sands (class 2) and Yellow Podzolic Soils (class 3).	2(3)
Psb	Wollongong 1:250 geology with reference to Kiama 1:100k Soil Landscapes	Undifferentiated Berry Formation: siltstone, shale, sandstone. Soil landscape ab indicates this geology on the Kiama sheet produces Brown Podzolic Soils on crests Yellow Podzolic Soils on midslopes and Soloths on footslopes and drainage lines.	Generally unknown.	2(3)
Psc	Wollongong 1:250k geology	Megalong Conglomerate, Conjola Formation: conglomerate, sandstone, silty sandstone.	Generally unknown. Predict predominantly sandy soils with some localised high sediment delivery soils.	2(3)
Psd	Wollongong 1:250k geology	Gerringong Volcanics, Kiama Tuff: sandstone and tuffaceous sandstone. Carser textured soils (Earthy Sands, sandy Earths) predominate, minor Yellow Podzolics on shale interbeds.	Generally unknown, predict low coherence soils dominant with high sediment delivery soils as minor component.	2(3)

Psm, Psn and no	Wollongong 1:250k geology (Psn) and Kiama 1:100k Soil Landscapes (no)	Megalong Conglomerate (undifferentiated and) associated Nowra Sandstone: quartz sandstone (Psm). Undulating rises to low hills on Nowra Sandstone with moderately deep Brown Podzolic Soils on crests and upper slopes and Soloths and Yellow Earths on midslopes and Yellow Podzolic Soils on lower slopes and drainage lines. Subsoil EATs more stable than 3(1), DP < 21%.	Spotted Gum Ironbark country. Sandy topsoils but clayey subsoils; contains gorge country adjacent to Shoalhaven River.	3(2)
Psw and gp	Wollongong 1:250k geology and Kiama 1:100k Soil Landscapes	Wandrawadian Siltstone: siltstone, silty sandstone pebbly in part (Psw). Gently undulating rises on siltstone with Red Solodic Soils on rises and Structured Loams and Yellow Podzolic Soils on Coastal Headlands. Subsoil EAT 6, DP 4%.	Generally unknown. Predict predominantly high sediment delivery soils with some localised stable soils.	3(1)
Qal and sf	Wollongong 1:250k geology (Qal) and Kiama 1:100k Soil Landscapes	Alluvium, gravel, swamp deposits and sand dunes (Qal). Level to gently undulation river bed and banks and active floodplain with Prairie Soils on levees and Red Earths and Yellow and Red Podzolic Soils on terraces. Some Potential Acid Sulphate Gleyed Podzolic Soils occur on floodplain (see no above).	Gleyed and Yellow Podzolic Soils are predicted to be high sediment delivery whilst Prairie Sols and Red Earths are predicted to be stable.	3(1)
Rh	Wollongong 1:250k geology	Hawkesbury Sandstone: quartz sandstone with some shale. Management Plan indicates soils are sandy yellow leached gradational soils with ironstone gravel and hardsetting sandy loam yellow texture contrast soils.	Hawkesbury sandstone sandy soils.	2
Rn	Wollongong 1:250k geology	Narrabeen Group: sandstone, siltstone, claystone, shale, and tuffaceous claystone. Management Plan soils indicate upper areas consist of Hawkesbury Sandstone type soils with yellow leached gradational soils and lower parts are more like Wianamatta Soils Clay Loam red gradational soils.	Stable soils good litter layer, well drained with wet sclerophyll or rainforest. Predict some sandy soils to occur on sandstones.	1(2)
Rwl	Wollongong 1:250 geology	Wianamatta Shale, Liverpool Sub-Group: shale with some sandstone beds. Management Plan indicates soils are Clay Loam and Red Gradational Soils.	Generally unknown predict generally high sediment delivery soils but stable soils and sandy soils (on sandstones) may occur.	3(2,1)
T	Ulladulla 1:250k geology	Undifferentiated Tertiary Sediments: gravel, sand, clay, quartzite, sandstone, conglomerate.	Tertiary Sediments have unstable batters.	3
Ted	Wollongong 1:250k geology	Olivine dolerite. Management Plan indicates soils are brown and red structured friable soils.	Management plan indicates stable well structured soils.	1
Tes	Wollongong 1:250k geology	Solvsbergite, microsyenite, bostonite and trachyte. Management Plan indicates soils are brown and red structured friable soils.	Management plan indicates stable well structured soils.	1
Tob	Wollongong 1:250k geology	Basalts and basonites. Management Plan indicates soils are brown and red structured friable soils.	Management plan indicates stable well structured soils.	1

Batemans Bay Management Area

References/data sources

Bureau of Mineral Resources, 1964, *Canberra 1:250 000 Geological Map*, Bureau of Mineral Resources, Canberra.

McIlveen, G. 1973, *Ulladulla 1:250 000 Metallogenic Map*, Geological Survey of NSW, Sydney.

Tulau, M.J. 1997, *Soil Landscapes of the Bega-Goalen Point 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Cobargo 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Field operatives

Charlie Bell, Soil Conservationist (Forestry), DLWC, Bega.
Don Goodridge, Forest Assistant, State Forests, Batemans Bay.
Brian Smith, Forest Assistant, State Forests, Narooma.
Ian Barnes, District Forester, State Forests, ex Batemans Bay.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
Derg	Canberra 1:250k geology	Braidwood Granite: Discordant massive granite.	Generally unknown; predominantly sandy soils.	2
Deyg = Dlg	Canberra (Deyg) and Ulladulla (Dlg) 1:250k geology	Moruya Granodiorite: discordant massive granite.	Sandy soils localised unstable batters.	2(3)
Dg	Canberra 1:250k geology	Monga Granite: discordant massive granites.	Stable moist forest soils, high organic matter.	1
Dlg	Ulladulla 1:250k geology	Moruya Granodiorite, Moruya Batholith: biotite granite, Adamellite, granodiorite, tonalite, diorite, gabbro.	Fine grained silty soils on lower slopes.	2(3)
Dlmd, Dlmu	Canberra 1:250k geology. Also see yp soil landscape on this geology - Bega-Goalen Point and Cobargo (draft) 1:100k Soil Landscapes	Extract from Soil Landscape report: Rolling to steep hills on sandstone, siltstone and conglomerate. Bedrock outcrop generally <2%; >29% locally. Soils--<50 cm, well-drained Lithosols on sites with resistant rock strata. <100 cm, moderately well-drained stony Yellow Podzolic Soils (Natric Brown Kurosols/Dystrophic Brown Kandosols and Dystrophic Red Kurosols) on hillslopes on sandstone. <100 cm, moderately well-drained Yellow Podzolic Soils (Natric Brown Kurosols) on hillslopes on siltstones and mudstones. <100 cm, moderately well-drained colluvial Yellow Earths (Dystrophic Brown Dermosols) on colluvial lower slopes on sandstones. <100 cm, moderately well-drained Brown Earths (Mesotrophic Red Dermosols) on footslopes. Subsoil EAT 2(1), 2(2). DP 20%, 24%, 68%, 27%.	Generally high sediment delivery class 3 soils with localised sandy class 2 soils on coarser sandstones and conglomerate.	3(2)
Dln	Canberra 1:250k geology	Conglomerate, interbedded siliceous sandstone and shale.	Small area (15 ha). Sandstone and conglomerate should produce class 2 type soils with some localised high sediment delivery soils (class 3) on shale.	2(3)

Dmc	Canberra and Ulladulla 1:250k geology	Coodella Creek Granites: discordant massive granites.	Very poor country generally unknown. Predict soil regolith class 2 but some class 3 may occur.	2(3)
Dmcg	Canberra 1:250k geology	Coondella Creek Granites: discordant massive granites.	Very poor country generally unknown. Predict soil regolith class 2 but some class 3 may occur.	2(3)
Mmm	Ulladulla 1:250k geology	Milton Monzonite.	Generally stable moist forest predominantly cleared, some sandy soils.	1(2)
Mte	Ulladulla 1:250k geology	Termeil Essexite.	Rocky outcrops, fairly sandy, generally unknown.	2
Oa = Olsa	Ulladulla (Oa) and Canberra (Olsa) 1:250k geology	Undifferentiated Adaminaby Group: quartzite, quartz phyllite, phyllite, slate.	Stable soils where stony.	3(1)
Ow	Ulladulla 1:250k geology	Undifferentiated Wagonga Group: chert, conglomerate, sandstone, basic volcanics.	Very gravelly, clayey red soils in south.	1
Pm	Ulladulla 1:250k geology	Undifferentiated Shoalhaven Group and Clyde Coal Measures: siltstone, sandstone, shale, conglomerate, coal.	In south has been influenced by basalt and is class 1. In north Earthy Sands (class 2) and Yellow Podzolic Soils (class 3) predominate.	1(2,3)
Qal and Qa	Ulladulla and Canberra 1:250k geology	Quaternary: alluvium, gravel, swamp deposits and sand dunes.	Generally unknown.	2(4)
Tbe	Ulladulla 1:250 000 geology	Tertiary Bergalia Formation: gravel, sand and clay.	Very gravelly, quarried for road base.	1
Tv	Ulladulla 1:250k geology	Undifferentiated, basalt, olivine basalt.	Dark brown stable Chocolate Soils.	1

Narooma Management Area

References/data sources

Bureau of Mineral Resources, 1964, *Canberra 1:250 000 Geological Map*, Bureau of Mineral Resources, Canberra.

McIlveen, G. 1973, *Ulladulla 1:250 000 Metallogenic Map*, Geological Survey of NSW, Sydney.

Tulau, M.J. 1997, *Soil Landscapes of the Bega-Goalen Point 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Cobargo 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Eden-Green Cape 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Narooma 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Field operatives

Charlie Bell, Soil Conservationist (Forestry), DLWC, Bega.
Don Goodridge, Forest Assistant, State Forests, Batemans Bay.
Brian Smith, Forester Assistant, State Forests, Narooma.
Mitch Tulau, Soil Surveyor, DLWC, Cooma.
Steve Beaman, Forest Practices Specialist, EPA, Sydney.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
bo	Narooma (draft) 1:100k Soil Landscapes	Undulating rises to rolling low hills on adamellite; 0-25 cm well-drained Yellow Earths and 50-100 cm Yellow Podzolic Soils and Yellow Earths on crests and slopes.	Sandy topsoils hence class 2, but subsoils can be clayey (class 3) and lower slopes can be highly unstable (class 4).	2(3,4)
br	Cobargo (draft), Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Recent river channel sands and gravels, often braided and migrating; deep (>150 cm), well-drained to poorly drained Siliceous Sands.		2
cb	Cobargo (draft) 1:100k Soil Landscapes	Undulating to rolling low hills on granodiorite. Soils: 25-75 cm well drained Red Podzolic and Red Solodic Soils on crests and upper to mid-slopes. 50-100 cm imperfectly to very poorly-drained Gleyed Podzolic, Yellow Podzolic, Yellow Solodic and Gleyed Podzolic Soils on lower slopes and drainage lines. 25 -100 cm well-drained Yellow Earths on granites and adamellites, and Structured Red Clays on diorites Subsoil EAT 5-2(1). DP 13%,14%.	Mainly sandy soils with some high sediment delivery soils.	2(3)
ck = cc	Code change to cc in Cobargo (draft) Soil Landscapes	Near-coastal valley flats and narrow floodplains in non-granitic catchments. Almost totally cleared intermediate and wet sclerophyll forest to rainforest. Soils 50>150 cm, very poorly-drained to moderately well-drained Alluvial Soils, and >150 cm, imperfectly to poorly drained Chernozems on floodplains and valley flats.	Well structured stable soils.	1

cm	Cobargo (draft) 1:100k Soil Landscapes	Steep to very steep hills on volcanics. Rock outcrop mainly on precipitous slopes. Open forest. Soils: well drained Lithosols generally 50-75 cm), well-drained Yellow Earths, and Brown Earths on slopes on rhyolites and other felsic volcanics. Subsoil EAT nt, DP 34%.	Sandy soils.	2
da and Dmcg	Cobargo (draft) 1:100k Soil Landscapes and Canberra 1:250k geology	Rolling to steep hills to mountains on Ordovician metasediments. Soils: <25 cm well-drained Lithosols, 50-100 cm moderately well-drained Yellow Podzolic Soils on upper slopes and exposed slopes. 50-100 cm moderately well-drained Red Earths on mid-slopes. 50-200 cm moderately well-drained Red Podzolic Soils on lower slopes. 50->200 cm well-drained to imperfectly-drained Brown Earths in drainage lines. Subsoil EAT 2(1), DP 35%, 9%.	Predominantly stable soils. Localised high sediment delivery soils occur.	1(3)
daa and Dmcd	Cobargo (draft) 1:100k Soil Landscapes and Canberra 1:250k geology	Variant of da soil landscape and Undifferentiated Comerong Volcanics : rhyolite, rhyolite breccia, basalt and conglomerate.	Soils are stable.	1
dr	Cobargo (draft) 1:100k Soil Landscapes	Valley flats of sandy alluvium. Flats are narrow to moderately broad. Soils: >300 cm well-drained Alluvial Soils, including Sand on buried Black Earth. Subsoil EAT nt, 8. DP 17%, 15%.	Sandy channel deposits.	2
gu	Narooma (draft) 1:100k Soil Landscapes	Steep mountain on banatite. Soils: 50-100 cm moderately well-drained Chocolate Soil on slopes. Subsoil EAT 3(2). DP 9%.	Preserved Forest with stable soils.	1
ji	Cobargo (draft) 1:100k Soil Landscape	Very steep mountains to steep hills on granites. Soils: 0-50 cm well-drained Siliceous Sand on upper slopes and crests. 50-100 cm well-drained Earthy Sand on mid-slopes. Subsoil EAT 3(2). DP 37%.	Sandy soils (class 2).	2
lb	Narooma (draft) 1:100k Soil Landscapes	Level supratidal to extratidal sandplains formed on sandy Holocene marine sediments. Soils: poorly drained Siliceous Sands/Solonchaks on sandplains.	Sandy soils (class 2).	2
ls	Narooma (draft) 1:100k Soil Landscapes	Coastal swamps on Holocene alluvium. Soils: >100 cm, very poorly drained peats and clays in swamps. Subsoil EAT 2(2). DP 44%.	Peats are stable (class 1).	1
mb	Cobargo (draft) 1:100k Soil Landscapes	Steep to rolling hills on granodiorite and adamellite. Soils: 25-75 cm, well-drained Red Podzolic Soils, 50->100 cm, well-drained Brown Earths and 50>100 cm, well-drained Yellow Earths on crests and slopes. 75->150 cm, imperfectly-drained Yellow Earths in drainage lines. Subsoil EAT 3(2), 5, 2(1). DP 46%., 10%, 7%. High sand content, low clay content.	Generally class 2, localised batters rilling in high sediment delivery soils.	2(3)
mba	Cobargo (draft) 1:100k Soil Landscapes	Landscape variant of mb.	Generally unknown.	1
mg	Bega-Goalen Point, Eden-Green Cape (draft) and Narooma (draft) 1:100k Soil Landscapes	Level to gently undulating terraces on Quaternary alluvium. Moderately deep (50-150 cm), moderately well-drained Yellow Podzolic Soils on terraces. Sandy clay loam/clay, EAT 3(2), DP 43/28%.	Generally high sediment delivery soils (class 3). Very small areas.	3
mu and Olsu and Oa	Bega-Goalen Point, Eden-Green Cape (draft) and Narooma (draft) 1:100k Soil Landscapes and Canberra and Ulladulla 1:250k geology	Rolling low hills to hills on sediments and metasediments. Soils: moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests and slopes. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on lower slopes and drainage depressions. Subsoil EAT 3(1). DP 18%.	Rainfall simulator work identified generally high sediment delivery but localised stony soils have low sediment delivery.	3(1)

na	Narooma (draft) 1:100k Soil Landscapes	Supratidal poorly drained fluvial delta to intertidal mudflats. Soils: >100 cm, very poorly drained Solonchaks on supratidal saltmarsh flats, very poorly-drained Wiesenboden/Prairie Soils on supratidal flats, imperfectly-drained Prairie Soils and Gleyed Prairie Soils on extratidal flats. Subsoil EAT 3(1). DP 43%. Very sandy.	Sodic, saline soils (class 4).	4
nb	Narooma (draft) 1:100k Soil Landscapes	Swampy flats and drainage depressions, valley fills of Quaternary alluvium in granitic catchments. Soils: moderately deep (50-150 cm), imperfectly to poorly drained clay loam over sand on fans and flats. Moderately deep (50-150 cm) or deep (>150 cm), imperfectly drained to poorly drained Gleyed Podzolic and Alluvial Soils on flats and in drainage depressions.Clay loam, sandy/ sandy clay loam. EAT 3(1)/3(2), DP 26/60%.	Generally unknown. Predict highly sodic soils due to position in landscape.	4(3)
pa	Bega-Goalen Point, Eden-Green Cape (draft) and Narooma (draft) 1:100k Soil Landscapes	Undulating to rolling low hills on Tertiary sediments. Soils: moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to well-drained Lateritic Soloths or moderately well-drained to imperfectly drained yellow Soloths over deeply weathered Tertiary sediments on crests, summit surfaces, slopes and flats. Moderately deep to deep, poorly drained Brown Clays in drainage lines. Subsoil EAT 3(1), 8. DP 32%, 7%.	Instability in batters.	3
pb and Dmc	Bega-Goalen Point and Cobargo (draft) 1:100k Soil Landscapes and Canberra 1:250k geology.	Steep hills to mountains on sandstones, conglomerates, mudstones and siltstones. Soils: shallow Lithosols, moderately deep stony Red Earths on slopes on mudstones and siltstones, moderately deep Yellow Podzolic Soils on slopes on sandstones and conglomerates. Subsoil EAT 3(2). DP 9%, 23%.	Predominantly stable soils but some localised class 2 and class 3. High fine and medium sand content. Subsoils can be high sediment delivery.	1(3,2)
qu	Eden-Green Cape (draft), Bega-Goalen Point and Narooma (draft) 1:100k Soil Landscapes	Rolling low hills on Quondolo Formation - silicified and indurated sands and gravels. Soils: moderately deep, well drained Yellow Earths on crests, and moderately deep, moderately well-drained grey-brown Soloths on slopes on Quondolo Formation sands and gravels. Subsoil EAT 5, DP 7%.	Generally sandy soils with some localised high sediment delivery soils.	2(3)
ta	Bega-Goalen Point, Eden-Green Cape (draft) and Narooma (draft) 1:100k Soil Landscapes	Sandplains and beach ridges on Holocene aeolian sands. Soils: deep (>150 cm), well-drained Podzols and Siliceous Sands on well drained sandplains and beach ridges. Deep (>150 cm), imperfectly drained to poorly drained groundwater Podzols on flats and swales.	Sandy soils (class 2).	2
tf	Narooma (draft) 1:100k Soil Landscapes	Broad floodplain of the Tuross River and tributaries on alluvium. Soils: >200 cm, moderately well drained Alluvial Soils and Prairie Soils on floodplains. Subsoil EAT 2(1). DP 53%.	Sandy soils (class 2).	2
tj	Bega-Goalen Point, Eden-Green Cape (draft) and Cobargo (draft) 1:100K Soil Landscapes	Undulating rises to low hills on sediments and metasediments. Soils: moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests and slopes. Moderately deep (50-150 cm), moderately well drained to imperfectly drained yellow Soloths on lower slopes and drainage depressions. Subsoil EAT 2(1). DP 39%.	High sediment delivery (class 3) soils.	3
tr	Bega-Goalen Point, Eden-Green Cape (draft) and Cobargo (draft) 1:100K Soil Landscapes	Narrow, high energy floodplains of coarse Quaternary alluvium. Deep (>150 cm), well-drained Alluvial Soils. Subsoil EAT 3(3). DP 40%.	Very thin units sandy soils.	2

tt	Narooma (draft) 1:100K Soil Landscapes	Rolling low hills on Mount Dromedary Igneous Complex monzonites. Soils: 50-150 cm, moderately well drained Chernozems on crests and slopes. 50-150 cm, poorly-drained Chernozems in drainage lines. Subsoil EAT 3(2). DP 13%.	Stable soils.	1
uw	Cobargo (draft) 1:100K Soil Landscapes	Rolling low hills to hills on granitics. Soils: <75 cm, well-drained to moderately well-drained Yellow Podzolic Soils on crests and slopes. Subsoil EAT 3(2). DP 19%.	Soils with unstable batters and localised sandy soils.	3(2)
wg	Narooma (draft) 1:100K Soil Landscapes	Rises to low hills on mudstones, sandstones and chert. Soils: <100 cm, well-drained Yellow Podzolic Soil on crests and slopes on chert. 100-150 cm, imperfectly-drained Red Podzolic Soil on slopes on mafic volcanics. 50-150 cm, well-drained Yellow Podzolic Soil on slopes on siltstones/mudstones. Subsoil EAT 2(1), 3(2). DP 11%, 25%.	Riling and wash on batters in places; more sandy pockets have small sediment fans evident in places.	3(2)
wga	Narooma (draft) 1:100k Soil Landscapes	Wagonga (wg) soil landscape variant.		3(2)
wo	Narooma (draft) and Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating rises on granitics. 50-100 cm, moderately well-drained Yellow Podzolic Soils on gently inclined slopes.	Very minor unit.	2(3)
ws	Cobargo (draft) 1:100k Soil Landscapes	Undulating rises on granitics. 50-100 cm, moderately well-drained Yellow Podzolic Soils on gently inclined slopes. Subsoil EAT 6. DP 6%.	Stable topsoils but subsoils can be high sediment delivery. Very small area.	3(2)
yp Dlmd, Dlmu	Bega-Goalen Point, Eden-Green Cape (draft) and Cobargo (draft) 1:100k Soil Landscapes and Canberra 1:250k geology	Rolling to steep hills on sandstone, siltstone and conglomerate. Bedrock outcrop generally <2%, >29% locally. Soils: 50 cm deep, well-drained Lithosols on sites with resistant rock strata. <100 cm, moderately well-drained stony Yellow Podzolic Soils on hillslopes on sandstone. <100 cm, moderately well-drained Yellow Podzolic Soils on hillslopes on siltstones and mudstones. <100 cm, moderately well-drained colluvial Yellow Earths on colluvial lower slopes on sandstones. <100 cm, moderately well-drained Brown Earths on footslopes. Subsoil EAT 2(1), 2(2). DP 20%, 24%, 68%, 27%.	Predominantly high sediment delivery soils with some localised sandy soils.	3(2)
ypa	Bega-Goalen Point, Eden-Green Cape (draft) and Cobargo (draft) 1:100k Soil Landscapes and Canberra 1:250k geology	Landscape variant of yp soil landscape with deeper or less rocky soils on undulating low hills. Loamy sand to sandy clay. EAT 8, 2(1). DP 30%, 38%.	as yp above.	3(2)

Queanbeyan and Badja Management Areas

References/data sources

Jenkins, B. R. 1993, *Soil Landscapes of the Michelago 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

Jenkins, B. R. 1996, *Soil Landscapes of the Braidwood 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

R.L. Newman and Partners, 1995, *An Assessment of the Soils of the Queanbeyan and Badja Management Areas, Queanbeyan and Badja Management Areas EIS, Supporting Document 1*, State Forests of NSW, Pennant Hills.

Tulau, M. J. 1994, *Soil Landscapes of the Cooma 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

Tulau, M. J. (in prep), *Soil Landscapes of the Cobargo 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Field operatives:

Charlie Bell, Soil Conservationist, (Forestry), DLWC, Bega.
Don Goodridge, Forest Assistant, State Forests, Batemans Bay.
Brian Smith, Forest Assistant, State Forests, Narooma.
Mitch Tulau, Soil Surveyor, DLWC, Cooma.
Brian Jenkins, Soil Surveyor, DLWC, Queanbeyan.

Map Unit	Reference	Map Unit Summary	Comment	Soil Regolith Stability Class
an	Michelago 1:100k Soil Landscapes	Undulating rises and flats on granitic material. Soils: Shallow (<60 cm) moderately well drained Earthy Sands on crests and upperslopes. Moderately deep (<120 cm) moderately well-drained Yellow Earths and Earthy Sands on midslopes. Moderately deep (<120 cm) moderately well-drained Red Earths also on midslopes. Moderately deep (<100 cm) moderately well-drained Red Podzolic Soils on lowerslopes. Moderately deep (generally <120 cm) poorly drained Yellow Podzolic Soils and very poorly drained Gleyed Podzolic Soils on areas of poor drainage. Subsoil EAT 2(1), DP 45%, 25%. Low clay content high sand content.	Sandy soils upper slopes, duplex soils lower slopes.	2(3,4)
bb	Cooma 1:100k Soil Landscapes	Rolling to steep low hills and hills on granitic material. Soils: Shallow (<25 cm), well-drained Earthy Sands associated with rock outcrop. Moderately deep (<90 cm), well-drained Earthy Sands and Earthy Sands/Bleached Earthy Sands on drier hill slopes. Yellow Earths, shallow to moderately deep (>40 cm) NSG and moderately deep (>90 cm), moderately well-drained Yellow Podzolic Soils on wetter hill slopes. Subsoil EAT 5, 3(3), 3(1). DP 9%, 23%, 35%.	Sheet erosion generally common on this landscape; predominantly class 3 with some localised class 1 and class 2 country.	3(1,2)
bd	EIS unit of the Araluen sheet	Rolling to steep low hills and hills on sediments with Yellow Earths and Yellow Duplex Soils. Subsoil EAT 3, DP 48%.		3

be	Michelago 1:100k Soil Landscapes	Rolling to steep low hills and hills on Silurian Volcanics. Soils: Shallow Lithosols near bedrock outcrops. Shallow Red Podzolic Soils on crests and slopes with imperfectly drained Yellow Podzolic Soils in depressions and areas of impeded drainage. Subsoil EAT 5, DP 41%,33%.	Minor sheet erosion. Yellow Podzolic Soils are class 3.	1(3)
bk	EIS unit of the Araluen sheet	Gently undulating plain on sediments with Alluvial Soils. High sand content. Subsoil EAT 3, DP 9%.	Unknown. Predict sandy soils.	2
bl	EIS unit of the Araluen sheet	Rolling low hills on igneous intrusives. Yellow Earths and Brown Podzolic Soils. Subsoil EAT 6 DP 0%.	Unknown. Predict sandy soils.	2
bo	Michelago 1:100k Soil Landscapes	Rolling low hills on Silurian Volcanics. Soils: Shallow Lithosols on crests, Yellow Podzolic Soils on sideslopes and Solodic Soils adjacent to scalds on Black Alluvial Soils in drainage depressions. Subsoils EAT 2(1), 2(2), DP 55%, 56%, 36%, 35%.	Stable stony soils on crests but high sediment delivery soils on slopes.	3(1)
br	Braidwood 1:100k Soil Landscapes	Undulating rises and low hills on granites. Soils: Extremely shallow (<30 cm) well drained Lithosols and Sands on crests. Moderately deep (<100 cm), moderately well-drained Yellow Podzolic Soils and Yellow Earths on upper slopes. Moderately deep (<130 cm), moderately well to imperfectly drained Yellow Podzolic Soils (Dy3.41) on midslopes. Moderately deep to deep, imperfectly to slowly drained Solodic Soils on areas of impeded drainage, lower slopes and minor drainage lines. Moderately deep to very deep (>80 cm) Alluvial Soils (NSG) in major drainage lines. Subsoil EAT 2(1), DP 47%.	Generally unknown. Soil landscape mapping indicates upper slopes sandy Lithosols, grading into Yellow Podzolic Soils on lower slopes and Yellow Soloths in drainage lines.	2(3,4)
br	Cooma 1:100k Soil Landscapes	Gently to moderately inclined slopes on basalt; shallow to moderately drained Chocolate Soils.	Mostly cleared for farming; associated areas of moderate rill and gully erosion in small areas.	1
bt	Braidwood 1:100k Soil Landscapes	Rugged hills and mountains on granitic rocks. Rock outcrops, as tors, are locally common. Soils: South and east facing slopes: moderately deep (<100 cm) well drained Red Earths on crests and upper slopes. Moderately deep and moderately well drained Red Podzolic Soils and Yellow Podzolic Soils on benches and less steeply inclined midslopes; shallow (<60 cm) well-drained Earthy sand/Yellow Earth intergrades on steep midslopes; moderately deep (<120 cm) moderately well to imperfectly drained Red Podzolic Soils and Yellow Podzolic Soils on lower slopes; and generally deep (50->150 cm) poorly drained Alluvial Soils (NSG) in drainage lines. North and west facing slopes: shallow (<60 cm) moderately well-drained Yellow Earths on crests and upper slopes; moderately deep (<90 cm) moderately well-drained Red Podzolic Soils and Yellow Podzolic Soils on benches and less steeply inclined midslopes; and, moderately deep to shallow (<90 cm) Earth Sand/Yellow Earth intergrades on mid and lower slopes. Subsoil EAT 5. DP 53%, 20%, high sand content.	Sandy soils.	2
bw	EIS unit of the Araluen sheet	Rolling low hills on igneous acidic volcanics with Yellow Podzolic Soils. Subsoil EAT 6, DP 29%.	Unknown. Predict high sediment delivery Yellow Podzolic Soils.	3

cc	Braidwood, Cooma and Michelago 1:100k Soil Landscapes	Rolling low hills on granitic rock. Rock outcrop as large tors is common (20-50%) on slopes and crests. Soils: Shallow (<40 cm) well to rapidly drained Earthy Sands and Lithosols on crests. Shallow to moderately deep (<70 cm) well drained Earthy Sands on upper slopes. Moderately deep to shallow (<80 cm) moderately well-drained Red Podzolic Soils and moderately well to slowly drained Yellow Podzolic Soils on lower slopes. Subsoil EAT 2(1), DP 64%.	Minor sheet erosion. Podzolic Soils are probably dominant. Class 2(3) dominant in western area but class 3(2) dominant in eastern area.	2(3)
cd	Cooma 1:100k Soil Landscapes	Rolling to undulating low hills on acid volcanics and interbedded fine to medium textured metasediments; shallow Brown Earths and Red Podzolics on hillslopes; Layered Alluvial Soils in drainage lines.		1(3)
cf	Michelago 1:100k Soil Landscapes	Undulating to rolling rises and flats on Silurian Volcanics. Soils: Lithosols on gossan rises. Yellow Podzolic Soils on midslopes and Euchrozems on limestone. Various Alluvial Soils on drainage lines and swamps. Subsoil EAT 2(1), 5. DP 36%, 30%.	Stony Lithosols and are predicted to be stable but Yellow Podzolic Soils are predicted to be high sediment delivery.	3(1)
cl	EIS unit of the Araluen sheet	Steep low hills on igneous acidic volcanics with Red Earths. High fine and coarse sand content. Subsoil EAT 5, DP 9%.	Unknown. Predict a mixture of soil types.	3(1,2)
dh	Braidwood and Michelago 1:100k Soil Landscapes	Rolling low hills and undulating rises on volcanics. Angular rock outcrops are locally common. Soils: Shallow (<30 cm), well-drained Lithosols on crests. Moderately deep (60-100 cm) Red Podzolic Soils on well-drained sideslopes and upper slopes. Moderately deep (70-120 cm) moderately well to imperfectly drained Yellow Podzolic Soils on mid to lower slopes. Moderately deep to deep, poorly drained Soloths, Solodic Soils and Solodized Solonetz on lower slopes and drainage lines. Subsoil EAT 3(1), 2(2), DP 28%, 87%.	Bleached silty A2 horizons common; upper slopes stable with some unstable soils present on lower slopes.	3(1,4)
ip	Braidwood 1:100k Soil Landscapes	Undulating rises and plain on Tertiary sediments. Rounded gravels are common. Landscape variant--ipa--steeper (>20%) sites. Soils: Shallow to moderately deep (<90 cm), moderately well-drained Yellow Podzolic Soils on broad ridges and summit surfaces. Shallow (<40 cm) well-drained Lithosols on steep short sideslopes. Moderately deep to very deep (>120 cm) poorly drained Solodic Soils and Solodized Solonetz on lower slopes and drainage lines. Subsoil EAT 6, DP 5%.	Solodics have Class 4, Podzolics have Class 3.	4(3)
jt	Cobargo (draft) 1:100k Soil Landscapes	Very steep mountains to steep hills on granitics. Local relief 100-500 m, elevation 100-1313 m, slopes 10->100 %. Narrow to moderately broad crests, long slopes with structural benches and incised drainage lines. Open forest to tall open forest. Soils: 0-50 cm well-drained Siliceous Sand on upper slopes and crests. 50-100 cm well-drained Earthy Sand on mid-slopes. No lab data.	Predominantly class 2 country, very steeply sloping with sandy soils.	2
la	Braidwood 1:100k Soil Landscapes	Flat to gently undulating floodplain on Quaternary alluvium. Soils: Moderately deep to deep (80-150 cm), poorly drained Solodic Soils on old terraces. Moderately deep to deep (70-100 cm), moderately well-drained Non-calcic Brown Soils and Prairie Soils on younger terraces. Moderately deep to very deep (>100 cm) poorly to very poorly drained Alluvial Soils (NSG) along drainage depressions and back swamps. Deep to very deep (>120 cm), well-drained Alluvial Soils (NSG) on floodplain. Subsoil EAT 2(2), 2(3). DP 92%, 96%. Highly dispersible.	Prairie Soils and Alluvial Soils are class 2 and Solodics on Terraces are class 4. Highly dispersible subsoil.	2(4)

md	Michelago 1:100k Soil Landscapes	Rolling to steep hills on granitic material. Shallow to moderately deep Lithosols and Siliceous Sands.	Sandy soil materials, minor to moderate sheet wash common.	2
mi	Braidwood 1:100k Soil Landscapes	Steep to rolling mountains and hills on volcanics. Narrow crests with common rock outcrop and surface stone. Soils: Extremely shallow (<20 cm), well-drained Lithosols (Um4.11) on crests. Shallow (<60 cm) moderately well to imperfectly drained Yellow Podzolic Soils on upper and midslopes. Extremely shallow (<20 cm) rapidly drained Lithosols on steep midslopes. Moderately deep (60-130 cm), poorly drained Yellow Podzolic Soils on lower slopes. Subsoil EAT 5, DP 57%.	Sheltered slopes (class 1) tend to be more stable (higher organic content) than exposed drier slopes (class 3).	1(3)
mm	Cooma and Michelago 1:100k Soil Landscapes	Rolling to steep hills and low hills on metasediments. Hill slopes are mostly cobble strewn with gradients 10-30%. Soils: Shallow (<40 cm) well-drained Lithosols on crests and some sideslopes. Moderately deep (<100 cm) moderately well-drained Red Podzolic Soils on sideslopes. Moderately deep (<130 cm) slowly drained Yellow Podzolic Soils and Yellow Solodic Soils in drainage lines. Subsoil EAT 8, 3(1). DP 27%, 24%.	Bleached A2 horizons common, low organic matter in A1 horizon, Sodic soils along drainage lines; some gullies; very stony.	3(4)
mm	Cooma 1:100k Soil Landscapes	Rolling to steep low hills on fine to medium grained sedimentary rocks. Soils: Massive structured Brown Earths on crests and rocky upper slopes; Red Podzolics on hillslopes; Solodics on narrow lower slopes and drainage lines.	Minor sheet erosion on cleared land; minor deep gullies in alluvial material.	1(3)
ns	EIS and Cobargo (draft) 1:100k Soil Landscapes	This is described as ns in EIS, and as a variant (bba) of bb in Soil Landscape report. Areas marked bba on the map are small patches of Acid Peats on poorly drained summit surfaces in higher rainfall zones.	Peat.	1
nu	Michelago 1:100k Soil Landscapes	Rolling to undulating low hills, rises and minor flats on metasediments. Soils: Shallow (<30 cm), well to rapidly drained Lithosols on crests, upperslopes and near rock outcrop. Moderately deep (<75 cm) and moderately well-drained Red Podzolic Soils and Yellow Podzolic Soils on lower, mid and some upperslopes. Alternatively, shallow (<60 cm), moderately well-drained Non-calcic Brown Soils and Red Podzolic Soils on lower, mid and some upperslopes. Subsoil EAT 5, DP 28%.	Prominent A2 horizons, fairly stony but sheet and some gully erosion occurs generally.	3
pa	Braidwood 1:100k Soil Landscapes	Steep rugged mountains on arenite and other sedimentary rocks. Common angular boulders and cobbles. Soils: Shallow (<70 cm) well-drained Lithosols on crests. Southern and Eastern Aspects: Moderately deep to shallow (<90 cm) well drained Alpine Humus Soils (Um4.23) on upper slopes; and, moderately deep (<100 cm), moderately well-drained Yellow Earths and Red Earths on mid and lower slopes. Northern and Western Aspects: shallow (<50 cm) moderately well-drained Yellow Podzolic Soils on upper slopes; extremely shallow (<20 cm), well-drained Lithosols on steep slopes and near rock outcrop; and, moderately deep to shallow (<80 cm), imperfectly drained Yellow Podzolic Soils on lower slopes. Subsoil EAT 2(1), 6. DP 63%,5%. Low clay content with high DP.	Moist forest with stable soils, high organic content.	1
rf	Cooma 1:100k Soil Landscapes	Rolling low hills on acid volcanics; Brown Earths and Red Podzolics on slopes and siliceous sands in drainage lines.	Severe gully erosion in some drainage lines in cleared land; some areas with moderate sheet erosion on heavily grazed and cleared land.	1(2)

rh	Cooma, Michelago 1:100k Soil Landscapes	Steep and often isolated hills on granitic material. Local relief is 90-250 m between 900-1,250 m elevation. Steep hill slopes (>20%) with abundant rock outcrop, (>25%), as tors.	Minor to moderate sheet erosion occurs generally. Earthy Sands predominate; minor red,	2(1,3)

		Soils: Shallow (<15 cm) rapidly drained Lithosols over bedrock on steep slopes. Shallow to moderately deep (30-90+ cm) well-drained Earthy Sands on steep slopes. Moderately deep to shallow (30-80 cm) and moderately to slowly drained Red Podzolic Soils and Yellow Podzolic Soils on moderate slopes and minor drainage lines. Subsoil EAT 2(2). DP 67%, 43%. Low clay, high sand content.	very stable Podzolic Soils.	
rv	Cooma 1:100k Soil Landscapes	Undulating low hills on vertically to sub-vertically bedded fine to medium grained sedimentary rocks in rainshadow area; Yellow Podzolic and Yellow Earth soils on hillslopes, Solodics and Solodized Solonetz on footslopes and drainage lines.	On agricultural land, severe gully erosion in drainage lines and some severe rill erosion on lower slopes.	3(4)
sc	Cooma 1:100k Soil Landscapes	Rolling hills on fine to medium grained sediments and metasediments; Lithosols on crests, Solodics with bleached massive surface and yellow or red blocky structured subsoil; EAT 2(1), DP 60-70%.	Mostly uncleared and unroaded; minor rilling on small cleared areas; number of severe gullies in drainage lines.	4(1)
si	Braidwood 1:100k Soil Landscapes	Rolling to steep hills on volcanics. Local relief 40-150 m between 650 and 820 m elevation. Slopes 20-40%. Surface gravel is common. Partially cleared open forest. Soils: Extremely shallow to shallow (<40 cm), well drained Lithosols on crests and upper slopes. Shallow (<60 cm) moderately well-drained Shallow Earths on rocky midslopes. Moderately deep (60-100 cm), moderately well-drained Red Podzolic Soils and imperfectly drained Yellow Podzolic Soils on mid and lower slopes. Subsoil EAT 2(1). DP 44%, 50%.	Sheet erosion common on batters and unsurfaced roads.	3
ta	Braidwood and Michelago 1:100k Soil Landscapes	Rolling to very steep hills and mountains on Ordovician metasediments of the Gourock Range. Surface rock 30-60%. Soil: Shallow (<60 cm) stony Red Earths, on crests and sideslopes. Shallow (<20 cm) Lithosols mainly on sideslopes with many minor localised occurrences on crests; shallow to moderately deep (<100 cm) Yellow Earths on lower slopes. Subsoil EAT 5. DP 6%, 12%	Predominantly stable but westerly facing slopes are more unstable and have class 3 rating.	1(3)
tc	Braidwood 1:100k Soil Landscapes	Undulating low hills on granite. Soils: Shallow Lithosols and Earthy Sands on crests and adjacent to rock outcrops. Red Earths on upper and midslopes and Soloths on lower slopes. Subsoil EAT 3(1). DP 25%, 50%.	Generally sandy soils but lower slopes with Soloths can be unstable and prone to gully erosion.	2(4)
tc	EIS unit of the Araluen sheet	Steep low hills on igneous intrusives with Yellow Podzolic Soils.	Unknown. Predict sandy soils but localised sodic clayey subsoils may occur on lower slopes	2(4)
tu	Braidwood 1:100k Soil Landscapes	Rolling upland on granitic rock. Common rock outcrops as tors. Soils: Moderately deep (<100 cm) moderately well-drained Red Earths on crests and upper slopes. Moderately deep (<100 cm), imperfectly drained Yellow Podzolic Soils on lower slopes and swamp margins. Subsoil EAT 3(1). DP 25%, 50%.	No appreciable erosion, stable soils.; lower slopes tend to be sandy.	1(2)
ut	Cooma 1:100k Soil Landscapes	Rolling low hills on Adaminaby Group sediments and metasediments. Shallow to moderately deep, moderately well drained Brown Earths and Red Earths.	Predict high sediment delivery soils with localised stable soils.	3(1)

Eden Management Area

References/data sources

Barnes, R.G. and Herzberger, G.A. 1975, *Bega 1:250 000 Metallogenic Map,* Geological Survey of NSW, Sydney.

Hird and Associates, 1994, 'Classification of Soils and Erosion Hazard and Description of Soil Landscapes', in *Environmental Impact Statement, Eden Management Area, Appendix 11*, State Forest of NSW, Pennant Hills.

Tulau, M.J. 1997, *Soil Landscapes of the Bega-Goalen Point 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Tulau, M.J. (in prep.), *Soil Landscapes of the Eden-Green Cape 1:100 000 Sheet*, Department of Land and Water Conservation, Sydney.

Field operatives:

Brian Clark, Forest Planner, State Forests, Eden.
Peter Fogarty, Research Officer, DLWC, Queanbeyan.
Mitch Tulau, Soil Surveyor, DLWC, Cooma.
Charlie Bell, Soil Conservationist (Forestry), DLWC, Bega.
Steve Beaman, Forestry Practices Specialist, EPA, Sydney.

Note 1: The western part of the Management Area was initially covered only by geological mapping. For this area, the Bureau of Resource Sciences (Canberra), with assistance from Mitch Tulau (DLWC), correlated soil landscape units across from the Eden-Green Cape (draft) and Bega-Goalen Point 1:100 000 Soil Landscape sheets using Bega 1:250,000 geological data.

Note 2: In the following tables for this Management Area, * indicates that the soil landscape on the Eden-Green Cape (draft) sheet has a different name to that on the Bega-Goalen Point sheet, but is essentially the same soil landscape. Relevant data on soil texture, clay content, DP, and EAT class has been provided by the author of Bega-Goalen Point and Eden-Green Cape (draft) Soil Landscapes (Mitch Tulau), as being the most common soil for that unit.

Map Unit	Reference	Map Unit Summary	Comment	Soil regolith Stability Class
ab* (wf)	Eden-Green Cape (draft) 1:100k Soil Landscapes, see wf in Bega-Goalen Point 1:100k Soil Landscapes	High foredunes of Holocene aeolian sands. Very deep (>300 cm), well-drained Siliceous Sands; EAT nt, DP 50-100%.	Not logged, sandy soils (class 2).	2
ba	Bega-Goalen Point 1:100k Soil Landscapes	Coastal brackish wetlands of Holocene peat on Holocene estuarine sands; Soils: Shallow (<50 cm) to moderately deep (50-150 cm) peat and clay over deep, imperfectly to very poorly drained sands in swamps. Peat/Clayey Sand; EAT 5/2(1); DP 15/11%.	Peaty surface (class 1) overlying estuarine sand (class 2). Not logged.	1(2)
bb	Bega-Goalen Point 1:100k Soil Landscapes	Undulating rises to low hills on granodiorite and adamellite; Soils: Shallow (<50 cm), well-drained Earthy Sands near bedrock outcrop. Moderately deep (50-150 cm), well-drained Earthy Sands on drier slopes. Moderately deep (50-150 cm), moderately well-drained Yellow Podzolic Soils and well-drained Red Podzolic Soils in higher rainfall areas. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Earthy Sands on flats; sandy loam/sandy clay. EAT 8/5(1), DP 20/50%.	Unit has a mixture of some high sediment delivery soils (class 3), some sandy soils on coarser grained material (class 2) and some stable soils (class 1).	3(1,2)

be	Bega-Goalen Point 1:100k Soil Landscapes	Undulating to rolling low hills on granodiorite. Minor bedrock outcrops. Soils: Moderately deep (50-150 cm), moderately well-drained and well-drained red Solodic Soils on granodiorites, shallow (<50 cm) to moderately deep (50-150 cm), well drained Yellow Earths on granites and adamellites, and structured Red Clays on diorites, on crests to midslopes. Moderately deep (50-150 cm), poorly drained yellow Podzolic Soils, Yellow Solodic and Gleyed Podzolic Soils on lower slopes and drainage lines. Sandy loam/sandy clay. EAT 3(1)/5. DP 28/12%.	Mainly Yellow Podzolic Soils (Class 3) with some Red Podzolic Soils (class 1) and some Earthy Sands (Class 2).	3(2,1)
bh	Bega-Goalen Point 1:100k Soil Landscapes	Rolling hills on basalt. Bedrock outcrop 20-50% on some ridges. Soils: Moderately deep (50-150 cm), moderately well-drained Chocolate Soils and reddish Chocolate Soils on crests to midslopes. Moderately deep (50-150 cm), imperfectly to poorly drained Chernozems in drainage lines. Clay loam/clay. EAT 3(1)/3(1). DP 6%.	Predominantly stable soils but soil batters unstable on rhyolites.	1(3)
bi	Bega-Goalen Point 1:100k Soil Landscapes	Rolling low hills to rolling hills on granite. Bedrock outcrop <10%. Soils: Moderately deep (50-150 cm), well-drained Red Podzolic Soils, Yellow Podzolic Soils, Siliceous Sands, Yellow Earths and Red Earths on crests to midslopes. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on lower slopes. Loamy sand/sandy clay. EAT 8/6, DP 20/50%.	Mainly sandy soils, some unstable soils.	2 (3)
bo	Bega-Goalen Point 1:100k Soil Landscapes	Rolling low hills to hills on rhyolite. Bedrock outcrop 2-20%. Soils: Shallow (<50 cm), well-drained Lithosols on crests. Moderately deep (50-150 cm), moderately well-drained Yellow Podzolic Soils on crests and upper slopes. Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on midslopes and lower slopes. Sandy loam/sandy clay. EAT 8/3(1), DP 40/27%.	Generally high sediment delivery (class 3) but some lower slope soils fall apart (class 4).	3(4)
boa	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Steeper country, similar soils as bo, but do not predict highly unstable footslope soils, and due to steepness predict more sandy soils.	Not exposed to forestry, no evidence of erosion.	3(2)
bob	Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating country with predicted similar soils to bo soil landscape.	Not exposed to forestry, no evidence of erosion.	3(4)
boc	Eden-Green Cape (draft) 1:100k Soil Landscapes	Coastal headland; moister soil conditions, with thick dark loamy topsoil. Sandy loam/sandy clay, EAT 3(2)/3(1), DP 18/27%.	No harvestable timber, generally unknown.	2
bod	Eden-Green Cape (draft) 1:100k Soil Landscapes	Wet sclerophyll/rainforest on Rhyolite, predict generally stable organic rich soils.	No harvestable timber, generally unknown.	1(3)
boe	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rhyolite outcrop.	Rock.	1
bp	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steep to rolling hills to low hills on metasediments. Soils: Moderately deep (50-150 cm), moderately well-drained Red Earths on slopes. Deep (>150 cm), moderately well-drained structured Red Clays on some lower slopes. Sandy loam-silty clay, EAT 3(1)-6, DP 5-25%.	Generally soils are stable Red Soils, some pockets of high sediment delivery soils.	1(3)
bpa	Eden-Green Cape (draft) 1:100k Soil Landscapes	Variant bpa--deeper, generally less rocky topsoils. Rolling low hills. Sandy loam-silty clay, % clay 9/30%, EAT 3(1)/6, DP 25/5%.		1(3)
br	Bega-Goalen Point and Eden-Green Cape (draft) Soil Landscapes	Recent river channel sands and gravels, often braided and migrating. Soils: Deep (>150 cm), well-drained to poorly drained Siliceous Sands, 0% clay, EAT 4, DP 0%.	Sandy soils (class 2).	2
bra	Bega-Goalen Point and Eden-Green Cape (draft)	Variant bra--alkaline, saline and sodic sands located below tidal limit. Potentially acid sulfate soils.	Not logged. Class 2 soils.	2

	Soil Landscapes			
brb	Eden-Green Cape (draft) 1:100k Soil Landscapes	Vegetated sites below tidal limit. Alkaline, saline and sodic sands with a thin loamy sand to sandy loam topsoil. Potential acid sulfate soils.	Not logged. Sandy class 2 soils.	2
cu* (ml)	Eden-Green Cape (draft) 1:100k Soil Landscapes, see ml in Bega-Goalen Point Soil Landscapes	Supratidal poorly drained fluvial delta to intertidal mudflats. Elevation <2 m a.s.l; mangrove or swamp paperback low closed-forest to low open-woodland and saltmarsh. Deep (>150 cm), very poorly drained Alluvial Soils and acid sulfate soils. Sandy loam /sandy loam, EAT 3(1)/2(1), DP 38/40%.	Sandy class 2 soils.	2
eb* (mu)	Eden-Green Cape 1:100k Soil Landscapes, see mu in Bega-Goalen Point Soil Landscapes	Rolling low hills to hills on sediments and metasediments. Soils: Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests and slopes. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on lower slopes and drainage depressions. Sandy loam/ silty clay, EAT 2(1)/2(2), DP 44/75%.	Predominantly high sediment delivery but localised stony soils are stable.	3(1)
eba	Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating variant of eb. Predict high sediment delivery soils and some highly unstable Soloths on lower slopes. Sandy loam/ silty clay, EAT 2(1)/2(2), DP 44/75%.	Generally unknown.	3(4)
ebb	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of eb, Predict predominantly stable soils with high organic matter.	Generally unknown.	1(3)
ebc	Eden-Green Cape (draft) 1:100k Soil Landscapes	Swampy and/or heathy variant of eb. Predict similar soils to eba (see above).	Generally unknown.	3(4)
fc	Eden-Green Cape (draft) 1:100k Soil Landscapes	Near coastal valley flats and narrow floodplains with Quaternary alluvium. Deep moderately well-drained or well-drained Alluvial Soils, Weisenbodens and Chernozems.	Generally stable but localised sandy soils occur.	1(2)
gc	Bega-Goalen Point 1:100k and Eden-Green Cape (draft) 1:100k Soil Landscapes	Rolling to steep low hills to hills on granodiorite. Bedrock outcrop <10%; >20% locally. Soils: Moderately deep (50-150 cm), moderately well-drained Yellow Podzolic Soils and shallow (<50 cm), well-drained Lithosols and Earthy Sands on hillcrests with tor outcrops, upper slopes and ridges. Moderately deep (50-150 cm), moderately well-drained Red Podzolic Soils and moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests to midslopes, and ridges and saddles with low slope angles. Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained or imperfectly drained Yellow Podzolic Soils or imperfectly or poorly drained Grey-brown Podzolic Soils on footslopes and alluvial benches. Brown Earths in drainage depressions. Sandy loam/sandy clay, EAT 5/5, DP 9/40%.	Generally class 3, but localised, localised stable soils and sandy soils occur.	3 (1,2)
gca	Eden-Green Cape (draft) 1:100k Soil Landscapes	Moist variant of gc with brown barrel. Predict stable soils with high organic matter content.		1(2,3)
gcb	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steeper variant of gc.	Predict generally high sediment delivery soils but localised stony soils are predicted to be stable.	3(1)

gh	Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating to rolling low hills on gabbro. Local relief 40-70 cm; slopes moderately inclined (10-20%). Elevation 0-110 m. Cleared. Soils: Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained Chocolate Soils and Prairie Soils or Reddish Chocolate Soils on crests and slopes. Shallow (<50 cm), moderately well-drained Structured Loams near bedrock outcrop. Moderately deep (50-150 cm) to deep (>150 cm), imperfectly to poorly drained Black Earths in drainage lines.	Well structured stable soils.	1
ji	Bega-Goalen Point 1:100k Soil Landscapes	Rolling hills on adamellite. Bedrock outcrop <10%, >20% locally. Soils: Shallow (<50 cm), well-drained Lithosols on crests near bedrock outcrop. Moderately deep (50-150 cm), well-drained Yellow Podzolic Soils or Yellow Earths on slopes. Loamy sand/ sandy clay, EAT 3(2)/5, DP 38/15%.	Mostly Flora reserve. Little known.	3(2,4)
jia	Bega-Goalen Point 1:100k Soil Landscapes	Variant of ji on Stanton Rock Adamellite; steeper slopes, bedrock outcrop >20%.	Generally unknown. Predict both sandy soils and high sediment delivery soils.	3(2,4)
ka	Eden-Green Cape (draft) 1:100k Soil Landscapes	Gently undulating plain to undulating rises on Tertiary sediments. Soils: Moderately deep (50-150 cm) to deep (>150 cm), imperfectly drained yellow Soloths over deeply weathered bedrock on moderately well-drained sites. Moderately deep (50-150 cm) to deep (>150 cm), poorly drained Gleyed Soloths over deeply weathered bedrock in poorly drained sites. Sandy loam/ sandy clay, EAT 3(1)/3(2), DP 33/21%.	Generally unknown. Predict some localised Soloths occur (class 4).	3(4)
kp	Eden-Green Cape (draft) 1:100k Soil Landscapes	Coastal Cliffs on Metasediments.	Not logged.	1
lb	Bega-Goalen Point 1:100k Soil Landscapes	Rolling to undulating low hills on granodiorite. Minor bedrock outcrop. Soils: Moderately deep (50-150 cm), moderately well-drained and well-drained leached Red Earths and leached Yellow Earths, and shallow (<50 cm), well-drained leached Yellow Earths on crests to midslopes. Moderately deep (50-150 cm), poorly drained Yellow Podzolic Soils, yellow Solodic Soils and Gleyed Podzolic Soils on lower slopes and drainage lines. Sandy loam/sandy clay loam, EAT 3(1)/2(1), DP 25/60%.	Very small area, similar soils to 'be' soil landscape.	3(2)
md	Bega-Goalen Point 1:100k Soil Landscapes	Rolling low hills on basalt, high elevation, high rainfall zone. Soils: moderately deep (50-150 cm), moderately well-drained Krasnozems on crests and slopes. Moderately deep (50-150 cm), poorly drained Gleyed clays on lower slopes and drainage lines. Clay loam/ clay, EAT 8/8, DP 0%.	Generally stable Basaltic soils. Note some instability at contact between granodiorite and basalt can cause localised slipping.	1
mda	Bega-Goalen Point 1:100k Soil Landscapes	Gently inclined (3-10%) slopes.	As above.	1

me* (yp)	Eden-Green Cape (draft) 1:100k Soil Landscapes, see yp in Bega-Goalen Point Soil Landscapes	Rolling to steep hills on sandstone, siltstone and conglomerate. Bedrock outcrop generally <2%, >29% locally. Soils: Moderately deep (50-150 cm), moderately well-drained to imperfectly drained yellow Soloths and Yellow Podzolic Soils on crests to midslopes on sandstones and conglomerates. Shallow (<50 cm), well-drained Lithosols on sites with resistant rock strata. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests to midslopes on siltstones and mudstones. Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to imperfectly drained yellow Soloths and Yellow Podzolic Soils on lower slopes on sandstones and conglomerates. Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to imperfectly drained yellow Soloths on lower slopes on siltstones and mudstones. Deep (>150 cm), well-drained to imperfectly drained yellow Soloths and Yellow Podzolic Soils, Earthy Sands or Brown Earths on colluvial slopes. Loamy sand/sandy clay, EAT 8/2(1), DP 30/38%.	Soils predominantly sandstone with some mudstone. Predict both sandy soils and high sediment delivery duplex soils.	3(2)
meb	Eden-Green Cape (draft) 1:100k Soil Landscapes	Very steep variant of me.	Fine sandy soils.	3(2)
mec	Eden-Green Cape (draft) 1:100k Soil Landscapes	Moderately steep variant of me. Predict sandier soils than me.	Generally unknown. Predict sandier soils than me.	2(3)
med	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of me soil landscape.	Generally unknown. Predict more stable soils with high organic matter content.	1(3)
mee	Eden-Green Cape (draft) 1:100k Soil Landscapes	Headland with Melaleuca variant of me soil landscape.	Generally unknown. No timber.	3(2)
mg	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Level to gently undulating terraces on Quaternary alluvium. Moderately deep (50-150 cm), moderately well-drained Yellow Podzolic Soils on terraces. Sandy clay loam/ clay, EAT 3(2), DP 43/28%.	Generally high sediment delivery soils (class 3). Otherwise unknown.	3
mgb	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Terrace remnants near Kameruka with coarse gravel and rounded cobble layers common.	Generally high sediment delivery soils but localised sandy soils occur. Otherwise generally unknown.	3(2)
mi	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steep hills to mountains on sandstones, conglomerates, mudstones, and siltstones. Soils: well drained stony Yellow Podzolic Soils, and Stony Yellow Earths, Stony Red Podzolic Soils and Red Earths.	Predict localised sandy soils with localised high sediment delivery soils. Some stable soils may be present.	3(1,2)
mia	Eden-Green Cape (draft) 1:100k Soil Landscapes	Cliffs on sandstone conglomerate mudstone and siltstones with very shallow stony soils.	Localised sandy soils. High stone content helps hold soil together.	3(2)
mib	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of mi soil landscape on conglomerate mudstone and siltstones.	Predict generally stable soils with high organic matter content. Some high sediment delivery soils may occur.	1(3)
mm	Bega-Goalen Point 1:100k Soil Landscapes	Steep hills to mountains on granite. Bedrock outcrop >20%, 100% locally. Soils: shallow (<50 cm), well-drained Lithosols on crests and near bedrock outcrop. Moderately deep (50-150 cm), well-drained Yellow Earths, Red Earths and Siliceous Sands on slopes. Sandy loam/ sandy loam, EAT 8/3(1), DP 25/8%.	High sand content non-cohesive soil.	2
mma	Bega-Goalen Point 1:100k Soil Landscapes	Granite rock outcrop	Rock	1
mn	Eden-Green Cape (draft) 1:100k Soil Landscapes	Merimbula Group sediments with heath on coastal summits.	No timber.	3(2)

mo	Eden-Green Cape (draft) 1:100k Soil Landscapes	Moist elevated country on Ademellite with Yellow Podzolic Soils and well structured soils.	Predict sandy topsoils overlying clay subsoils and both class 2 and localised class 3 being present.	2(3)
moa	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rocky, stonier variant of mo soil landscape.	Predict sandy soils and some rock outcrop.	2(3)
mob	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of mo soil landscape.	Generally unknown. Predict stable surface soils with high organic matter content and sandy subsoils.	2(3)
moc	Eden-Green Cape (draft) 1:100k Soil Landscapes	Aplite variant of mo soil landscape.	Poor access. Generally unknown. Predict predominantly siliceous, coarse sandy soils and some high sediment delivery soils.	2(3)
mp	Bega-Goalen Point 1:100k Soil Landscapes	Rolling hills on granodiorite. Minor bedrock outcrop. Soils: Moderately deep (50-150 cm), moderately well-drained Yellow Podzolic Soils on crests to lower slopes. Shallow (<50 cm), well-drained Lithosols on some crests. Moderately deep (50-150 cm), imperfectly to poorly drained Chernozems and Black Earths on lower slopes and in drainage lines. Sandy loam/ sandy clay, EAT 3(1)/2(1), DP 29/35%.	Very small areas. Generally unknown. Predict generally high sediment delivery soils.	3(2)
mu	Bega-Goalen Point 1:100k Soil Landscapes	Rolling low hills to hills on sediments and metasediments. Soils: Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests and slopes. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on lower slopes and drainage depressions. Sandy loam/silty clay, EAT 2(1)/2(2), DP 44/75%.	Minor to moderate rilling in small areas, gravel content highly variable.	3(1)
nb	Bega-Goalen Point 1:100k Soil Landscapes	Swampy flats and drainage depressions, valley fills of Quaternary alluvium in granitic catchments. Soils: Moderately deep (50-150 cm), imperfectly to poorly drained clay loam over sand on fans and flats. Moderately deep (50-150 cm) or deep (>150 cm), imperfectly drained to poorly drained Gleyed Podzolic Soils and Alluvial Soils on flats and in drainage depressions. Clay loam, sandy/ sandy clay loam, EAT 3(1)/3(2), DP 26/60%.	Generally unknown. Likely to be highly sodic soils due to position in landscape.	4(3)
ng	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Steep hills to mountains on metasediments. Soils: Very shallow (<25 cm), well-drained Lithosols (Um1.21) on crests, and slopes on hornfels, moderately deep (50-150 cm), moderately well-drained to imperfectly drained stony Yellow Podzolic Soils, stony Red Earths and stony Yellow Earths on slopes. Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained stony Brown Earths on lower slopes. Sandy loam/silty clay, EAT 3(1)/3(2); DP 19/33%.	Generally high sediment delivery soils with localised stony soils.	3(1)
nga	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of ng soil landscape on easterly facing gullies.	Predict predominantly stable soils with high organic matter content. Some high sediment delivery soils may occur.	1(3)
nma	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rises on Tertiary Sediments with Yellow Podzolic Soils.	Generally unknown. Yellow Podzolic Soils predicted to be class 3.	3

pa	Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating to rolling low hills on Tertiary sediments. Soils: Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to well-drained Lateritic Soloths or moderately well-drained to imperfectly drained yellow Soloths over deeply weathered Tertiary sediments on crests, summit surfaces, slopes and flats. Moderately deep to deep, poorly drained Brown Clays in drainage lines. Sandy loam/ sand clay, EAT 3(1)/5, DP 8/17%.	Instability in batters.	3
pab	Eden-Green Cape (draft) 1:100k Soil Landscapes	Variant of pa soil landscape. Rolling low hills on Tertiary sediments.	Sandy topsoils	2
pb	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steep hills to mountains on sandstones, conglomerates, mudstones and siltstones. Bedrock outcrop is generally minor (<2%), locally >20%. Soils: Shallow (<50 cm), well-drained Lithosols and moderately deep (50-150 cm), moderately well-drained stony Red Earths on slopes on mudstones and siltstones, moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on slopes on sandstones and conglomerates. Loamy sand/sandy clay, EAT 5, DP 17/30%.	Topsoils with high fine and medium sand content but clayey subsoils are high sediment delivery.	3(2)
pba	Eden-Green Cape (draft) 1:100k Soil Landscapes	Bedrock outcrop and very shallow, stony soils.	Stony stable soils.	1
pe	Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating to rolling low hills with Earthy Sands and Yellow Podzolic Soils on Adamellite.	Sandy earthy soils are class 2 and Yellow Podzolic Soils are high sediment delivery (class 3).	2(3)
peb	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steeper variant of pe soil landscape predict similar soils.	As above. Subject to sheet erosion.	2(3)
pec	Eden-Green Cape (draft) 1:100k Soil Landscapes	Stonier variant of pe soil landscape.	Predict generally sandy soils with some stable stony soils.	2(1)
ped	Eden-Green Cape (draft) 1:100k Soil Landscapes	Ademelite rock outcrop.	Rock	1
pee	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of pe soil landscape.	Generally unknown. Predict generally stable soils high in organic matter. Some localised high sediment delivery soils may occur	1(3)
ps	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Backswamps and swamps in Quaternary alluvium with deep (>150 cm), poorly drained Alluvial Soils and Black Earths; EAT 3(1)-5, DP 7-22%.	Stable soils.	1
psa	Bega-Goalen Point 1:100k Soil Landscapes	Variant psa complex and highly variable stratigraphy with abundant sand layers in backswamps of Bega, Brogo, Bemboka and Murrah Rivers.	Stable soils.	1
psb	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Variant psb--back lagoons generally with watertables above the ground surface.	Stable soils.	1
qu	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Rolling low hills on Quondolo Formation-silicified and indurated sands and gravels. Soils: Moderately deep, well-drained Yellow Earths on crests, and moderately deep, moderately well-drained grey-brown Soloths on slopes on Quondolo Formation sands and gravels. Slopes moderately inclined (10-20%). Sandy loam/sandy loam, EAT 3(1)/2(1), DP 29/59%.	Generally unknown. Predict sandy class 2 on Yellow Earths and at least class 3 on Soloths.	2(3)

sc	Eden-Green Cape (draft) 1:100k Soil Landscapes	Granitic swamps with forest.	Generally unknown. Difficult access. Predict high sediment delivery soils with some highly unstable soils due to position in landscape.	3(4)
ss	Eden-Green Cape (draft) 1:100k Soil Landscapes	Swamp Gum country on Tertiary Sediments with loamy soils, peats overlying clayey sands.	Not logged. Peaty topsoils with predicted sodic subsoils.	1(3,4)
ssa	Eden-Green Cape (draft) 1:100k Soil Landscapes	Dry Heath on Tertiary sediments predict same as ka soil landscape.		3(4)
ta	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Sandplains and beach ridges on Holocene aeolian sands. Soils: Deep (>150 cm), well-drained Podzols and Siliceous Sands on well-drained sandplains and beach ridges. Deep (>150 cm), imperfectly drained to poorly drained groundwater Podzols on flats and swales. Loamy sand /sand, EAT 8, DP 50%.	Sandy soils.	2
taa	Eden-Green Cape (draft) 1:100k Soil Landscapes	Landscape variant of ta with sand sheets.	Sandy soils.	2
te	Bega-Goalen Point and Eden-Green Cape1:100k Soil Landscapes	Deep to very steep hills to mountains on granodiorite. Rock outcrop generally <10 %. Soils: Shallow (<50 cm), well-drained Lithosols and structured loams and moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained Yellow Podzolic Soils, Yellow Earths and Brown Earths on steep slopes. Moderately deep (50-150 cm), moderately well-drained massive Brown Earths in steep drainage lines and on colluvial sites. Sandy loam/ sandy clay, EAT 3(1)/2(1), DP 31/50%.	Predominantly high sediment delivery soils (class 3) but with some stony stable Lithosols (class 1) and some sandy Yellow Earths (class 2).	3(2,1)
ti* (pa)	Eden-Green Cape (draft) 1:100k Soil Landscapes, see pa in Bega-Goalen Point Soil Landscapes	Undulating to rolling low hills on Tertiary sediments. Soils: Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to well-drained Lateritic Soloths or moderately well-drained to imperfectly drained yellow Soloths over deeply weathered Tertiary sediments on crests, summit surfaces, slopes and flats. Moderately deep to deep, poorly drained Brown Clays in drainage lines. Sandy loam/sand clay, EAT 3(1)/5, DP 17/8%.	Sandy topsoils Subsoils can be high sediment delivery but don't fall apart.	2(3)
tib* (pab)	Eden-Green Cape (draft) 1:100k Soil Landscapes, see tib in Bega-Goalen Point Soil Landscapes	Variant of ti soil landscape. Rolling low hills on Tertiary sediments.	Topsoils sandy but subsoils if exposed are high sediment delivery.	2(3)
tj	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating rises to low hills on sediments and metasediments. Soils: Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests and slopes. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained yellow Soloths on lower slopes and drainage depressions. Loam/silty clay, EAT 2(1)/2(1), DP 44/41%.	Predominantly high sediment delivery soils (class 3).	3
to	Eden-Green Point 1:100k Soil Landscapes	Undulating to rolling low hills on granodiorite with Yellow Earths.	High sediment delivery soils with localised sandy soils.	3(2)
toa	Eden-Green Point 1:100k Soil Landscapes	Undulating to rolling on granite and adamellite with Yellow Earths on pine plantation.	Predominantly sandy soils with areas of clayey subsoils with high sediment delivery.	2(3)
tr	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Narrow, high energy floodplains of coarse Quaternary alluvium. Deep (>150 cm), well-drained Alluvial Soils. Loamy sand /sand, EAT 3(1)/3(1), DP 17/0%.	Very thin unit with sandy soils.	2

wc	Bega-Goalen Point 1:100k Soil Landscapes	Undulating rises to low hills on granodiorite. Soils: Moderately deep (50-150 cm), moderately well-drained Red Podzolic Soils and Red Earths on slopes. Moderately deep (50-150 cm), imperfectly to poorly drained Brown Clays and grey sands on lower slopes and in drainage lines. Sandy loam /sandy clay, EAT 3(1)/5, DP 45/11%.	Generally unknown. Predict high sediment delivery soils with localised sandy soils in drainage lines.	3(2)
wg	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rolling low hills on granites. Yellow Podzolic Soils. Sheet erosion risk.	Generally sandy low sediment delivery soils. Localised higher sediment delivery are predicted to occur where subsoils are exposed. Sheet erosion risk.	2(3)
wga	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rolling low hills and ridges on Aplite and Ademellite.	Generally unknown. Predict generally sandy soils with localised clayey subsoils that are high sediment delivery.	2(3)
wgc	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of wg soil landscape on conglomerate mudstone and siltstones.	Generally unknown. Predict stable soils with high organic matter surface horizons. Localised high sediment delivery soils may occur.	1(3)
wgd	Eden-Green Cape (draft) 1:100k Soil Landscapes	Undulating variant of wg soil landscape.	Generally unknown. Predict Earthy Sands (class 2) and Yellow Podzolics Class 3.	2(3)
wge	Eden-Green Cape (draft) 1:100k Soil Landscapes	Dry variant of wg soils landscape.	As above but generally sandier. Possible lower slopes are sodic and dispersible (class 4).	2(3,4)
wgf	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steeper variant of wg soil landscape.	Do not predict lower slope sodic soils.	2(3)
wt	Eden-Green Cape (draft) 1:100k Soil Landscapes	Moist hills on ademellite with well structured Red, Orange and Yellow Podzolic Soils.	Generally unknown. Predict generally stable well structured soils with some localised high sediment delivery soils.	3(1)
wta	Eden-Green Cape (draft) 1:100k Soil Landscapes	Soil landscape variant of wt soil landscape with rainforest. Predict more stable soils.	More stable soils with high organic matter and dense roots (rainforest). Some localised high sediment delivery soils may occur.	1(3)
wtb	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steeper variant of wt soil landscape.	Very little present.	3(1)
wtd	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rock outcrop.	Rock outcrop.	1
wya	Eden-Green Cape (draft) 1:100k Soil Landscapes	Flood-tide, supratidal and intertidal marine sand flats in Quaternary marine sediments. Elevation <1 m above sea level. Mangrove to saltmarsh. Very deep (>300 cm), very poorly drained estuarine sands over deep clayey sand on supratidal and intertidal sites.	Estuarine	2

yp	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Rolling to steep hills on sandstone, siltstone and conglomerate. Bedrock outcrop generally <2%; Soils: Moderately deep (50-150 cm), moderately well-drained to imperfectly drained yellow Soloths and Yellow Podzolic Soils on crests to midslopes on sandstones and conglomerates. Shallow (<50 cm), well drained Lithosols on sites with resistant rock strata. Moderately deep (50-150 cm), moderately well-drained to imperfectly drained Yellow Podzolic Soils on crests to midslopes on siltstones and mudstones. Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to imperfectly drained yellow Soloths and Yellow Podzolic Soils on lower slopes on sandstones and conglomerates. Moderately deep (50-150 cm) to deep (>150 cm), moderately well-drained to imperfectly drained yellow Soloths on lower slopes on siltstones and mudstones. Deep (>150 cm), well-drained to imperfectly drained yellow Soloths and Yellow Podzolic Soils, Earthy Sands or Brown Earths on colluvial slopes. Variant ypc very rocky soils on steep or very steep slopes to cliffs, often associated with conglomerate or sandstone. Loamy sand/sandy clay, EAT 8/2(1), DP 30/38%.	Generally high sediment delivery duplex soils with localised sandy soils.	3(2)
ypa	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Landscape variant of yp soil landscape with deeper or less rocky soils on undulating low hills.	High sediment delivery soils with localised sandy soils.	3(2)
ypb	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Variant of yp soil landscape with rolling low hills.	as above.	3(2)
ypd	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rainforest variant of yp soil landscape.	Generally unknown. Predict more stable soils.	1(3)
yw	Eden-Green Cape (draft) 1:100k Soil Landscapes	Steep hills on rhyolite with rocky sandy soils.	Rocky sandy soils with localised sodic soils in poorly drained areas.	2(4)
ywa	Eden-Green Cape (draft) 1:100k Soil Landscapes	Rock outcrop.	Rock outcrop or sandy soils.	1(2)
xx	Bega-Goalen Point and Eden-Green Cape (draft) 1:100k Soil Landscapes	Disturbed terrain (quarries etc) mainly on Quondolo Sediments. Sandy clay loam/ sandy loam, EAT 3(1)/2(1), DP 29/59%.	Predict generally sandy sediments.	2

Bathurst Management Area (including hardwoods)

References/data sources

Hird C. 1991, *Soil Landscapes of the Goulburn 1:250 000 Sheet*, Soil Conservation Service of NSW, Sydney.

King D.P. 1993, *Soil Landscapes of the Wallerawang 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

King D.P. 1994, *Soil Landscapes of the Katoomba 1:100 000 Sheet*, Department of Conservation and Land Management, Sydney.

Kovac M., Murphy B.M. and Lawrie J.W. 1990, *Soil Landscapes of the Bathurst 1:250 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Field Operatives

David Bell, Forest Assistant, State Forests, Bathurst.
Dr Philip Ryan, Senior Research Scientist, CSIRO Division of Forests and Forest Products, Canberra.
Chris Marshall, Environment Protection Officer, Environment Protection Authority, Bathurst.
John Rogers, Catchment Manager, Department of Land and Water Conservation, Bathurst.

Map Unit	Reference	Map Unit Summary	Comments	Soil Regolith Stability Class
bb	Katoomba 1:100k Soil Landscapes	Sandy Lithosols on upper slopes and Red Podzolics and Non-Calcic Brown Soils on lower slopes, developed on rolling terrain on diorite and granodiorite.	Minor extent, no exposure.	1
bc	Katoomba 1:100k Soil Landscapes	Solodics and gley podzolics along drainage lines; EAT 2(1,2), high DP.	Not exposed to forestry operations	4
bd	Bathurst 1:250k Soil Landscapes	Steep hills with shallow sands and loams and shallow Red Podzolics on hillslopes, and Soloths and Yellow Earths in drainage lines.	Minor scalding in drainage lines, sheet erosion reported after severe fires.	1(3)
bg	Bathurst 1:250k Soil Landscapes	Low undulating hills developed on acidic lavas; brown structured clays and Chocolate Soils on slopes, black structured heavy clays on lower slopes.	Stable, minor gullying in drainage lines in cleared areas.	1
bl	Bathurst 1:250k Soil Landscapes	Rolling to undulating terrain; Red Podzolic Soils on crests to midslopes and Yellow Podzolics on lower slopes, developed largely on fine to medium grained sediments, with minor limestone supporting Terra Rossa Soils.	Generally stable with minor gully erosion in some drainage lines.	1(3)
bm	Bathurst 1:250k Soil Landscapes	Lithosols, outcrop and shallow sands on sediments and acid volcanics.	Largely unused, no signs of erosion.	1
br	Katoomba 1:100k Soil Landscapes	Sandy to loamy Yellow Earths, minor Red Earths and Lithosols on gently sloping terrain on Permian sediments; EAT 2(2), DP 22% in subsoil.	Minor extent, little exposure to forestry operations.	2(1)
bs	Bathurst 1:250k Soil Landscapes	Undulating terrain om granodiorite; Red Podzolic, dark sandy loam over moderately structured sandy clay loam; Red Earths, weakly structured sandy loam grading to sandy clay, on flatter lower slopes.	Minor gullying present in some small drainage lines, minor rilling on batters.	3
bu	Bathurst 1:250k Soil Landscapes	Red Podzolics on crests and Yellow Podzolics with bleached, massive sandy loam over yellow brown moderately structured light clay on mid and lower slopes on low undulating terrain developed on sediments and acid volcanics.	Few signs of instability. Some gullying in drainage lines.	3(1)
by	Bathurst 1:250k Soil Landscapes	Gently sloping, undulating terrain on trachyte; strongly structured Red Podzolic Soils.	Few minor signs of erosion, generally stable.	1

cb	Wallerawang 1:100k Soil Landscapes	Shallow Yellow Podzolic Soils and medium to fine textured Yellow Earths on rolling hills on Berry formation sediments; Solodics in narrow drainage lines. EAT 2(1), DP 58% in subsoil.	Rill erosion on tracks and gully erosion in drainage lines common.	3(4)
cb	Bathurst 1:250k Soil Landscapes	Undulating low hills on Carcoar Granite; sandy Red Podzolics on slopes, weakly structured subsoils; Yellow Podzolics and Solodics on footslopes and drainage lines; Siliceous Sands on crests and upper slopes.	Generally stable, although extensive sheet erosion noted after wildfires in 1989.	3(2)
cg	Wallerawang 1:100k Soil Landscapes	Shallow stony Red Podzolic and Yellow Podzolic Soils on horizontal Permian sediments, EAT 3(1) to 3(2); Solodics in narrow drainage lines.	Common gully erosion along drainage lines.	3(4)
cn	Bathurst 1:250k Soil Landscapes	Rolling to steep slopes on volcanic complex including trachyte and rhyolites; Skeletal loam and structured fine textured Red Earths, minor Krasnozems on hillslopes; Yellow Podzolics in drainage lines.	Rill erosion on road surfaces and batters common, minor slumping of batters; where very stony, erosion is only minor.	3(1)
co	Wallerawang 1:100k Soil Landscapes	Variable shallow to moderately deep stony Lithosols and earthy sands on crests, ridges and steep sideslopes; Yellow Podzolics, minor Red Earths and Red Podzolics on lower slopes on Devonian porphyry, quartzite and metasediments.	Minor gully erosion along some drainage lines.	2(3)
co	Bathurst 1:250k Soil Landscapes	Rolling to steep hills on fine sediments and minor acid volcanics; Yellow Podzolics and Solodics on lower slopes and drainage lines; Red Podzolics and shallow coarse sands on crests and upper slopes.	No exposure to forestry operations.	3(1)
cp	Bathurst 1:250k Soil Landscapes	Undulating low hills on Permian sediments; Yellow Podzolic and Brown Podzolic Soils on slopes and Solodics in drainage lines.	Minor gully erosion in depressions.	3
cs	Bathurst 1:250k Soil Landscapes	Steep rolling terrain on sandstone and shale; Non-calcic Brown Soils and Red Podzolics on slopes and Siliceous Sands on crests and upper slopes.	Moderate rill erosion on some grazing lands.	1(2)
ct	Goulburn 1:250k Soil Landscapes	Steep rocky hills on acid volcanics; extensive bouldery outcrop with shallow weakly structured medium textured Red Earths and Yellow Earths; Lithosols and Terra Rossa Soils on limestone.	Not used for forestry operations, stable soil.	1
dc	Wallerawang 1:100k Soil Landscapes	Deep Humic Gleys and Grey Earths, minor peaty sands and Earthy Sands in swampy drainage lines within Narrabeen sandstone.	Not generally affected by forest operations or roading, no erosion apparent.	3(2)
dca	Wallerawang 1:100k Soil Landscapes	Valley side swamps on more steeply sloping terrain.	Not generally affected by forest operations; no erosion apparent.	4
dm	Bathurst 1:250k Soil Landscapes	Undulating terrain on granite; Rock outcrop and shallow sands on upper slopes and crests, Siliceous Sands on mid and lower slopes.	Minor to moderate gullying exists in some gullies on grazing land.	2
ga	Goulburn 1:100k Soil Landscapes	Low undulating terrain on granite; sandy Red Podzolic Soils on upper slopes and sandy weakly structured Yellow Podzolics on lower slopes.	Occasional gullying on drainage lines in grazing land.	3
gi	Bathurst 1:250k Soil Landscapes	Undulating low hills on basalt; Krasnozems on upper slopes, Chocolate Soils and Red Podzolics on mid and lower slopes; minor Yellow Podzolics in drainage lines.	No erosion evident.	1
gv	Katoomba 1:100k Soil Landscapes	Moderately deep Red Podzolics and Krasnozems on rolling low hills developed on Devonian metasediments; EAT 3(2) and 6 in subsoil, low DP; occasional Yellow Earths and Yellow Podzolics on intermediate and acid volcanics.	Generally stable with minor rilling on batters; yellow coloured soils show common rilling on batters and incision in gutters.	1(3)
ho	Wallerawang 1:100k Soil Landscapes	Steep terrain on basaltic breccia and colluvium; Yellow Podzolics on upper and mid slopes, Yellow-brown Earths and Red Podzolics on mid and lower slopes.	Not exposed to forestry operations, no erosion evident.	3(1)

hw	Katoomba and Wallerawang 1:100k Soil Landscapes	Shallow sandy Lithosols and rock outcrop on cliffs and talus slopes associated with Narrabeen Group.	Minor extent, no exposure.	2
je	Goulburn 1:250k Soil Landscapes	Flat to gently undulating terrain on Tertiary deposits; deep stony and weakly structured Yellow Earths, minor Yellow Podzolics on low crest area.	Sheet erosion has occurred on some grazing land following clearing.	3
ka	Katoomba 1:100k Soil Landscapes	Shallow Structured Loams, Lithosols and minor shallow Brown and Yellow Podzolics on very steeply sloping terrain developed on Devonian, Silurian and Ordovician metasediments.	Generally stable, few areas of common rilling on batters and unsurfaced roads in pine plantations.	1(3)
la	Bathurst 1:250k Soil Landscapes	Shallow very gravelly loams and minor Red Podzolics on hillslopes on Lambie Group sediments with minor Yellow Podzolics on lower slopes.	Few signs of erosion; predict high sediment delivery soils on Yellow Podzolics on lower slopes.	1(3)
li	Wallerawang 1:100k Soil Landscapes	Yellow Podzolic and Red Podzolic Soils, minor Yellow Earths on low undulating terrain on Illawarra Coal measures and Berry formation. EAT 5, DP 44-67% in subsoil.	Moderate gully erosion occurs on some drainage lines in grazing land.	3(1)
li	Goulburn 1:250k Soil Landscapes	Steep to very steep hills on Ordovician metasediments; shallow Red Earths and Red Podzolics on slopes and Yellow Podzolics in drainage lines.	Common gully erosion along drainage lines in agricultural land.	3(1)
lm	Bathurst 1:250k Soil Landscapes	Rolling to steep hills on trachyte and acid volcanics; skeletal sands and loams, slightly deeper soils on lower slopes.	Not exposed to forestry operations.	1
lo	Bathurst 1:250k Soil Landscapes	Undulating low hills on granite and associated colluvium; Yellow Podzolics and minor Siliceous Sands on upper slopes, Solodics on lower slopes and in drainage lines.	Minor gullying in some drainage lines in grazing land.	3(4)
ls	Wallerawang 1:100k Soil Landscapes	Drainage lines and swamps on peaty alluvium; Peaty Loams with minor associated Grey Loams and Humic Gley Soils.	Stable material, not exposed to forestry operations.	1
ma	Goulburn 1:250k Soil Landscapes	Rolling to steep hills on fine metasediments and rhyolite; Yellow Podzolic Soils on hillslopes, bleached sandy loam surface over yellow brown coarse structured clay, rock outcrop and Lithosols on crests.	Not exoposed to forestry operations; predict potential for rill erosion on exposed soils.	3(1)
mb	Wallerawang 1:100k Soil Landscapes	Moderately deep Earthy Sands and Yellow Earths developed on crests and moderately inclined slopes on Narrabeen Group Sandstones. EAT 5, DP 40-50% in subsoil.	Some rilling and sandy wash with associated depositional fans on unformed road surfaces.	2
mc	Goulburn 1:250k Soil Landscapes	Krasnozems and Red Earths on basalt, stable well structured, coherent soils, stony on steeper slopes.	No signs of erosion.	1
mf	Bathurst 1:250k Soil Landscapes	Rolling terrain on metasediments and minor acid volcanics; Yellow Podzolic Soils, bleached sandy loam over weakly structured yellow brown clay, on sideslopes; rock outcrop and shallow Lithosols on crests.	Moderately extensive sheet erosion, minor gullying present on grazing land.	3(1)
mi	Goulburn 1:250k Soil Landscapes	Hilly terrain on Ordovician metasediments; medium textured, weakly structured Yellow Earths and Yellow Podzolics on sideslopes, minor Lithosols on narrow crests and Soloths in drainage lines.	Major gully erosion problems, and minor to moderate sheet erosion from agricultural usage.	3(1)
mk	Bathurst 1:250k Soil Landscapes	Rolling low hills on metasediments; Yellow Soloths on hillslopes and drainage lines, bleached sandy loam over coarse structured heavy clay, with Red Podzolics and Lithosols on crests and upper slopes, dark sandy loam over strongly structured heavy clay.	Severe gullying and tunnelling, some sheet erosion, much of which was initiated in earlier clearing phase.	4(1)
mq	Bathurst 1:250k Soil Landscapes	Plains and terraces along the major rivers; well structured Red Podzolics, Prairie Soils on plains, medium textured Red Earths on terraces.	Not exposed to forestry operations; exisitng stream bank erosion common on agricultural land.	1
mr	Katoomba 1:100k Soil Landscapes	Shallow Siliceous and Earthy Sands and deep sandy Red Earths on rolling terrain developed on Devonian porphyritic granite; minor Yellow Earths and Solodics on lower slopes.	Minor extent only; minor rill erosion on batters.	2(3)

ms	Wallerawang 1:100k Soil Landscapes	Lithosols and rocky outcrop, minor shallow sands and earths on rugged crests and upper slopes on Narrabeen sandstone.	Not exposed to forestry operations, no erosion evident.	1(2)
mu	Bathurst 1:250k Soil Landscapes	Undulating low hills; Yellow Soloths, bleached sandy loam over coarse structured yellow heavy clay, on hillslopes and Red Podzolic Soils on crests, dark sandy loam over strongly structured heavy clay, developed on metasediments and associated colluvium.	Severe gullying and tunnelling, and common sheetwash, much of which was initiated by former clearing and farming practices.	4(1)
mw	Katoomba 1:100k Soil Landscapes	Shallow Lithosols, Red Earths and Red Podzolics on steep to very steep hills developed on Lambie metasediments; EAT 3(1), DP 14% in subsoil; minor Red Earths, Red Podzolics and Yellow Podzolics on lower slopes.	Extensive areas under pine; generally stable with minor rilling on batters and road surfaces. Occasional slumping on high batters.	1(3)
np	Wallerawang 1:100k Soil Landscapes	Shallow Siliceous and sandy Lithosols on Triassic sandstone plateau.	Sheet erosion following severe fires and on unsurfaced tracks is common.	2
ob	Bathurst and Goulburn 1:250k Soil Landscapes	Low undulating terrain on acid volcanics and fine sediments; Structured Red Earths and Krasnozems; Yellow Podzolics on footslopes and drainage lines.	Stable soils with few erosion features.	1(3)
oe	Bathurst 1:250k Soil Landscapes	Shallow Red Podzolic Soils on crests to midslopes and Yellow Podzolics and Solodics in drainage lines, developed on undulating to rolling terrain on sediments and acid volcanics.	Stable, few signs of erosion.	1(3)
pf	Wallerawang 1:100k Soil Landscapes	Grey-brown alluvial soils and Soloths on recent alluvium.	Common gullying and stream bank collapse.	4
pm	Goulburn 1:250k Soil Landscapes	Very steep hills on Wyangla granite batholith; shallow sandy Lithosols and shallow sands on granite/granodiorite, minor Yellow Podzolics on lower slopes.	Minor sheet erosion on slopes, minor gullying and streambank collapse in grazing land.	1(3)
pr	Bathurst 1:250k Soil Landscapes	Low undulating terrain on basalt; Krasnozems, dark brown structured loam grading to structured light clay, and Chocolate Soils, dark structured surface over brown structured clay subsoil; Yellow Podzolic Soils in drainage lines.	Stable, few erosion features.	1
pu	Bathurst 1:250k Soil Landscapes	Undulating low hills on acid volcanics and sediments; Red Podzolics on crests and upper slopes, Yellow Podzolics and Solodics on lower slopes and drainage lines.	Stable, few erosion features	3(1)
rb	Goulburn 1:250k Soil Landscapes	Steep hills on andesite and some fine metasediments; shallow loams and Red Earths, Yellow Podzolics on drainage lines.	Minor to moderate sheet erosion where cleared for grazing.	3(1)
rl	Goulburn 1:250k Soil Landscapes	Yellow Podzolics, Soloths and minor Red Podzolics on metasediments, sediments and acid volcanics.	Common sheet erosion on agricultural land, minor rilling on road batters, minor gully erosion in some drainage lines.	3(1)
rl	Bathurst 1:250k Soil Landscapes	Undulating low hills on mixed sediments and acid volcanics; long hillslopes with Yellow Podzolics and Soloths; Red Podzolics on crests.	Common sheet erosion on agricultural land, minor rilling on road batters, minor gully erosion in some drainage lines.	3(1)
rm	Katoomba 1:100k Soil Landscapes	Lithosols and shallow Siliceous Sands on steeply to very steep hills on Carboniferous granite.	Not generally used for forestry; minor rilling on trails.	1(2)
ro	Bathurst 1:250k Soil Landscapes	Rolling to steep hills developed on granite and adamellite; Siliceous Sands and Podzols on slopes and sandy solodics in drainage lines and lower slopes.	Moderate sheet erosion associated with more intensive agricultre.	2(3)
ry	Wallerawang 1:100k Soil Landscapes	Narrow crests and sideslopes on Lambie metasediments; medium to fine textured Red Earths and Yellow Earths on crests and slopes, Yellow Podzolics and Soloths/Solodics in drainage lines and on lower slopes.	Minor gullies in drainage line in grazing land.	3(1)
sc	Bathurst 1:250k Soil Landscapes	Red Podzolics, structured Red Earths on mid and upper slopes on sediments and acid	Very minor sheet and rill erosion on cleared land,	1(3)

		volcanics, Yellow Podzolics on narrow lower slopes and drainage lines.	minor gully erosion and road drainage incision on lower slopes and footeslopes.	
sh	Bathurst 1:250k Soil Landscapes	Gently undulating terrain on basalt and ash interbeds; Krasnozems on mid and upper slopes, with solodics on lower slopes.	Little erosion evident.	1(3)
so	Bathurst 1:250k Soil Landscapes	Rolling low hills on acid volcanics; strongly structured Red Podzolics and Krasnozems on crests and slopes, Soloths in drainage lines.	Sheet erosion and gully erosion on drainage lines common on agricultural land.	1(3)
ta	Goulburn 1:250k Soil Landscapes	Gently sloping plateaux and valleys on basalt; Krasnozems on gently sloping land, Chocolate Soils and Prairie Soils on sideslopes.	Occasional sheet erosion where cultivated.	1
tl	Goulburn 1:250k Soil Landscapes	Lower slopes on Lambie Group sediments; weakly structured, medium textured Yellow Earths on upper slopes, Yellow Podzolics on lower slopes.	Minor to moderate gullying on grazing land.	3
to	Bathurst 1:250k Soil Landscapes	Rolling hills on basalt and associated ash deposits; Krasnozems, dark structured loam over structured red clay loam; Yellow Podzolic/Solodic soils in drainage lines.	Stable with only minor occurrences of soil erosion.	1(3)
tr	Bathurst 1:250k Soil Landscapes	Rolling hills on metasediments and acid volcanics; Yellow Podzolics and Solodics on footslopes and sideslopes; strongly structured Red Podzolic Soils on upper slopes and shallow sandy Lithosols and Red Podzolic Soils on crests.	Common gully erosion in drainage lines.	3(1)
ts	Bathurst 1:250k Soil Landscapes	Steep slopes and cliffs on sandstone, shale, coal and other sediments; mostly rock outcrop and scree, minor leached loams and siliceous sands on narrow lower slopes.	Not exposed to forestry operations, few signs of erosion.	1
tu	Bathurst 1:250k Soil Landscapes	Steep undulating terrain on Permian sediments; Yellow Podzolics on slopes, shallow Red Podzolics and skeletal sand on upper slopes.	Minor gully erosion in drainage lines on cleared land.	3(1)
tu	Bathurst 1:250k Soil Landscapes	Red Earths, Yellow Earths and Yellow Podzolics on Narrabeen and Lambie sediments.	Minor gully erosion and sheet erosion on agricultural land.	3(1)
vb	Bathurst 1:250k Soil Landscapes	Rolling hills on acid volcanics and sediments; Structured Red Earths and Krasnozems, dark fine sandy loam over structured red clay loam to light clay, on upper slopes, and outcrop on crests; Yellow Earths and Yellow Podzolics, bleached sandy loam over mottled yellow brown light clay on lower slopes.	Minor gullying in drainage lines in grazing land.	1(3)
vu	Bathurst and Goulburn 1:250k Soil Landscapes	Low undulating terrain on Ordovician Metasediments; medium textured Red Earths on crests and upper slopes, Yellow Earths on slopes and Soloths in drainage lines.	Sheet erosion and gully erosion common, mostly due to historical land use practices.	3(1)
wb	Wallerawang 1:100k Soil Landscapes	Shallow Lithosols and outcrop, minor Red Podzolic Soils on crests and slopes, minor Yellow Podzolics on lower slopes.	Not exposed to forestry operations, no erosion evident.	1(3)
wo	Wallerawang 1:100k Soil Landscapes	Shallow Siliceous Sands and Lithosols on crests and steep sideslopes; earths on more gentle sideslopes; Yellow Podzolics on lower slopes Narrabeen sandstone.	Sheet erosion on exposed slopes and tracks, common rilling on tracks.	2(3)
wr	Wallerawang 1:100k Soil Landscapes	Alluvial flats and terraces with deep loamy Alluvial Soils and Yellow Podzolics.	Streambank erosion is common, particularly where cleared for agriculture.	3

Tumut Management Area (including hardwoods)

References/data sources

Abel, R. (in prep.), *Part Yarrangobilly 1:100,000 Geological Map*, AGSO, Canberra.

Basden, H. and Smart, K.G. 1990, *Tumut 1:100,000 Geological Map*, Department of Minerals and Energy, Sydney.

Geological Survey of NSW, 1966, *Wagga Wagga 1:250 000 Geological Map*, Geological Survey of NSW, Sydney.

Geological Survey of NSW. 1998, *Wagga Wagga 1:250,000 Geological Map (Provisional),* NSW Department of Mineral Resources, Sydney.

Owen, M., Wyborn, D. and Salter, J. 1979, *Brindabella 1:100 000 Geological Map*, Bureau of Mineral Resources, Canberra.

Ryan, P.J. 1990, *State Forests 1:25,000 Parent Rock Code Mapping*, Forestry Commission of NSW, Pennant Hills[4].

Wyborn, D., Owen, M. and Wyborn, L. 1990, *Geology of the Kosciusko National Park-1:250,000 Map*. Bureau of Mineral Resources, Canberra.

Field Operatives

Col Wilkinson, Research Assistant, State Forests, Tumut.
David Priem, Catchment Manager, Department of Land and Water Conservation, Tumut.
Dr Philip Ryan, Senior Research Scientist, CSIRO Division of Forests and Forest Products, Canberra.
Mr John O'Donnell, Environment Protection Officer, Environment Protection Authority, Albury.

Map Unit	Reference	Map Unit Summary	Comments	Soil Regolith Stability Class
Cza	1:25k PRC mapping	High level alluvial deposits on gently undulating basaltic terrain; Yellow Podzolic and Soloth soils.	Minor extent only, not exposed to forestry operations; predict high sediment delivery with minor highly unstable soils.	3(4)
Czb	Brindabella 1:100k geology	Gently undulating terrain on basalt; Krasnozems, deep, strongly structured, medium grading to fine textured subsoil; EAT 5 to 8; 20-40% stone on steep slopes.	Stable, few signs of sediment movement.	1
Dd	Wagga 1:250k geology	Low undulating terrain on diorite; structured Red Earths and weakly developed Krasnozems, stony on steeper slopes.	Stable soil regolith, few erosion features.	1
Dem	Wagga (prov.) 1:250k geology	Undulating terrain on acid volcanics and conglomerate (Minjerry Formation). Sandy Yellow Earths, Earthy Sands and gravelly Sands; minor sandy Yellow Podzolics.	Very minor extent, not impacted by forestry operations, predict low coherence soils.	2
Dg	Wagga 1:250k geology and 1:25k PRC mapping	Undulating terrain on adamellite and coarse granite; Earthy Sands and sandy Lithosols on hillslopes; on mid and lower slopes, Soloths and Yellow Podzolics with deep bleached A2, dispersible B horizons.	Common gullies in low order drainage lines, rilling on exposed soil and road batters, gutters commonly washed out; crests and upper slopes have low coherence, wash in gutters common, sediment fans common at drain outlets.	4(2)

[4]parent rock code mapping is derived from all of the other geological references for the region.

Dga	Tumut and Yarrangobilly (draft) 1:100k geology and 1:25k PRC mapping	Low undulating terrain on granite; Yellow Podzolics with bleached massive A2 horizon; weak structured sandy subsoil; Yellow Podzolic and Solodic in drainage lines and lower slopes.	Rilling on batters and washing out of gutters; minor drainage line instability.	3(4)
Dgda	1:25k PRC mapping	Undulating terrain on granite; Yellow Podzolics with bleached sandy surface over weakly structured yellow subsoil; Solodics in drainage lines.	Rilling on batters, washing out along gutters, minor gully development in drainage lines.	3(4)
Dgg	Wagga 1:250k and Tumut 1:100k geology.	Gently to steeply undulating hills on Green Hills Granodiorite; structured Red Earths and weakly developed and often stony Krasnozems.	Stable terrain.	1
Dgma	1:25k PRC mapping	Undulating terrain on granite; Yellow Podzolics, strongly bleached surface over weakly structured clay, subsoil EAT 2(1)-2(2); medium to coarse textured Yellow Earths on upper slopes and crests; Solodics in drainage lines.	Stable with few erosion features on Red Earths, while yellow soils on lower slopes, where exposed, tend to rill and wash out in gutters.	3(4)
Dgxi	1:25k PRC mapping	Undulating terrain on adamellite; Earthy Sands and sandy Lithosols on hillslopes; on mid and lower slopes, Soloths and Yellow Podzolics with deep bleached A2, dispersible B horizons.	Common gullies in low order drainage lines, rilling on exposed soil and road batters, gutters commonly washed out; crests and upper slopes have low coherence, wash in gutters common, sediment fans common at drain outlets.	4(2)
Dls	Wagga 1:250k geology	Undulating terrain on sandstone, siltstone and shale of Ravendale Terrestrial Basin; Yellow Podzolics soils on hillslopes with Earthy Sands and sandy Yellow Earths on coarser sediments.	Very minor extent, no forestry activities.	3(2)
Dmr	Tumut 1:100k geology	Undulating terrain on acid volcanics and conglomerate (Minjerry Formation). Sandy Yellow Earth soils, Earthy Sands and gravelly Sands; minor sandy Yellow Podzolics.	Very minor extent, not impacted by forestry operations, predict low coherence soils.	2
Ds	1:25k PRC mapping	Undifferentiated sediments and volcanics; rolling to steeply sloping terrain with Yellow Podzolic and Red Podzolic soils.	Minor extent, not exposed to forestry operations; predict high sediment delivery soils.	3
Dtr	Tumut 1:100k geology	Gently to steeply undulating terrain on porphyritic ignimbrite; shallow and stony Yellow Podzolics, with some deeper Yellow and Red Podzolic soils.	Very minor occurrence, no associated foretry activities.	3
Oj	Wagga 1:250k geology	Rolling to steep terrain on amphibolite and basic volcanics, Yellow Podzolics and Structured Yellow and Red Earths.	Very minor extent.	3
Olkn	Wagga 1:250k geology	Undulating to steeply sloping terrain on acid volcanics and sediments; Well structured Red Podzolic Soils with shallower stony profiles on steeper slopes.	Stable soils with few minor signs of erosion.	1
On	Tumut and Brindabella 1:100k geology and 1:25k PRC mapping	Undulating terrain on Ordovician metabasic complex; stony Lithosols with medium to fine textured coherent matrix; shallow structured Red Earths on gentler sloping terrain; Yellow Podzolics in drainage lines.	Red Earths stable soil regolith, few erosion features; Yellow Podzolics display some rill erosion on batters and in gutters; occasional gullys in drainage lines.	1(3)
Os	Tumut 1:100k geology and 1:25k PRC mapping	Undulating to hilly terrain on Ordovician metasediments; Lithosols with >40% gravel and fine to medium textured coherent matrix.	Stable material, few erosion features.	1
Ous	Wagga 1:250k geology	Undulating to hilly terrain on Ordovician metasediments; Lithosols with >40% gravel and fine to medium textured coherent, stable matrix.	Stable soil with few erosion features.	1
Ovc	1:25k PRC mapping	Gently undulating to steeply sloping terrain on Copper Creek altered lavas; structured Red Earths, stony on steeper slopes.	Stable soil regolith with few signs of erosion.	1

Qa	Wagga 1:250k geology	Alluvial plain along medium to larger drainage lines; dark coloured silty and clayey alluvial soils with minor soloth solodic soils on elevated terrace areas.	Not exposed to forestry.	3(4)
Sbd	Tumut 1:100k geology and 1:25k PRC mapping	Moderately steep terrain on medium to coarse grain volcaniclastic sediments; gravelly and stony Lithosols with stable coarse to medium textured matrix; Yellow Podzolics with shallow bleached A2 and medium textured subsoil. EAT 3(2), 3(3).	Stable soil regolith, few erosion features on Lithosols; rill and gully erosion occurs commonly on lower slopes.	1(3)
Sbl	Tumut 1:100k geology and 1:25k PRC mapping	Steeper terrain on fine grain volcaniclastic sediments; gravelly and stony Lithosols with fine textured stable matrix material; deeper gravelly structured Red Earths on gentler lower slopes.	Stable soil regolith, few erosion features.	1
Sbm	Brindabella 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on Micalong Creek basic complex; Red Podzolic, A2 absent; strongly structured organic surface soil over structured red clay subsoil.	Stable soil regolith, few erosion features.	1
Sbv	Wagga 1:250k geology	Moderately steep terrain on acid volcanics and sediments; gravelly and stony Yellow Podzolics and Yellow Earths on upper and mid slopes; Yellow Podzolics with shallow bleached A2 and medium textured subsoil on lower slopes. EAT 3(2), 3(3).	Rill erosion occurs commonly on batters and unsealed tracks on Yellow Podzolics on lower slopes.	3
Sc	Tumut 1:100k geology and 1:25k PRC mapping	Undulating to steeply sloping terrain on serpentinite; Brown Podzolics with moderate structure in A and strong structure in B; low interped strength so low cohesion.	Fretting of batters, occasional slumping; drainage lines stable.	2
Scg	Wagga 1:20k geology	Undulating terrain on Corryong granite; shallow Red Podzolic Soils and structured Red Earths with minor Yellow Podzolics on narrow lower footslopes.	Generally stable with little evidence of erosion.	1
Sd	Wagga 1:250k geology	Gently sloping terrain on diorite and monzonite, at higher elevations; medium to fine textured, strongly structured Alpine Humus Soils and structured Red Earths.	Very minor extent; stable soils, with little evidence of erosion.	1
Sdg	Wagga 1:250k geology	Low undulating terrain on granite; Yellow Podzolics with bleached massive A2 horizon; weak structured sandy subsoil; Yellow Podzolic and Solodic in drainage lines and lower slopes.	Rilling on batters and washing out of gutters; minor drainage line instability	3(4)
Set	Wagga 1:250k geology	Undulating to steep terrain on metasediments; Lithosols with >40% gravel and fine to medium textured coherent matrix.	Stable material, few erosion features.	1
Sg	Brindabella 1:100k geology, 1:25k PRC mapping	Gently undulating terrain on Silurian acid volcanics; structured medium textured Red Earths, minor gravelly Yellow Podzolics on lower slopes in incised terrain.	Generally stable with unstable pockets associated with Yellow Podzolics.	1(3)
Sgc	1:25k PRC mapping	Undulating terrain on Corryong granite; shallow Red Podzolic Soils and structured Red Earths with minor Yellow Podzolics on narrow lower footslopes.	Generally stable with little evidence of erosion.	1
Sge	Tumut 1:100k geology, 1:25k PRC mapping	Rolling terrain on granodiorite; structured Red Earths with medium textured surface, EAT 5/6 and clay subsoil, EAT 3(1) to 5/6.	Stable soil regolith, few erosion features.	1
Sgg	Tumut and Brindabella 1:100k geology and 1:25k PRC mapping	Undulating to steeply sloping terrain on granodiorite; structured Red Earths, strong structure in A and upper B (EAT 8-5/6), weaker in lower subsoil (EAT 5/6-3(1)) and weathered rock; minor Yellow Podzolics in drainage lines and lower slopes; rocky shallow structured Red Earths and Lithosols along eastern fall.	Generally stable soil regolith with few erosion features.	1
Sggh	1:25k PRC mapping	Undulating to steeply sloping terrain on granodiorite; structured Red Earths, strong structure in A and upper B (EAT 8-5/6), weaker in lower subsoil (EAT 5/6-3(1)) and weathered rock; minor Yellow Podzolics in drainage lines and lower slopes; rocky shallow structured Red Earths and Lithosols along eastern fall.	Generally stable soil regolith with few erosion features.	1

Sgo	Brindabella 1:100k geology, 1:25k PRC mapping	Undulating terrain on Corryong granite; shallow Red Podzolics and structured Red Earths with minor Yellow Podzolics on narrow lower footslopes.	Generally stable with little evidence of erosion.	1
Sgsr	1:25k PRC mapping	Steeply sloping ridge terrain on Snubba Range Gabbro; stony shallow lithosols and interspersed shallow structured Red Earths.	Generally stable with minor rill erosion on exposed batters; minor forestry operations only.	1
Sgv	1:25k PRC mapping	Gently to moderately steeply undulating terrain on granodiorite; structured Red Earths.	Very minor unit not exposed to forestry operations. Predicted to be stable.	1
Sgw	Tumut 1:100k geology and 1:25k PRC mapping.	Gently to moderately steeply undulating terrain on Wondalaga granodiorite; medium to fine textured, structured Red Earths and Red Podzolics with strong structure; minor Earthy Sands and shallow Sands on coarser granites.	Generally stable soils with small areas prone to wash on sandy soils.	1(2)
Sgy	Tumut 1:100k geology and 1:25k PRC mapping	Undulating terrain on Young granodiorite; structured Red Earths as above; in north Yellow Podzolics and grey earths more common on mid and lower slopes.	Red Earths stable, few erosion features; Yellow Podzolics and grey earths show common erosion features including rilling of batters, washing along gutters, common drainage line instability.	1(3)
Sh	Tumut 1:100k geology and 1:25k PRC mapping	Undulating to gently undulating terrain on Silurian metabasic complex; Krasnozems and structured Red Earths; strongly structured in top 50-80cm; greater than 1 metre over weathered rock.	Stable soil regolith, few erosion features.	1
Shg	Tumut 1:100k; 1:25k PRC mapping	Steeply sloping terrain on Honeysuckle metabasic complex; stony strongly structured brown clays with areas of Lithosols on very steep slopes.	Very minor unit not exposed in forestry opeations.	1
Sim	Brindabella 1:100k geology and 1:25k PRC mapping.	Gently sloping terrain on tonalite associated with Micalong Creek basic igneous complex. structured Red Earths.	Very minor unit not widely exposed to forestry; stable soils.	1
Sj	Tumut 1:100k geology, 1:25k PRC mapping	Undulating terrain on fine grained metasediments; red very stony and gravelly Lithosols and shallow structured Red Earths, EAT 3(1) in surface and 5/6 in subsoil; Yellow Podzolics and Soloth soils in narrow drainage lines.	Stable soil regolith, few erosion features on hillslope soils; drainage lines have occasional gully development.	1(3)
Sjc	Tumut 1:100k geology, 1:25k PRC mapping	Steeply sloping upper slopes and ridge lines on very small exposures of conglomerate of Jackalass Formation; coarse textured Lithosols and shallow stony sands.	Little exposure to forestry operations due to restricted extent, predict low coherence soils.	2
Skg	Wagga 1:250k geology	Undulating to steeply sloping terrain on Koetong granite; Earthy Sands and sandy Lithosols on hillslopes; on mid and lower slopes, Soloths and Yellow Podzolics with deep bleached A2, dispersible B horizons.	Common gullies in low order drainage lines, rilling on exposed soil and road batters, gutters commonly washed out; crests and upper slopes have low coherence, wash in gutters common, sediment fans common at drain outlets.	4(2)
Slf	Wagga 1:250k geology	Gently to steeply undulating terrain on Frampton acid volcanics; weakly structured Red Podzolics on mid and upper slopes, Yellow Podzolics on lower slopes.	Minor rill erosion on batters, occasional gully erosion in drainage lines associated with farming land.	3
Slog	1:25k PRC mapping.	Undulating terrain on very minor acid volcanics unit; location not known, predict Red Podzolic Soils; requires field checking and assessment.	Unit not located, predict stable soils.	1
Slv	Wagga 1:250k geology	Gently to steeply undulating terrain on acid volcanics in west of region; Yellow and Red Podzolic Soils with weak to moderate structure; Yellow Podzolics have well developed, often bleached A horizon.	Not widely exposed to forestry operations; occasional rill erosion on batters and unsealed roads; minor gully erosion in drainage lines on farming land.	3

Sm	Tumut 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on Micalong basic complex; Structured plastic clays and structured Red Earths, stony in places; EAT 5/6.	Stable, few signs of soil movement.	1
Sme	Brindabella 1:100k geology and 1:25k PRC mapping	Undulating terrain on fine grained Silurian metasediments; Grey earths, weakly structured throughout, with bleached sandy loam surface over greyish clay subsoil; EAT 2(1)-2(2).	Common rilling of batters and washing out along gutters.	3
So	Tumut 1:100k geology and 1:25k PRC mapping	Undulating terrain on Silurian acid volcanics; Yellow Podzolics with bleached A2 and strongly structured subsoil, moderately dispersible; shallow and stony in places; structured Red Earths on steeper slopes in north (Bongongo section) with Yellow Podzolics on lower slopes.	Common wash along gutters and rilling of batters and unsurfaced roads; low order drainage lines gullied occasionally; Red Earths also tend to erode on batters and along gutters.	3
Sos	Tumut 1:100k geology and 1:25k PRC mapping	Undulating terrain on Silurian metasediment interbeds with acid volcanics; Yellow Podzolics with bleached A2 and strongly structured subsoil, moderately dispersible; shallow and stony in places; structured Red Earths on steeper slopes in north (Bongongo section) with Yellow Podzolics on lower slopes.	Common wash along gutters and batters; occasional gullying of drainage lines.	3
Src	Tumut 1:100k and 1:25k PRC	Rolling to steeply sloping terrain on Brungle Creek Formation chert; structured Red Earths; stony and gravelly Red Earths.	Stable soils.	1
Stp	1:25k PRC mapping	Undulating to steep terrain on metasediments; Lithosols with >40% gravel and fine to medium textured coherent matrix.	Stable material, few erosion features.	1(3)
Sts	Wagga 1:250k geology	Undulating to steeply sloping terrain on serpentinite; Brown Podzolics with moderate structure in A and strong structure in B; low interped strength so low cohesion.	Fretting of batters, occasional slumping; drainage lines stable.	2
Su	Tumut 1:100k geology and 1:25k PRC mapping	Rolling terrain on Silurian fine-grained metasediments; red stony and gravelly Lithosols, shallow with stable medium to fine textured matrix; Yellow Podzolics along narrow drainage lines and small areas of footslopes.	Stable soil regolith, few erosion features on hillslope soils; high order drainage lines have occasional gully development.	1(3)
Sv	Brindabella 1:100k geology and 1:25k PRC mapping	Rolling terrain on Silurian acid volcanics; gravelly and stony Yellow Earths on crests, Yellow Podzolics dominant on slopes; coarse to medium textured surface over medium to fine textured subsoil, moderate structure in subsoil, EAT 2(1)-3(3), moderately dispersible in places.	Minor sheet erosion and rilling on exposed soil; occasional drainage line instability.	3
Svg	1:25k PRC mapping	Undulating terrain on Silurian metasediment interbeds with acid volcanics; Yellow Podzolics with bleached A2 and strongly structured subsoil, moderately dispersible; shallow and stony in places; structured Red Earths on steeper slopes in north with Yellow Podzolics on lower slopes.	Common wash along gutters and batters; occasional gullying of drainage lines.	3
Svs	Tumut 1:100K geology, 1:25k PRC mapping	Undulating to steeply sloping terrain on serpentinite; Brown Podzolics with moderate structure in A and strong structure in B; low interped strength so low cohesion.	Fretting of batters, occasional slumping; drainage lines stable.	2
Sw	Tumut 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on Young Granodiorite; structured Red Earths and Structured Loams and clays, stony in places.	Stable.	1
Syb	Brindabella 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on Young Batholith granodiorite; structured Red Earths.	Stable.	1
Syc	Brindabella 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on Young Batholith granodiorite; structured Red Earths.	Stable.	1
Syl	Brindabella 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on Young Batholith leucogranite; structured Red Earths.	Stable.	1

Syo	Brindabella 1:100k geology and 1:25k PRC mapping	Gently to moderately steeply undulating terrain on Young granodiorite and minor adamellite; medium to fine textured, structured Red Earths and Red Podzolic soils with strong structure on granodiorite; Earthy Sands and shallow Sands on adamellites.	Generally stable soils with small areas prone to wash on sandy soils.	1(2)
T	1:25k PRC mapping	Flat terrain on plateau surfaces developed on Tertiary sediments including clays, sands, lignite.	Very minor unit not exposed to forestry; estimate unstable soils on clays with more stable organic rich soils on clays and lignite.	4(1)
Tb	Tumut 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on basalt; Krasnozems, deep, strongly structured, medium grading to fine textured subsoil; EAT 5 to 8; 20-40% stone on steep slopes.	Stable, few signs of sediment movement.	1
Td	Tumut 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on Tertiary dolerite; Krasnozems; deeper on gentle slopes, stony and less than 1 metre deep on crests and upper slopes; strongly structured throughout; EAT 5-8.	Stable soil regolith, few erosion features.	1
Ts	Tumut 1:100k geology and 1:25k PRC mapping	Gently undulating terrain on weathered tertiary sediments; generally structured Red Earths and Red Podzolics, moderate to strong structure; EAT 3(1)-5 in subsoil.	Stable soil regolith, few erosion features.	1

Section 3: Maps Showing Soil Regolith Stability Classes for State Forests in Eastern NSW

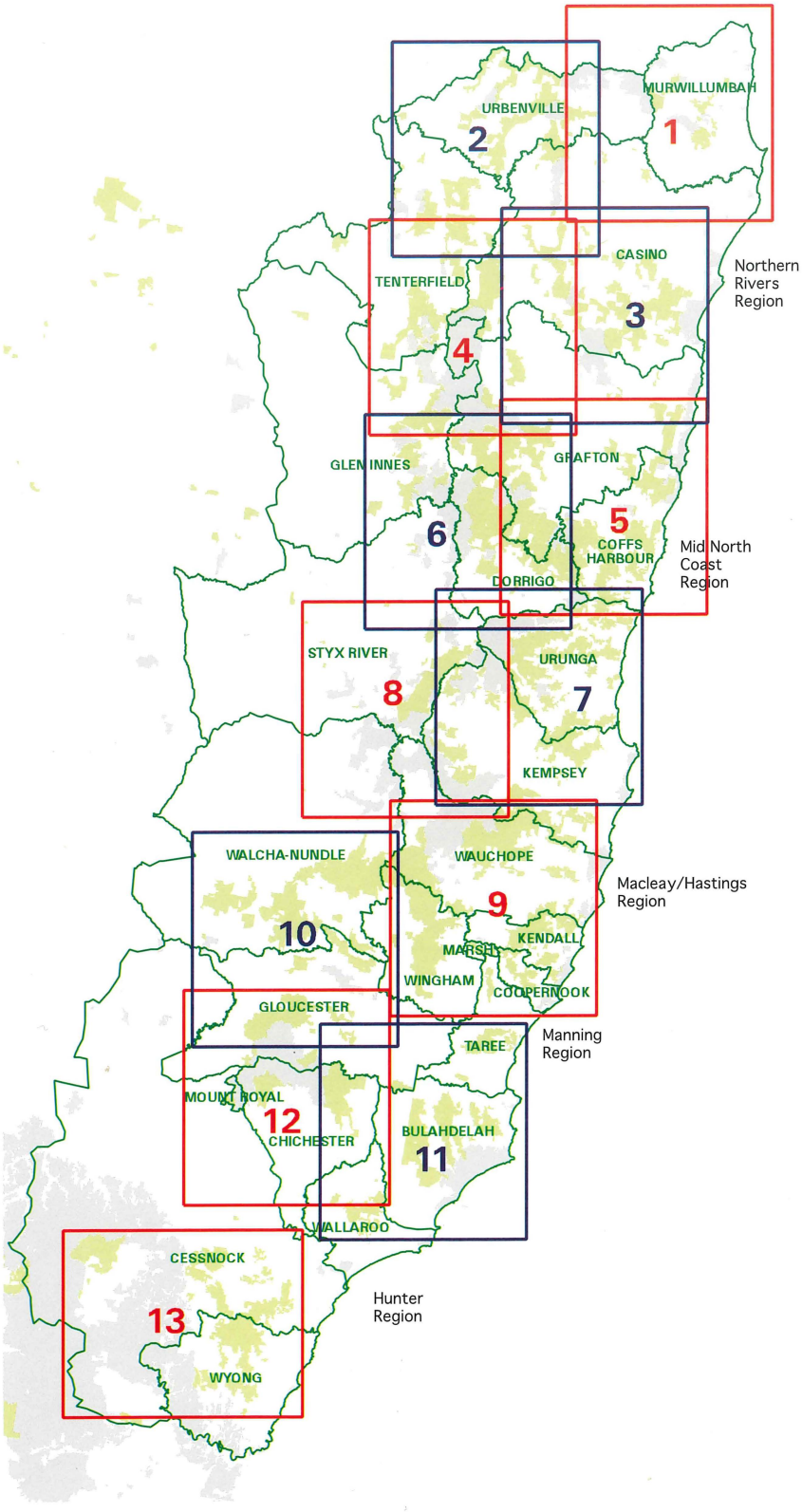
Soil Erosion and Water Pollution Hazard Assessment

Index for the Soil Regolith Stability Maps

North Coast

Scale 1 : 3 000 000

0 10 20 30 40 50 100km



State Forests

National Parks

Region Boundary

Management Area Boundary

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Soil Erosion and Water Pollution Hazard Assessment

Index for the Soil Regolith Stability Maps

South Coast

Scale 1 : 2 500 000

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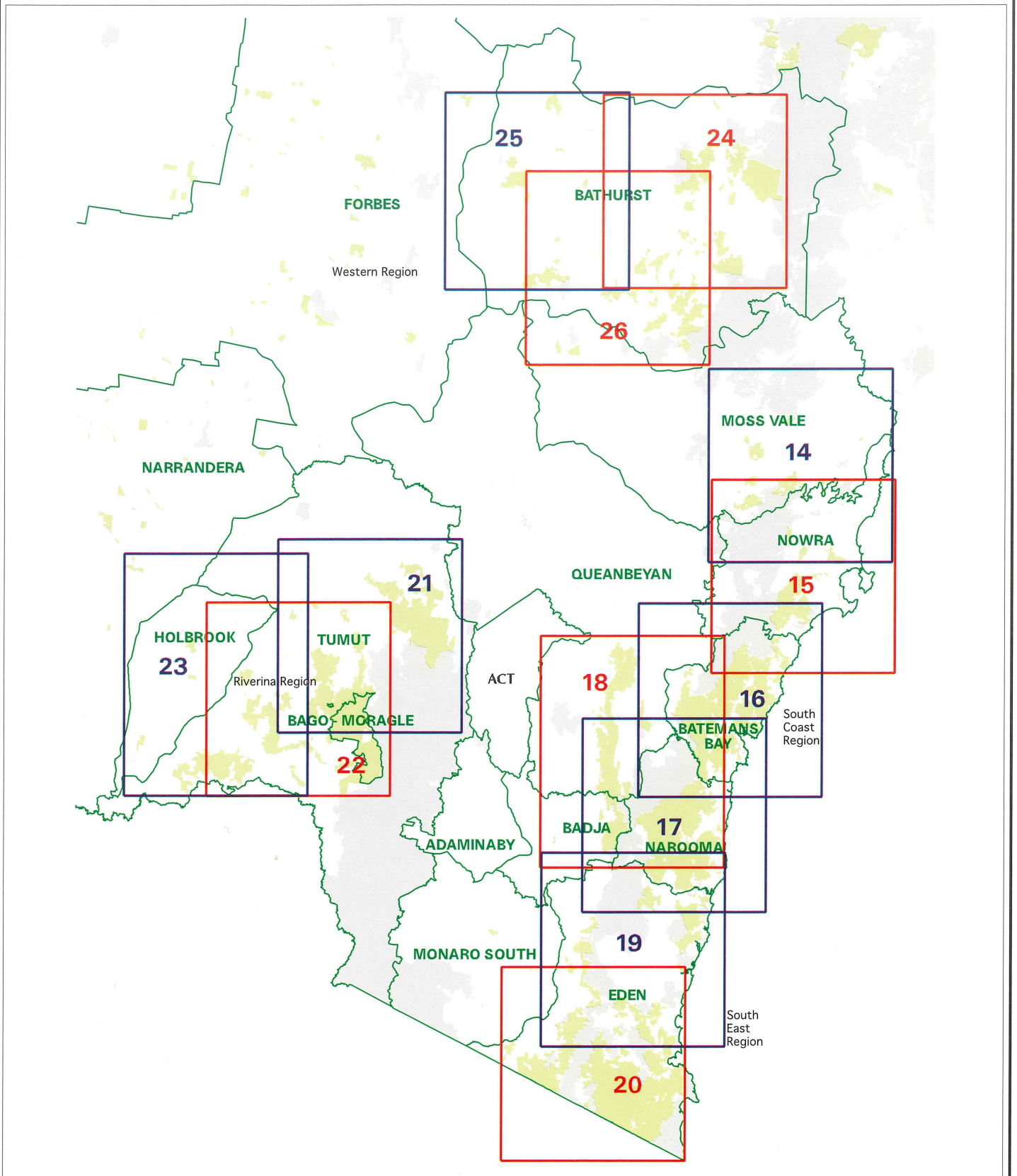


State Forests

National Parks

Region Boundary

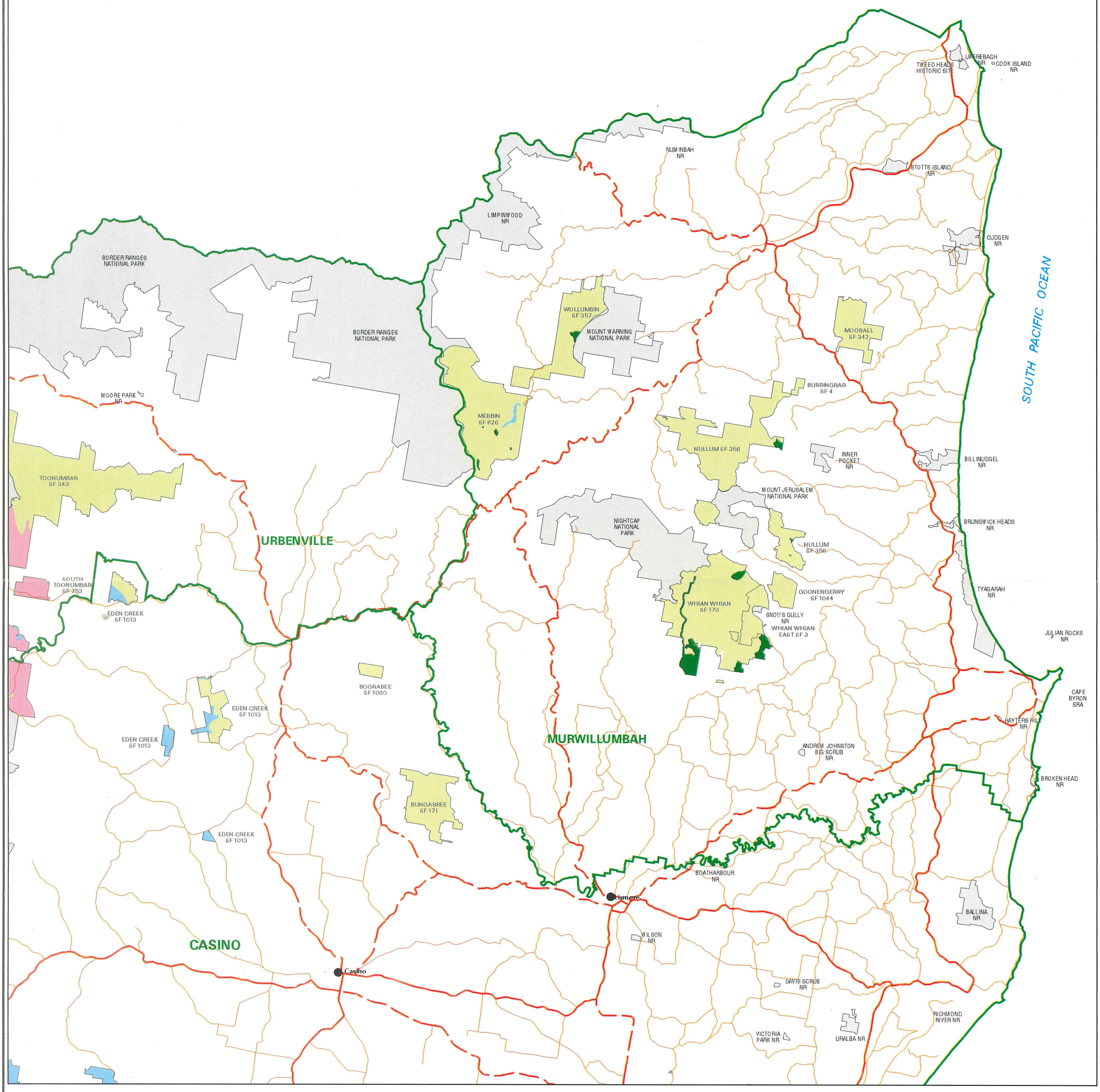
Management Area Boundary

/data/ws3/epa slp/revised/soilsth index a4 map - 1:31 PM, May 18, 1998.

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 1

Murwillumbah MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

EPA NSW

LAND & WATER CONSERVATION

STATE FORESTS

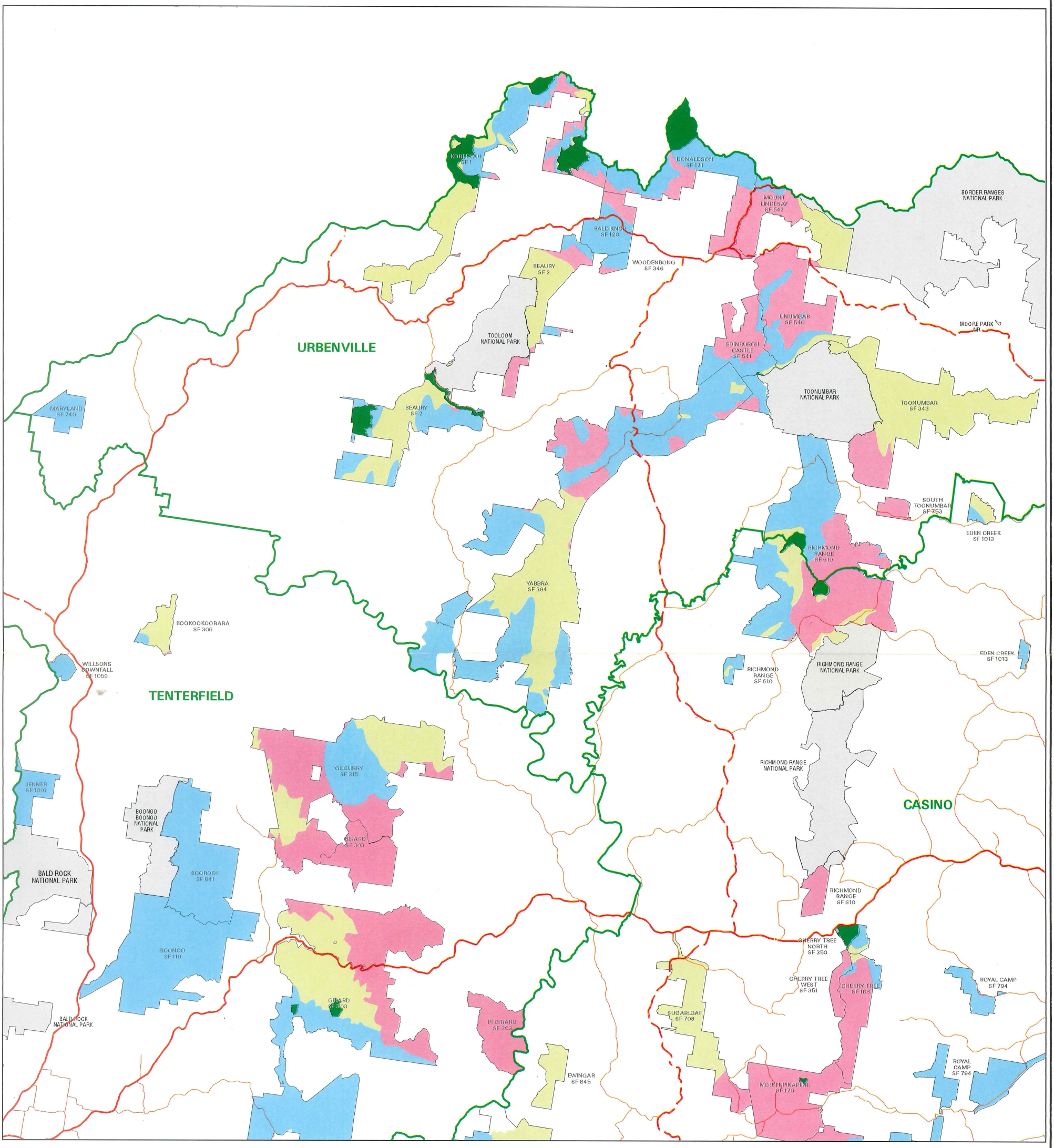
Map Produced by State Forests of NSW, Resources GIS

NOTE: Soil data & Rainfall Erosivity data supplied by DLWC
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 2

Urbenville MA - Tenterfield MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

EPA NSW

LAND & WATER CONSERVATION

STATE FORESTS

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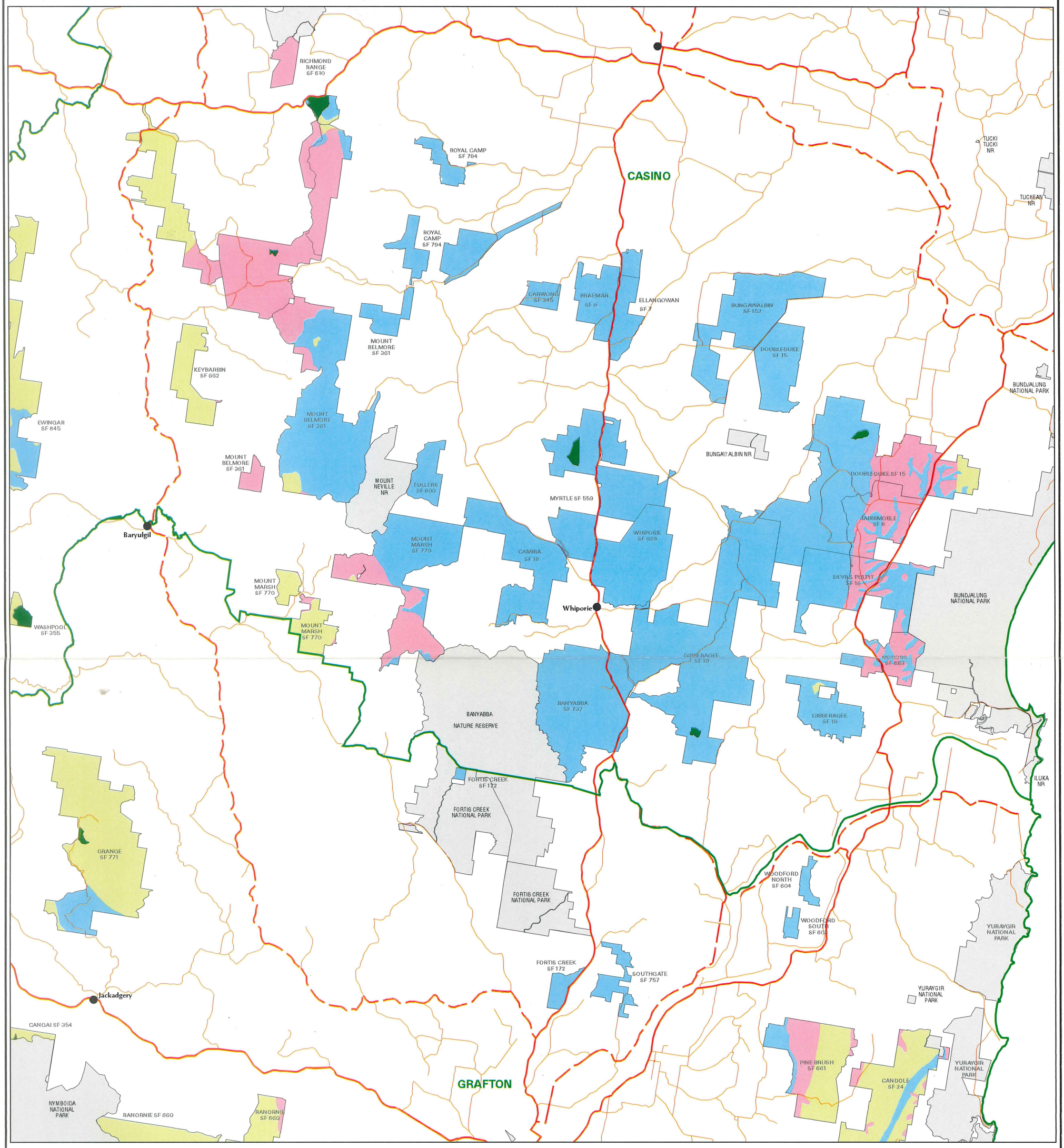
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 3

Casino MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

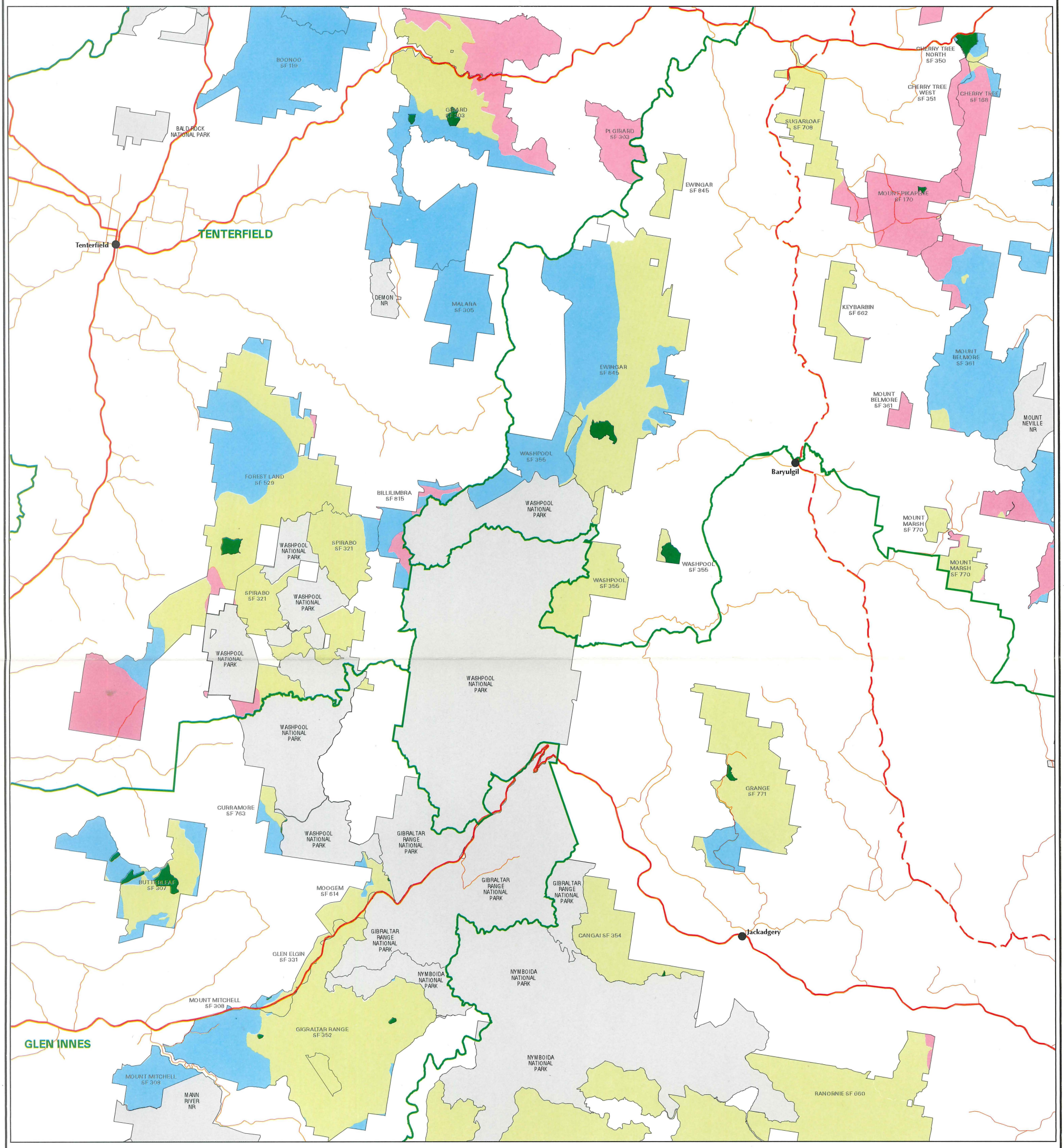
Map Produced by State Forests of NSW, Resources GIS

NOTE: Soil data & Rainfall Erosivity data supplied by DLWC
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 4

Tenterfield MA - Glen Innes



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

EPA NSW

LAND & WATER CONSERVATION

STATE FORESTS

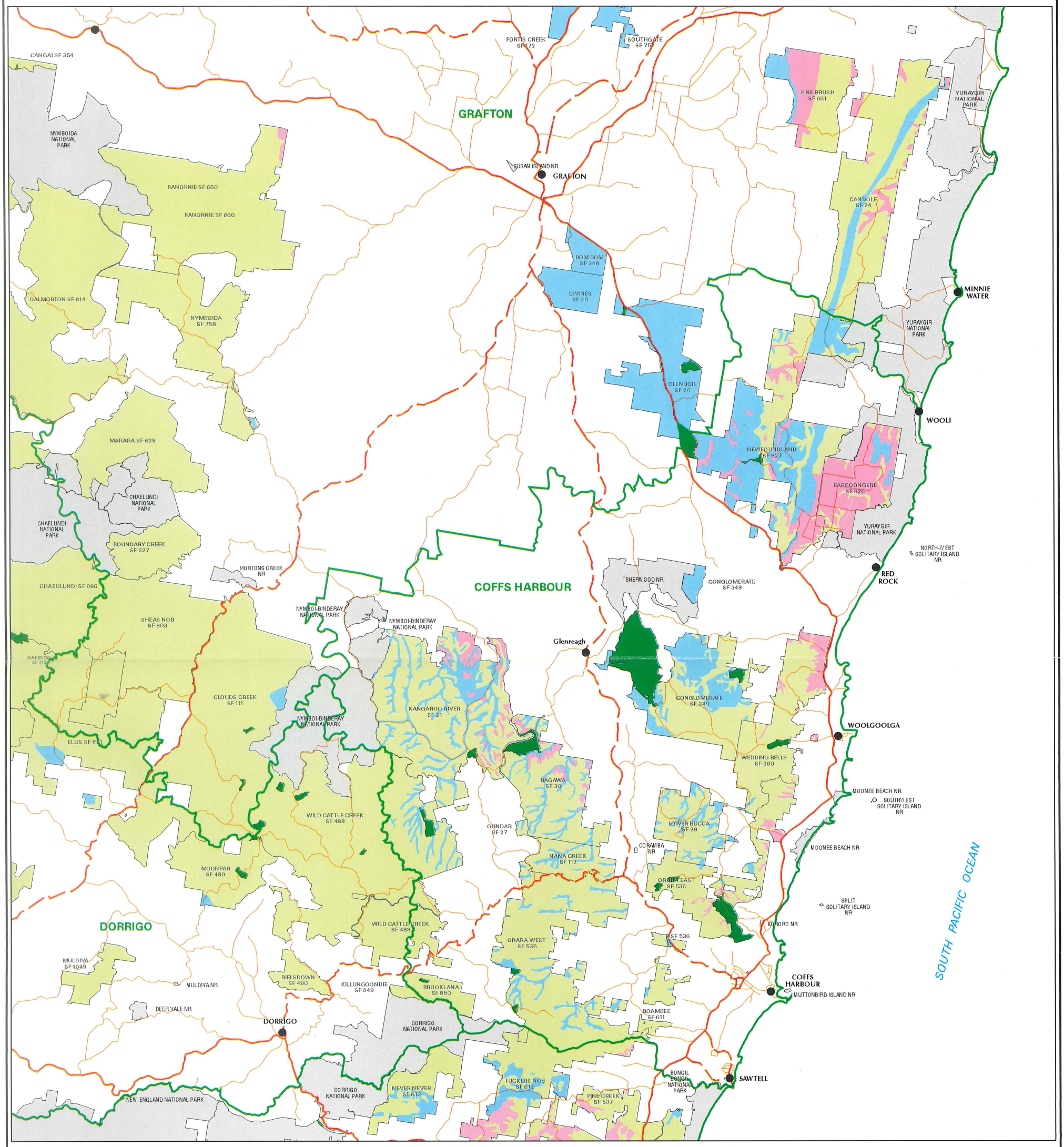
Map Produced by State Forests of NSW, Resources GIS

NOTE: Soil data & Rainfall Erosivity data supplied by DLWC
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 5

Coffs Harbour MA, Pt Grafton MA, Pt Dorrigo MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

EPA NSW

LAND & WATER CONSERVATION

STATE FORESTS

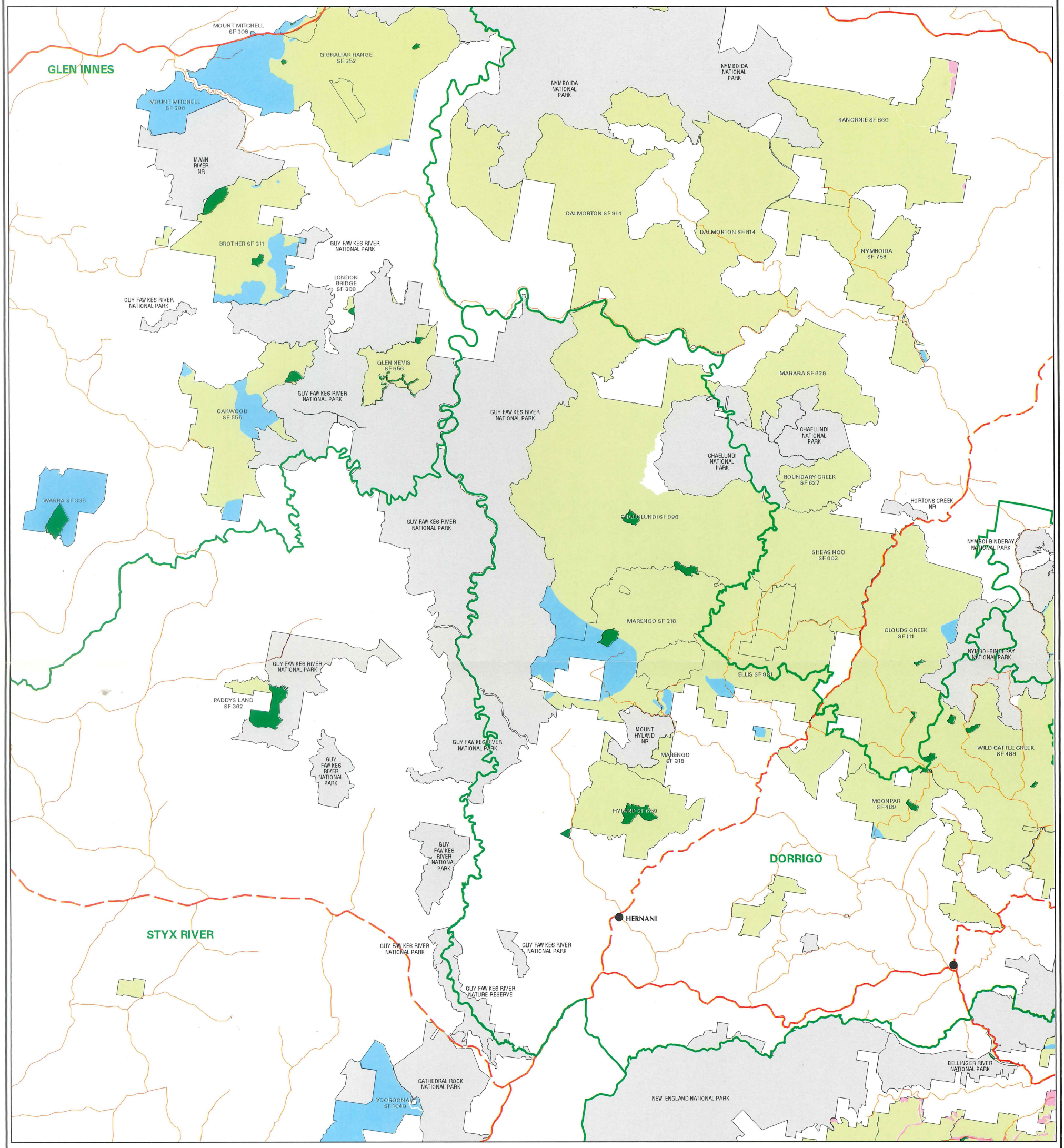
Map Produced by State Forests of NSW, Resources GIS

NOTE: Soil data & Rainfall Erosivity data supplied by DLWC
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 6

Dorrigo MA - Glen Innes MA - Styx River MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

EPA NSW

LAND & WATER CONSERVATION

STATE FORESTS

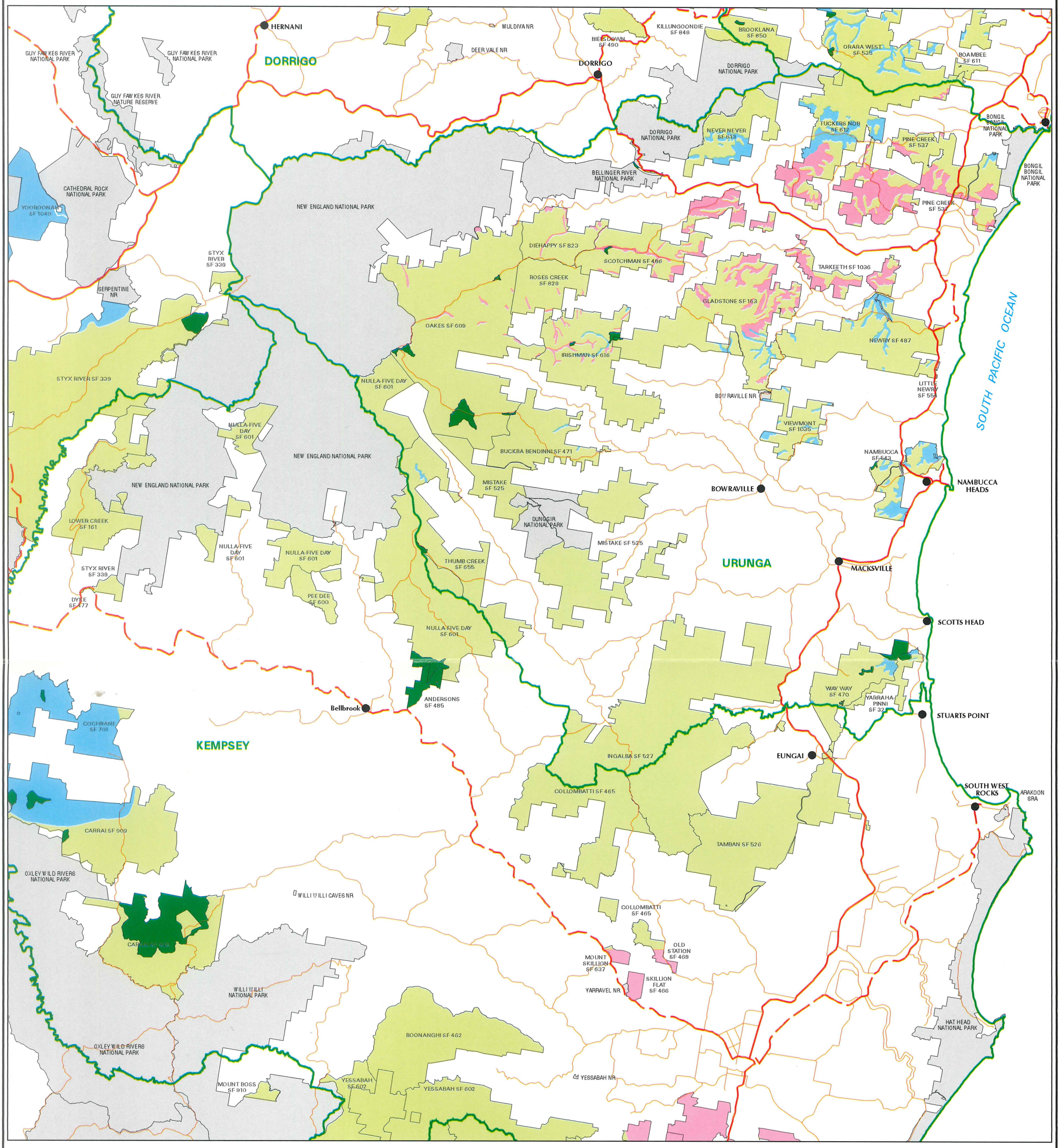
Map Produced by State Forests of NSW, Resources GIS

NOTE: Soil data & Rainfall Erosivity data supplied by DLWC
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 7

Urunga MA - Kempsey MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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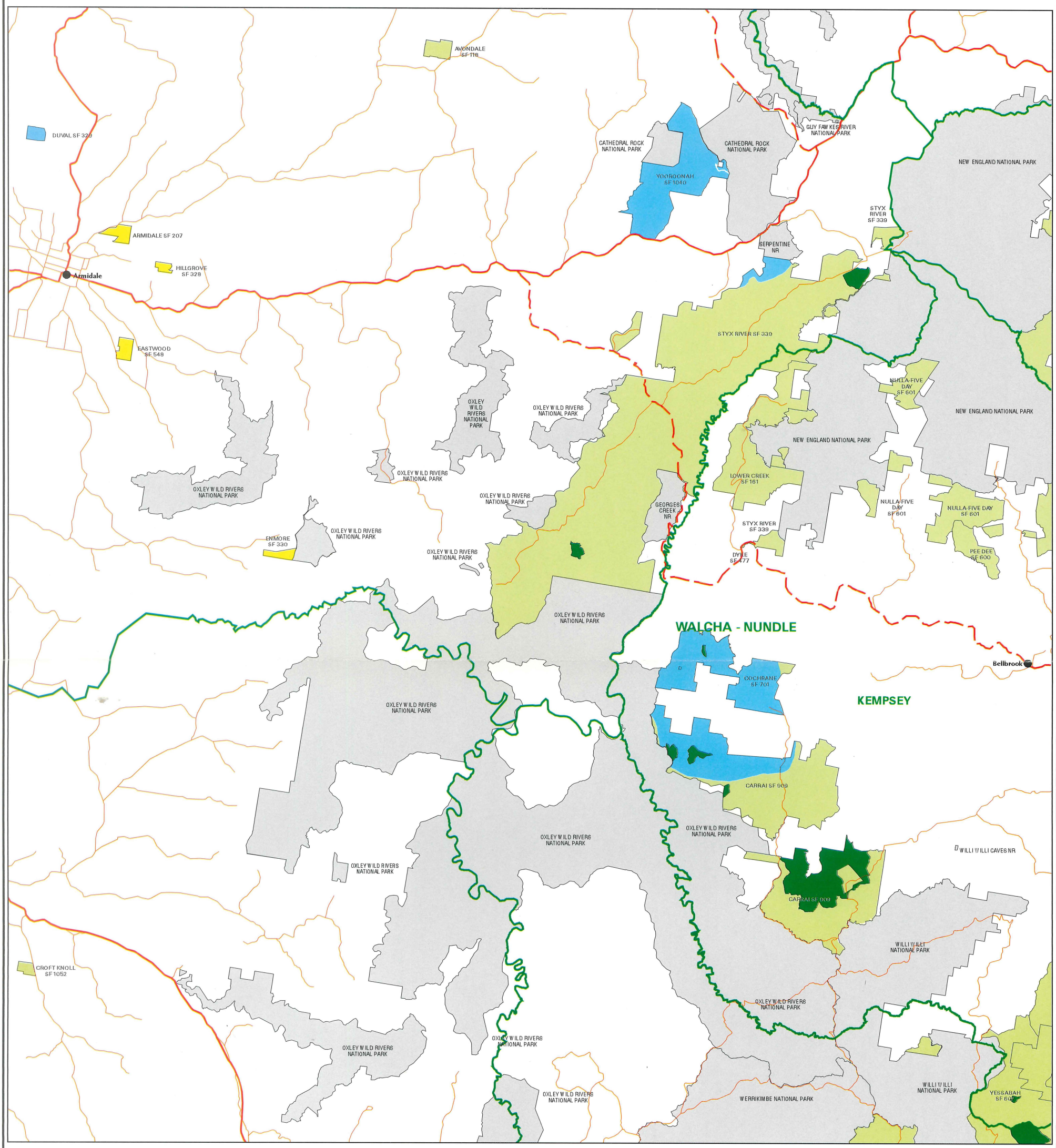
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 8

Styx River MA - Kempsey MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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STATE FORESTS

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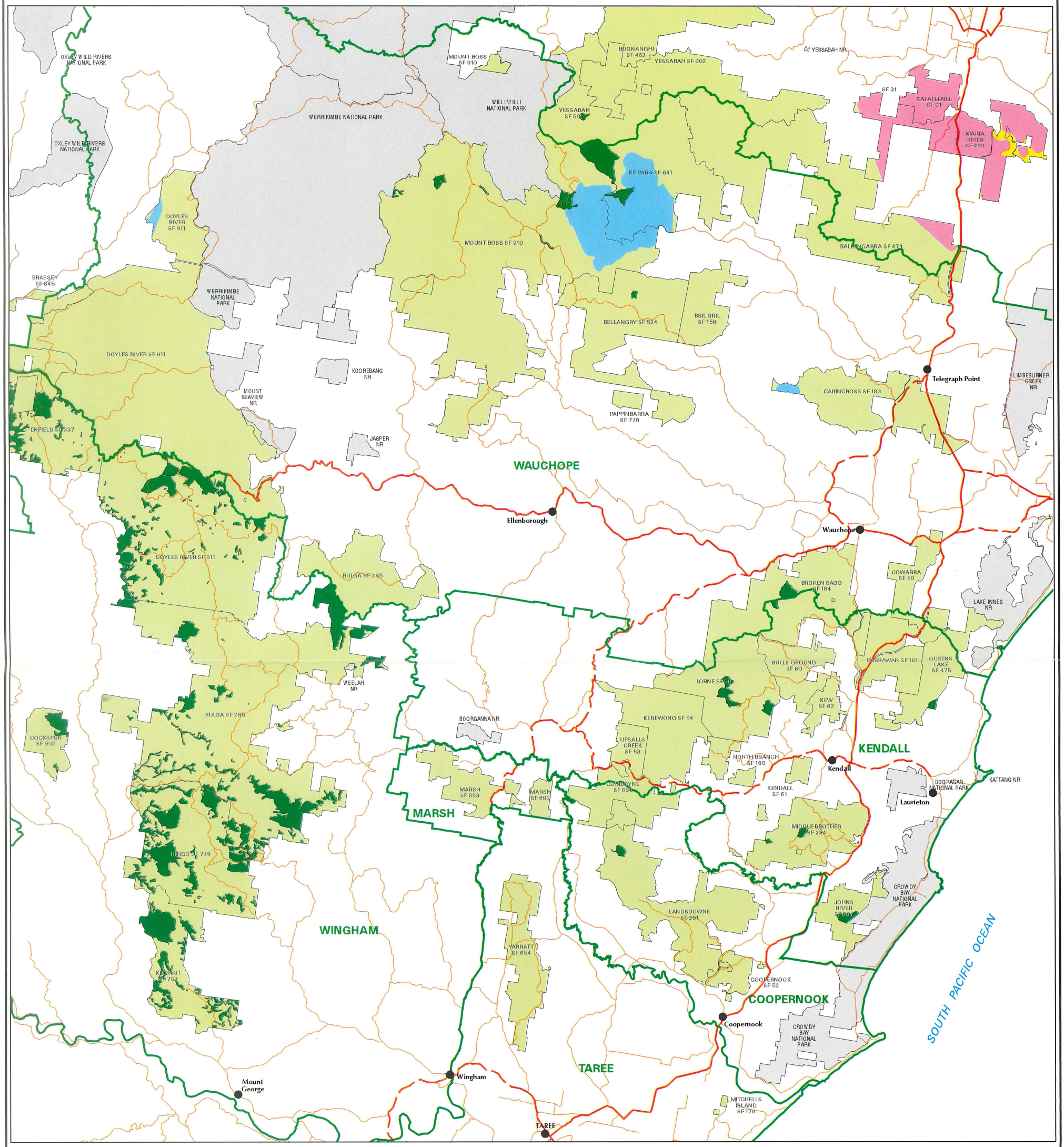
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 9

Wauchope MA - Wingham MA - Kendall MA - Coopernook MA - Mount Marsh MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
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- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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STATE FORESTS

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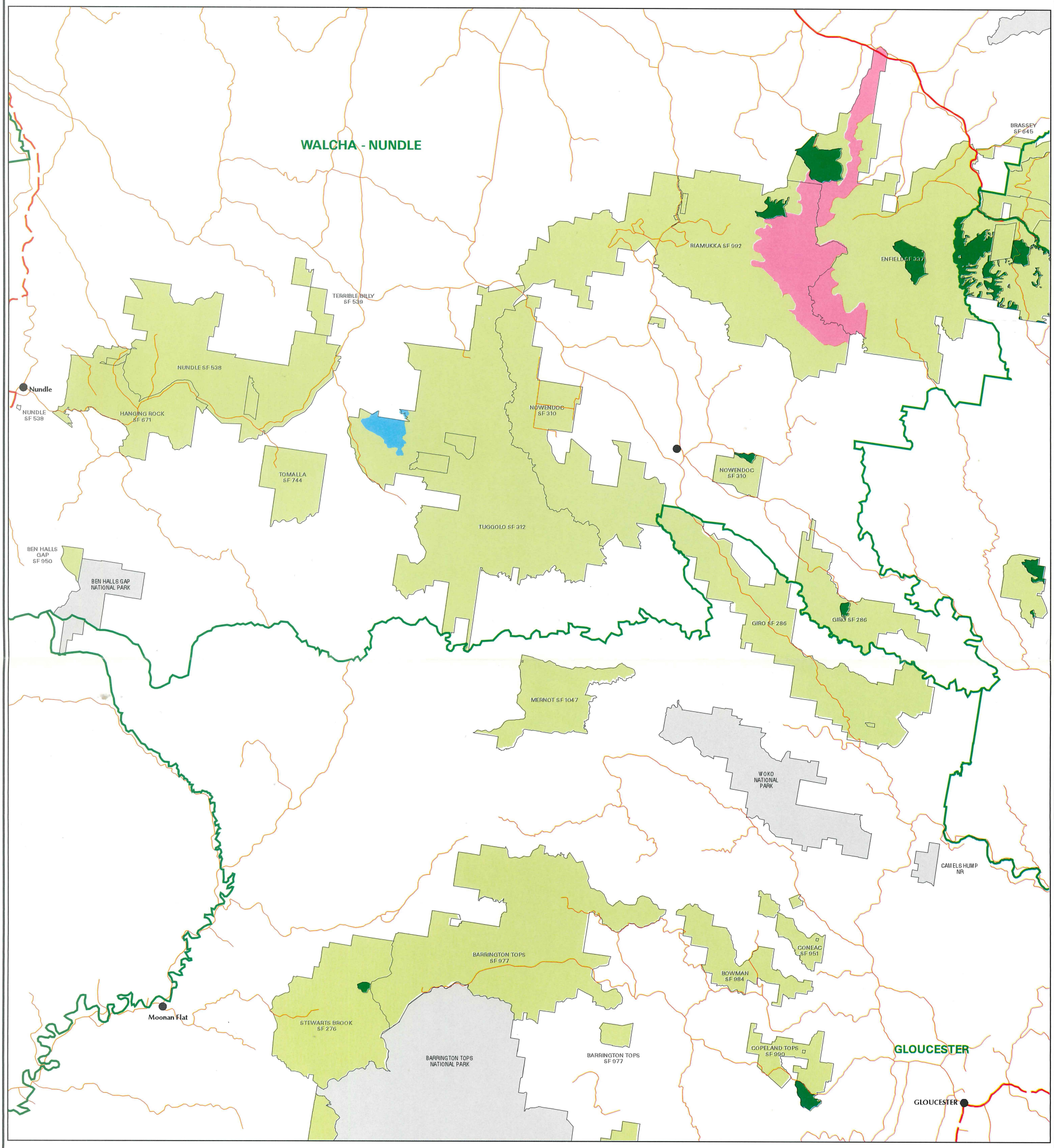
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 10

Walcha-Nundle MA - Gloucester MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
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N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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STATE FORESTS

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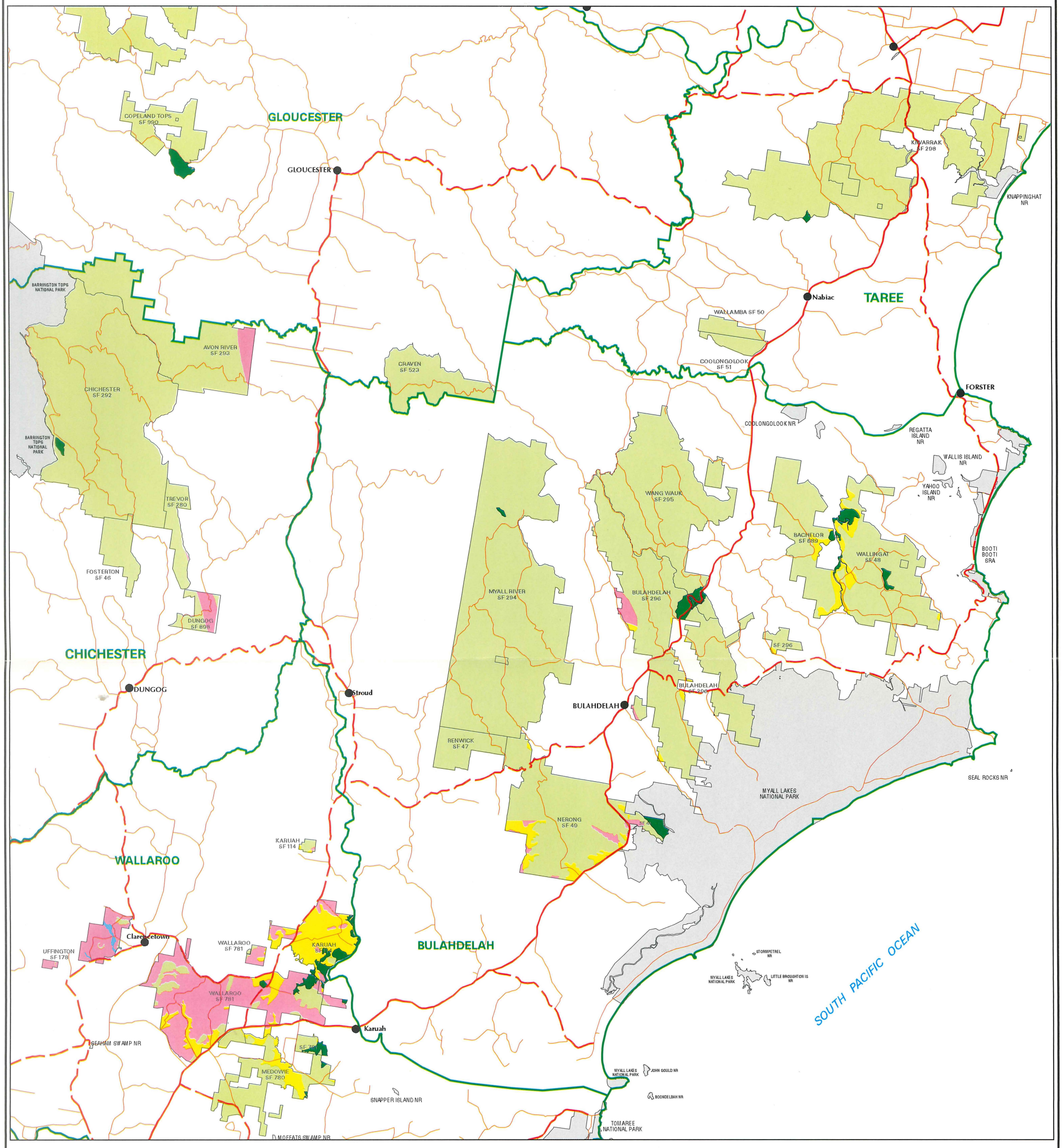
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 11

Bulahdelah MA - Taree MA - Wyong MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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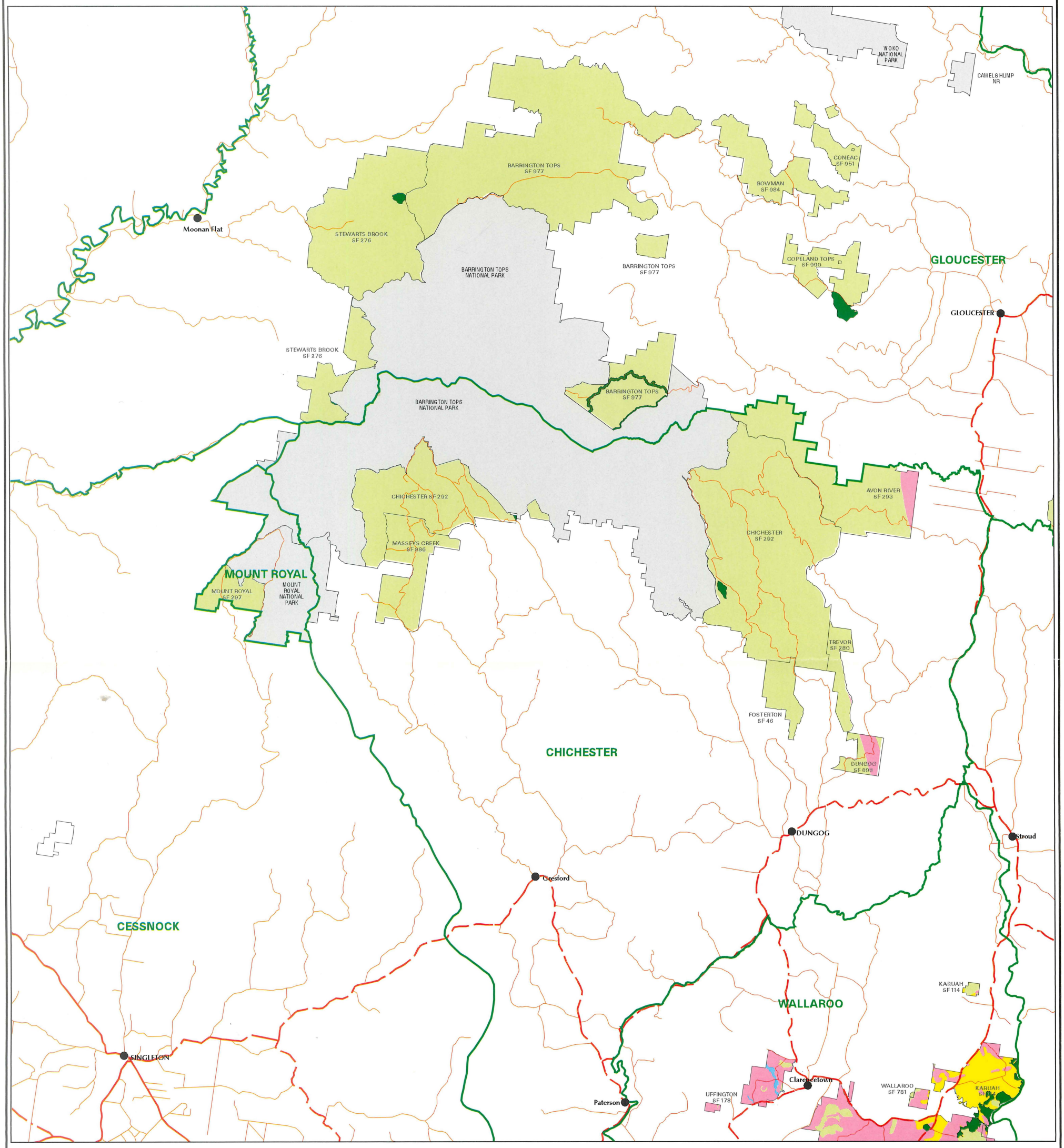
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 12

Gloucester MA - Chichester MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
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- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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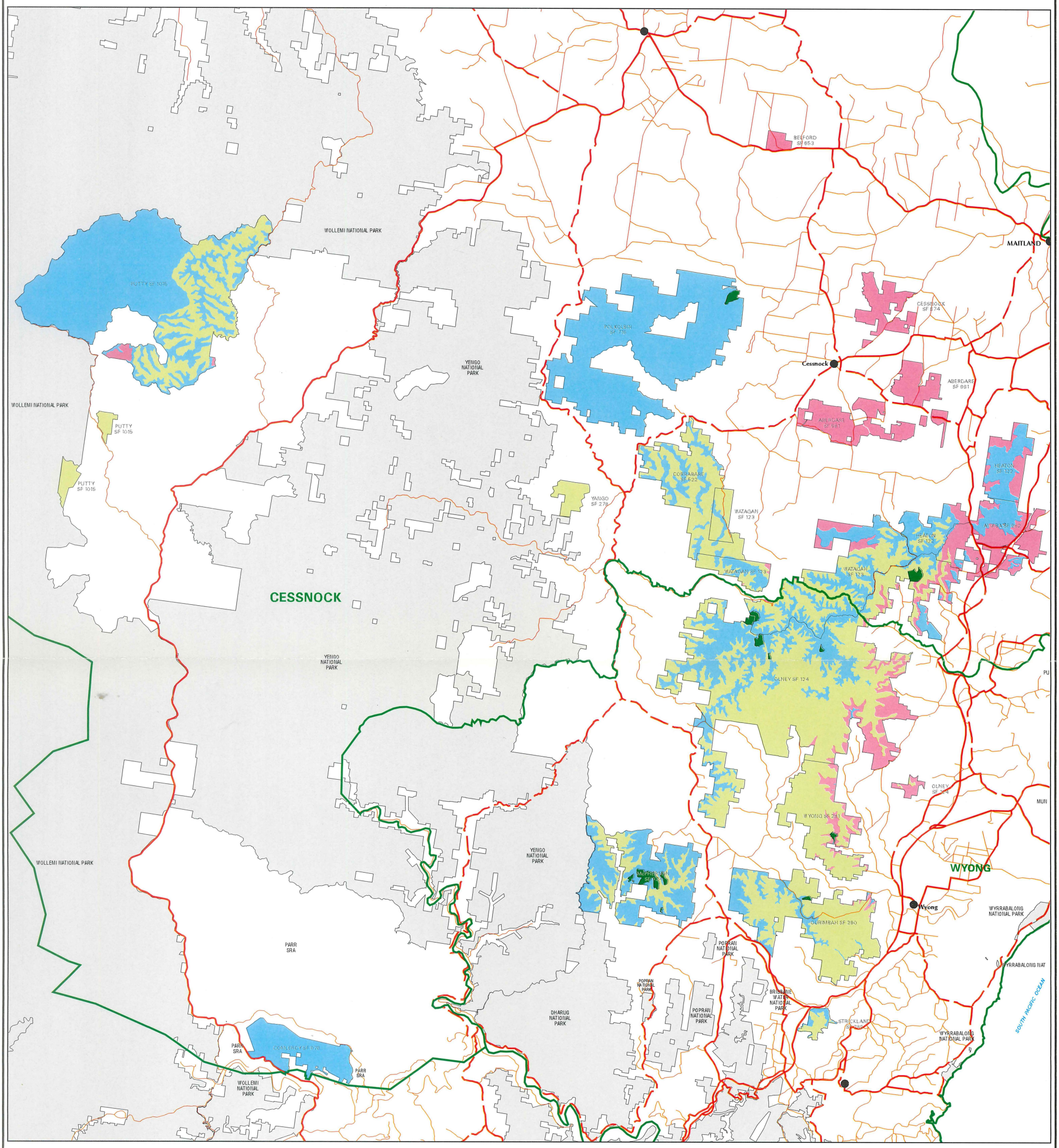
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 13

Cessnock MA - Wyong MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 350 000

0 1 2 3 4 5 10km

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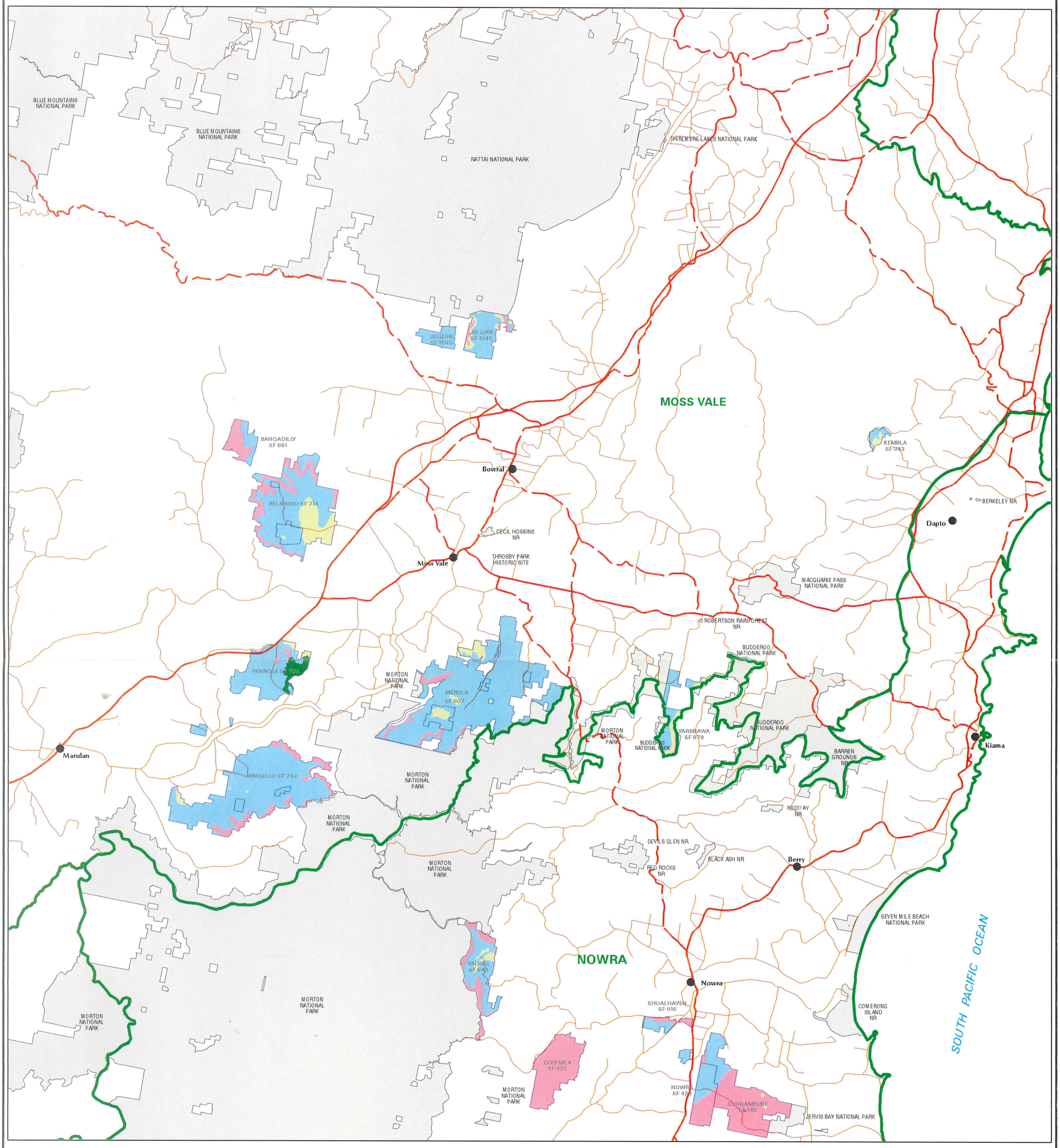
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 14

Moss Vale MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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STATE FORESTS

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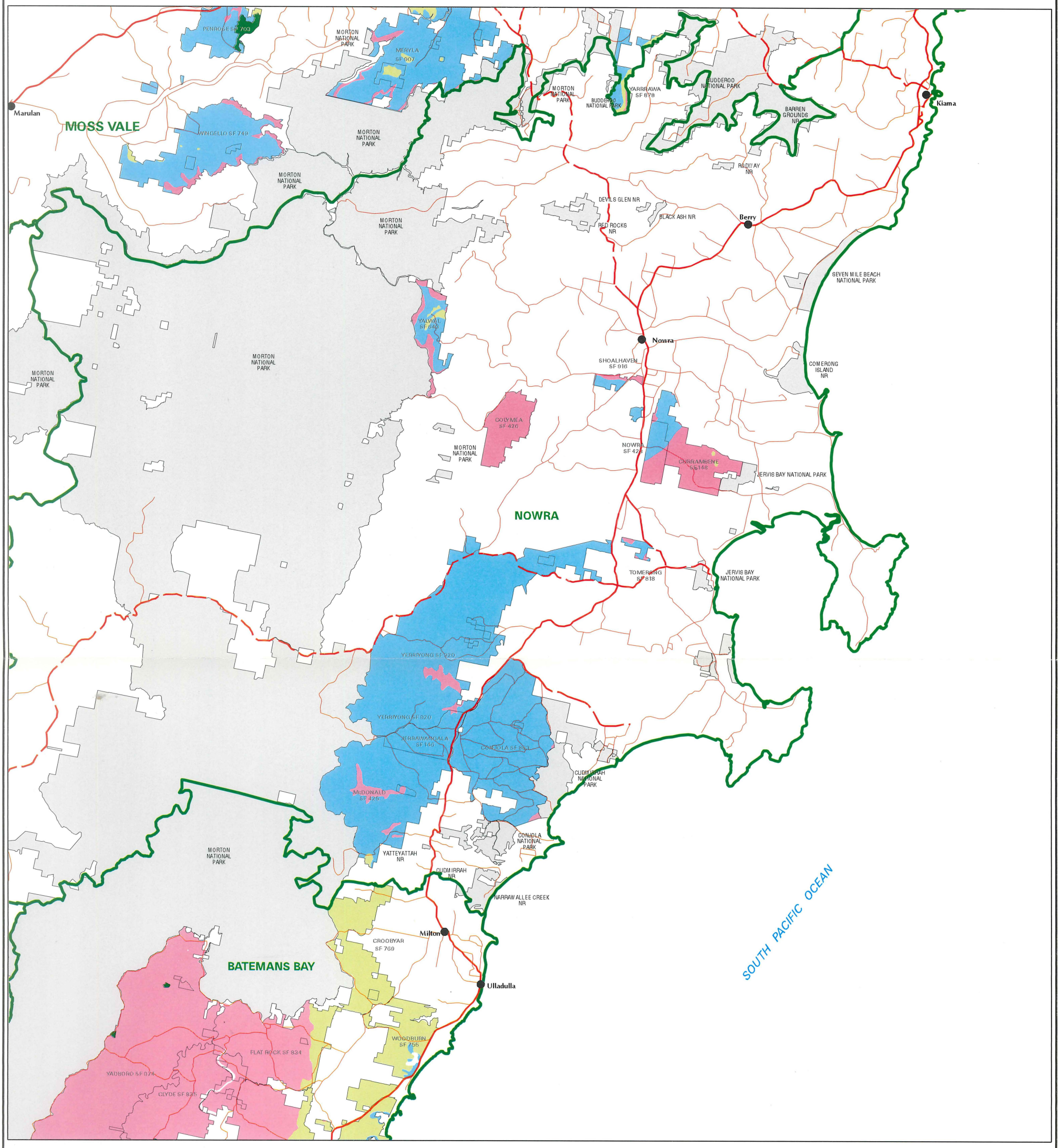
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 15

Nowra MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

Map Produced by State Forests of NSW, Resources GIS

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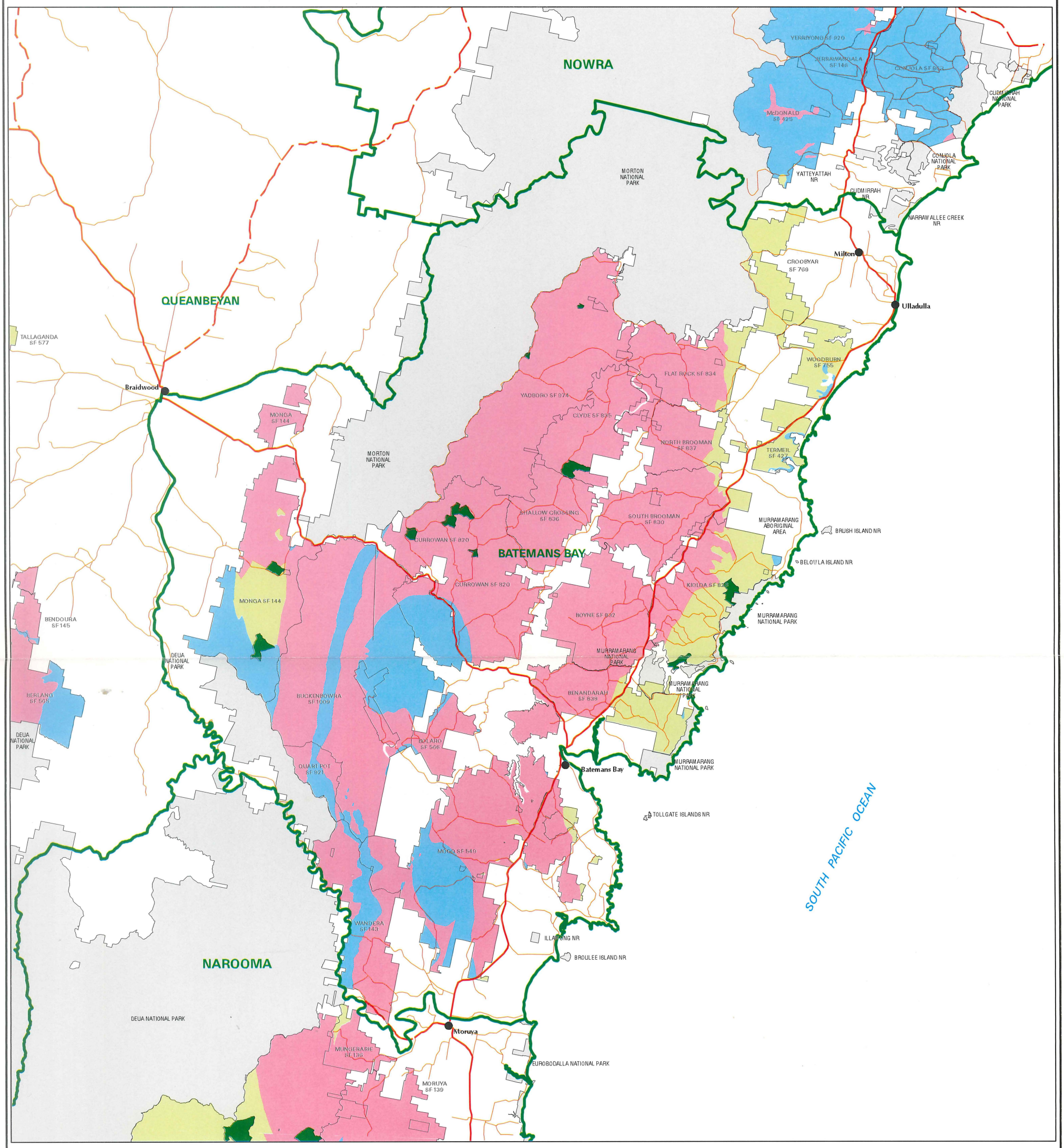
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 16

Batemans Bay MA



Soil Regolith Stability Class

- R1
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- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
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- Major Road (Freeway, Highway, through roads)
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- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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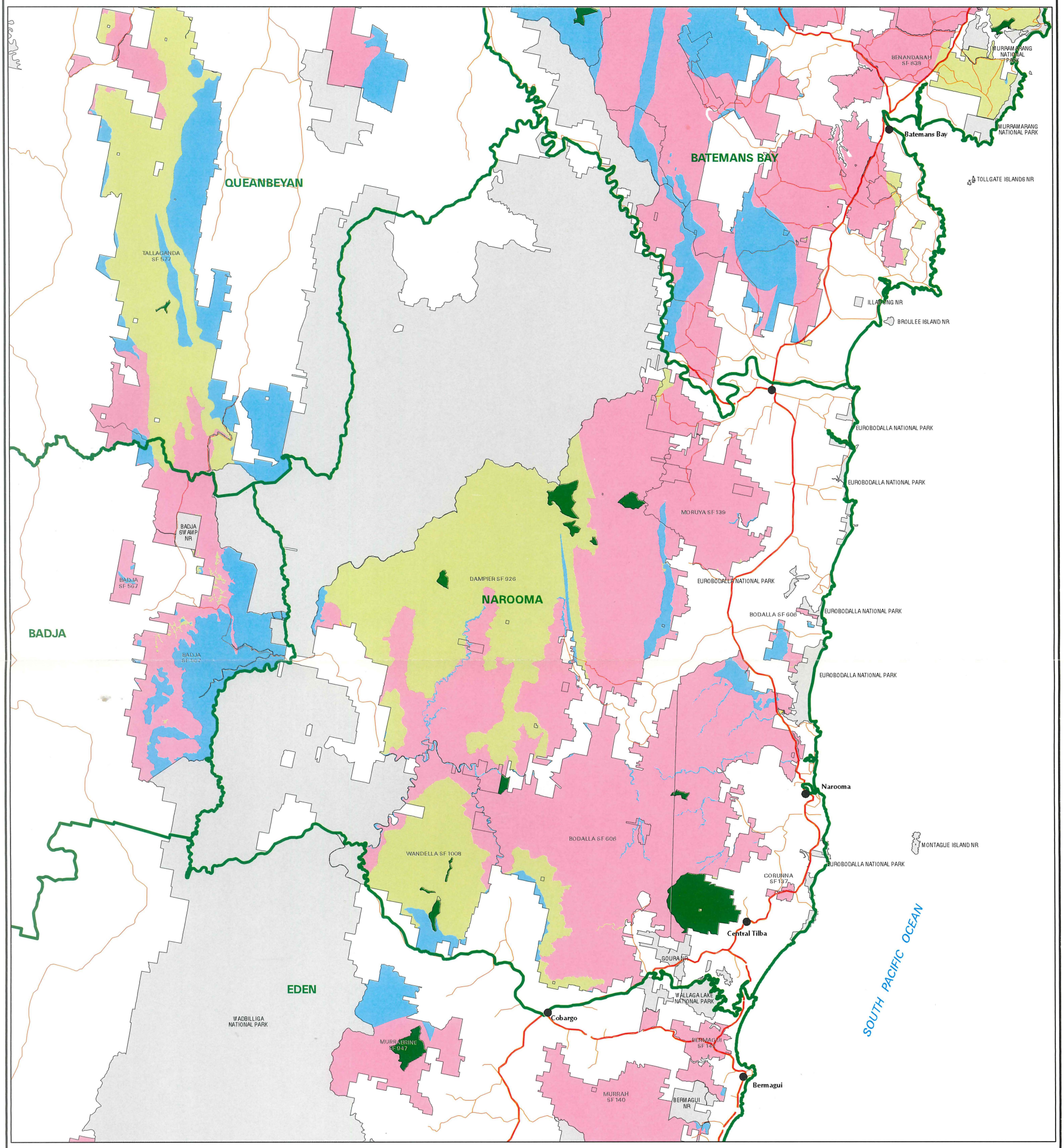
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 17

Narooma MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
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- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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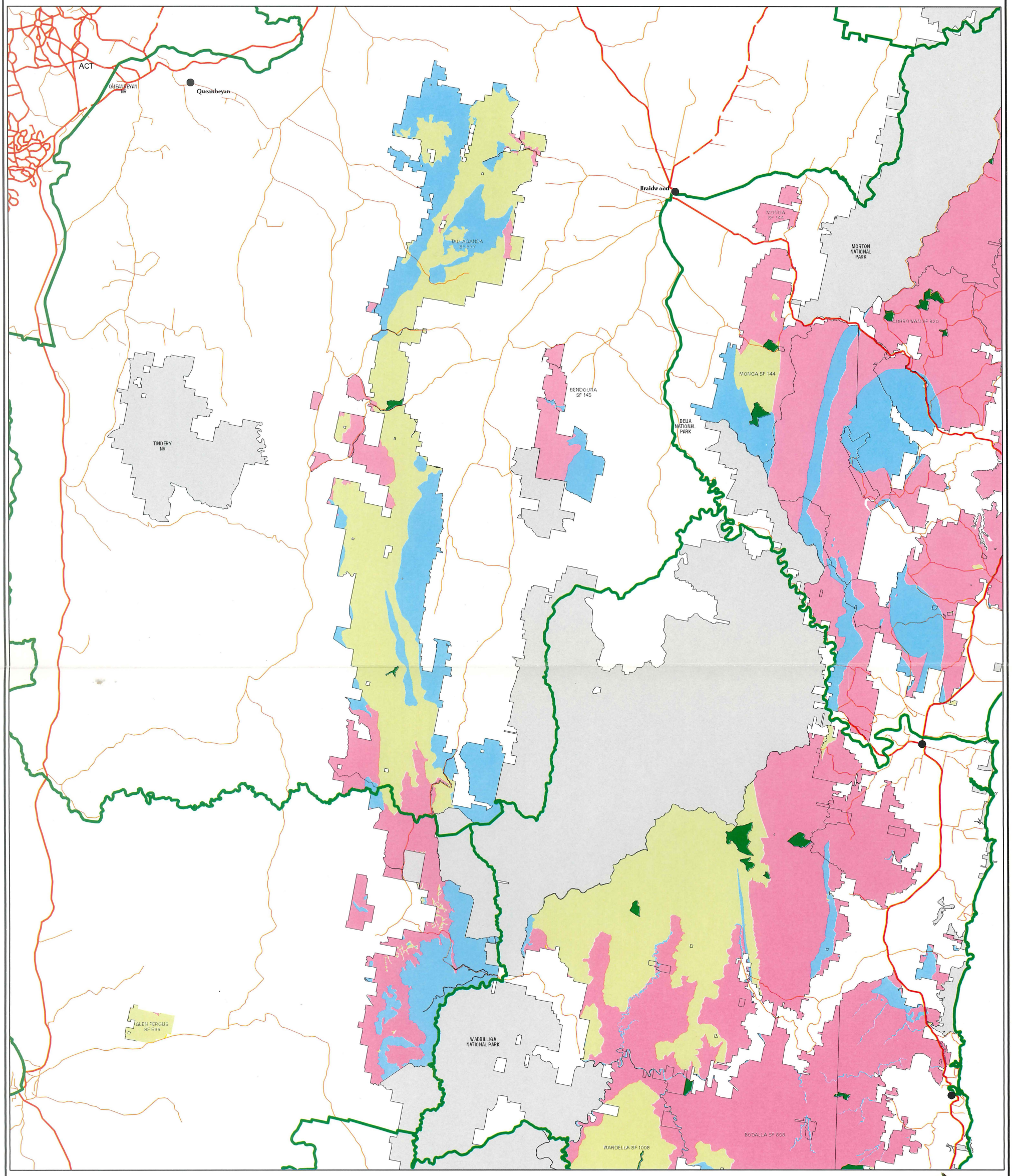
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 18

Queanbeyan-Badja MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
- Management Area Boundary
- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 350 000

0 1 2 3 4 5 10km

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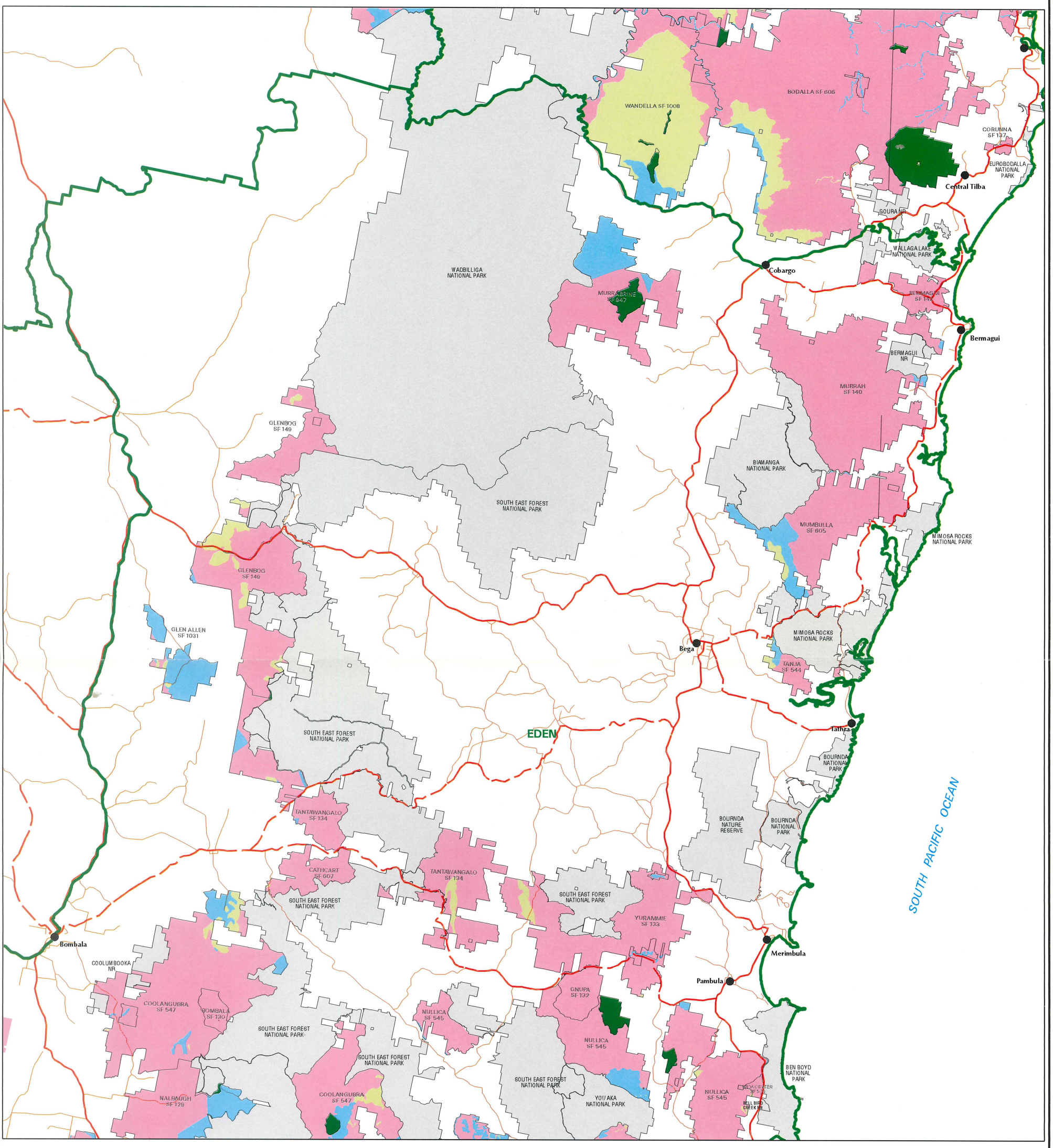
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 19

Upper Eden MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
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- 360 State Forest Boundary and Number
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- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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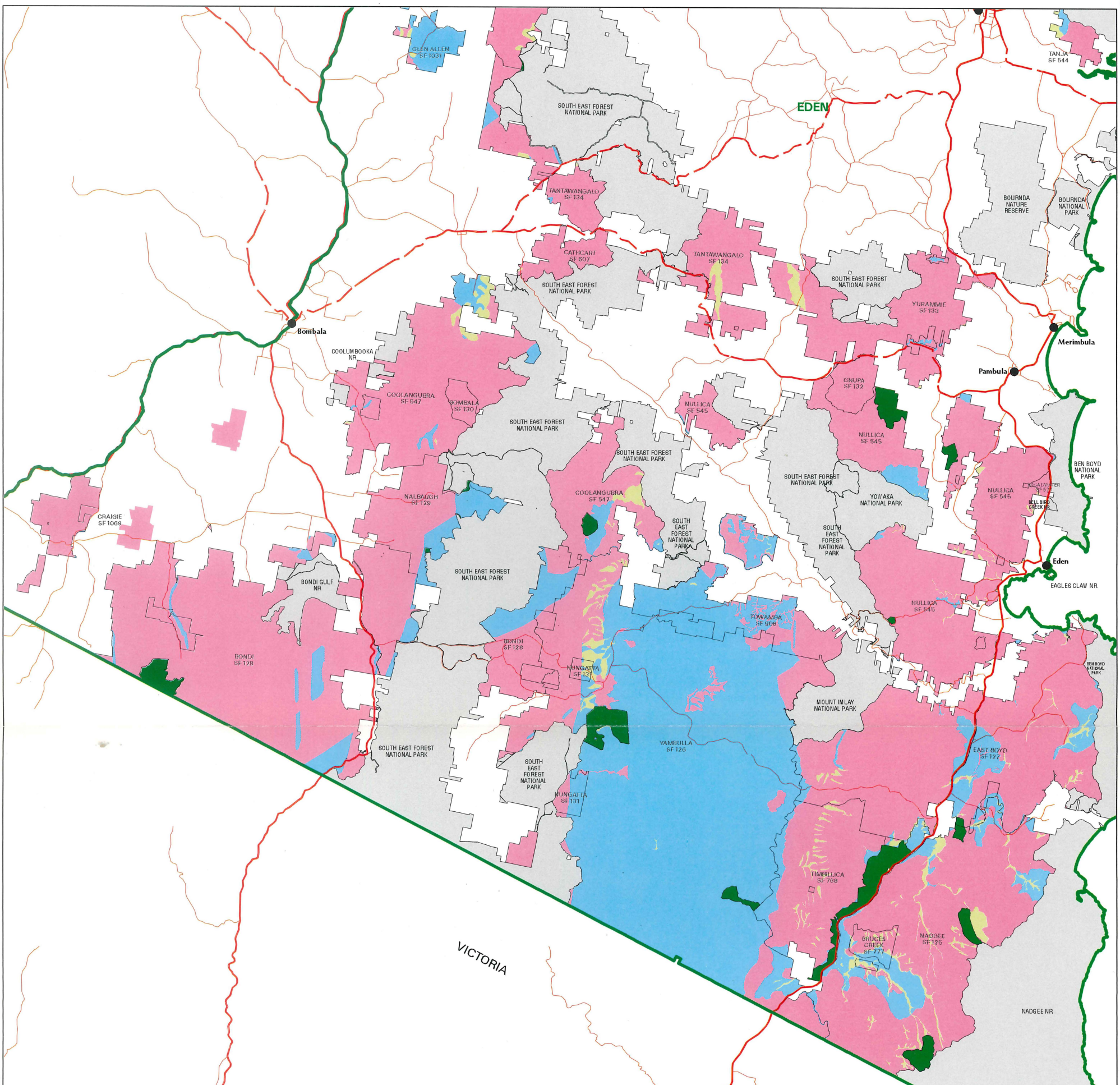
Geology data supplied by Dept. of Mineral Resources
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 20

Lower Eden MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
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- Major Road (Freeway, Highway, through roads)
- Secondary Road (connector)
- Minor Road (access)

N

Scale 1 : 320 000

0 1 2 3 4 5 · 10km

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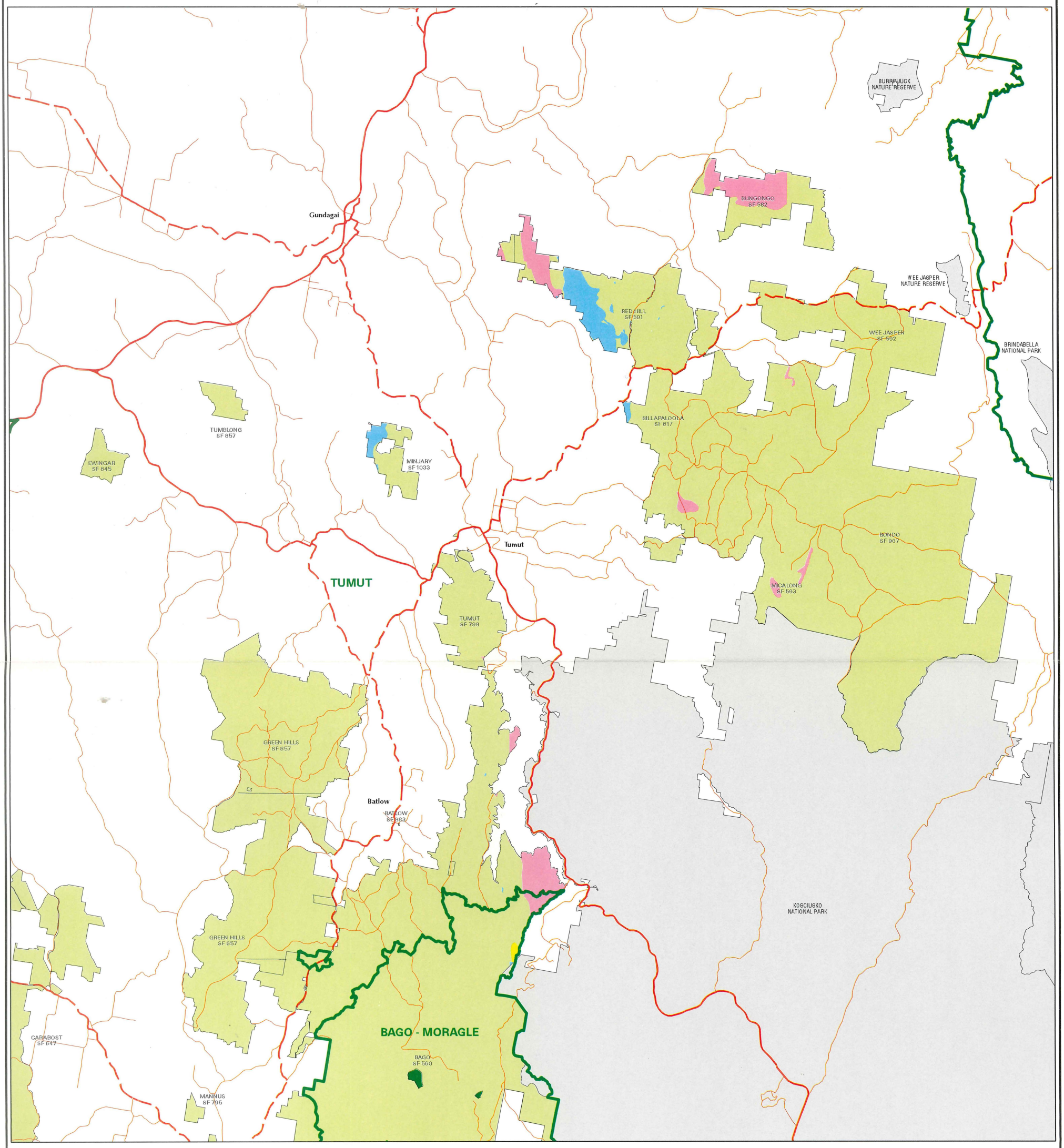
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 21

Tumut MA



Soil Regolith Stability Class

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- R3
- R4

- Preserved Natural Forest
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Scale 1 : 320 000

0 1 2 3 4 5 10km

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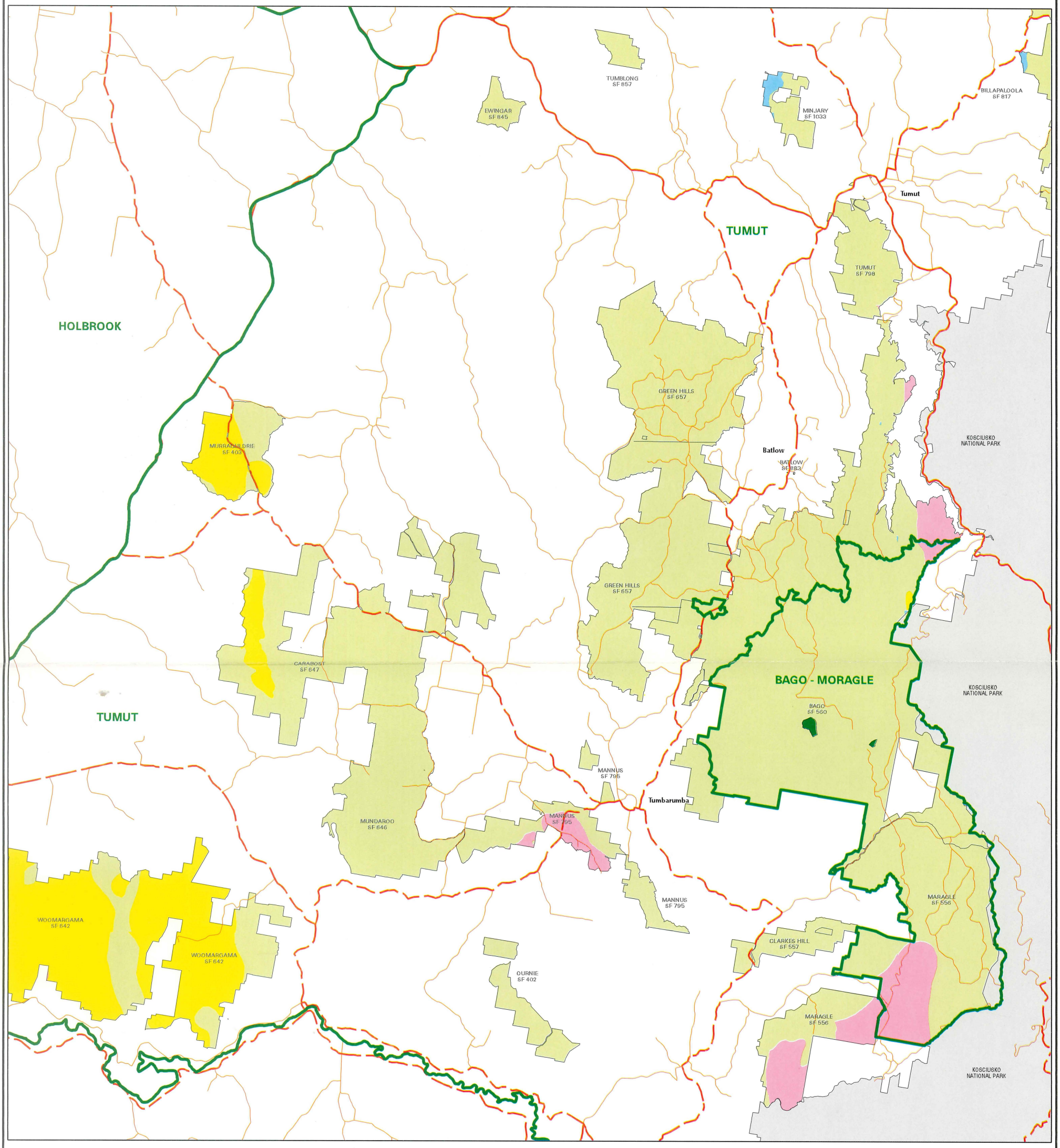
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 22

Bago-Moragle MA



Soil Regolith Stability Class

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- R4

- Preserved Natural Forest
- National Park / Nature Reserve
- 360 State Forest Boundary and Number
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N

Scale 1 : 320 000

0 1 2 3 4 5 10km

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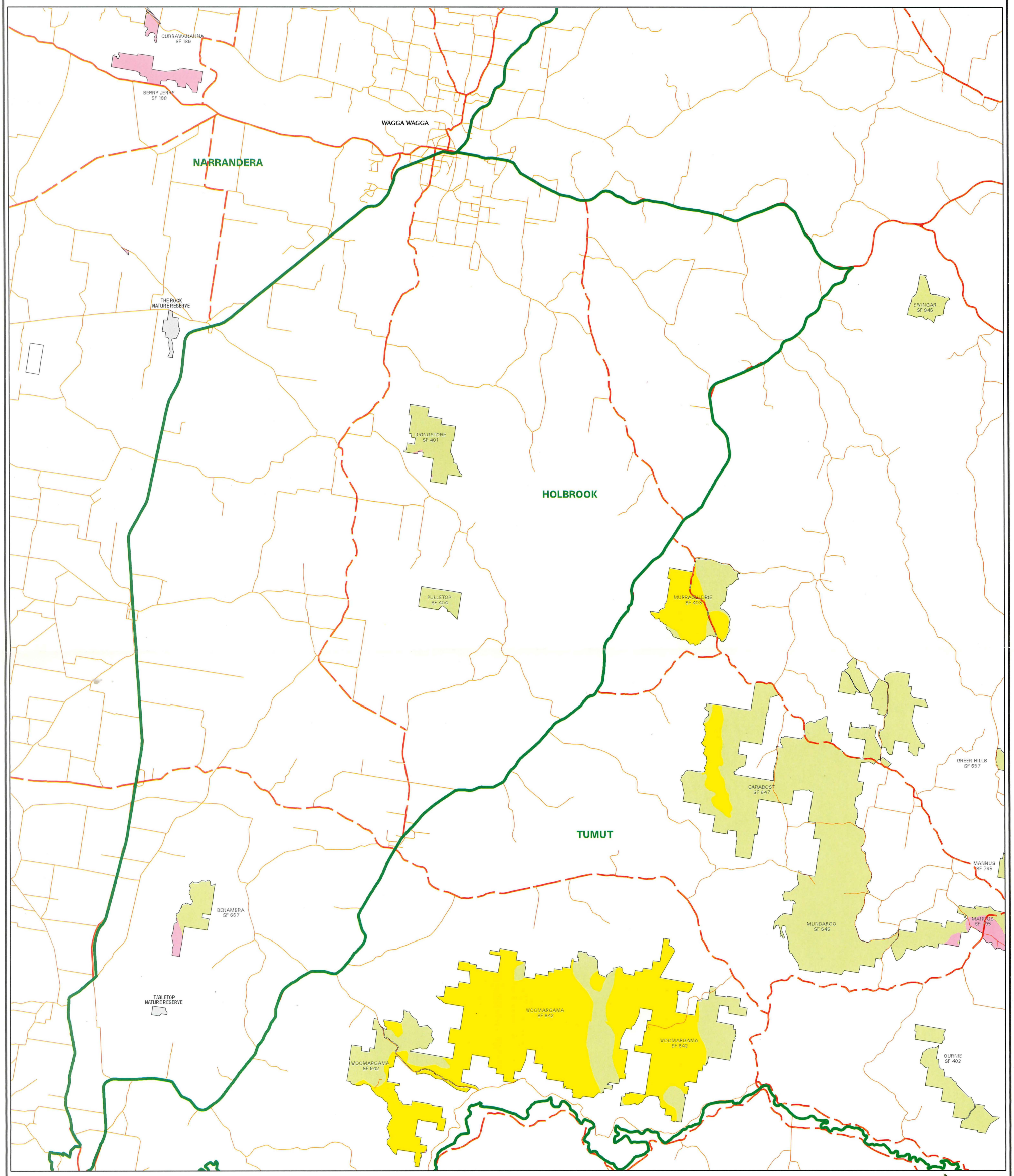
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 23

Holbrook MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

- Preserved Natural Forest
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- 360 State Forest Boundary and Number
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N

Scale 1 : 350 000

0 1 2 3 4 5 10km

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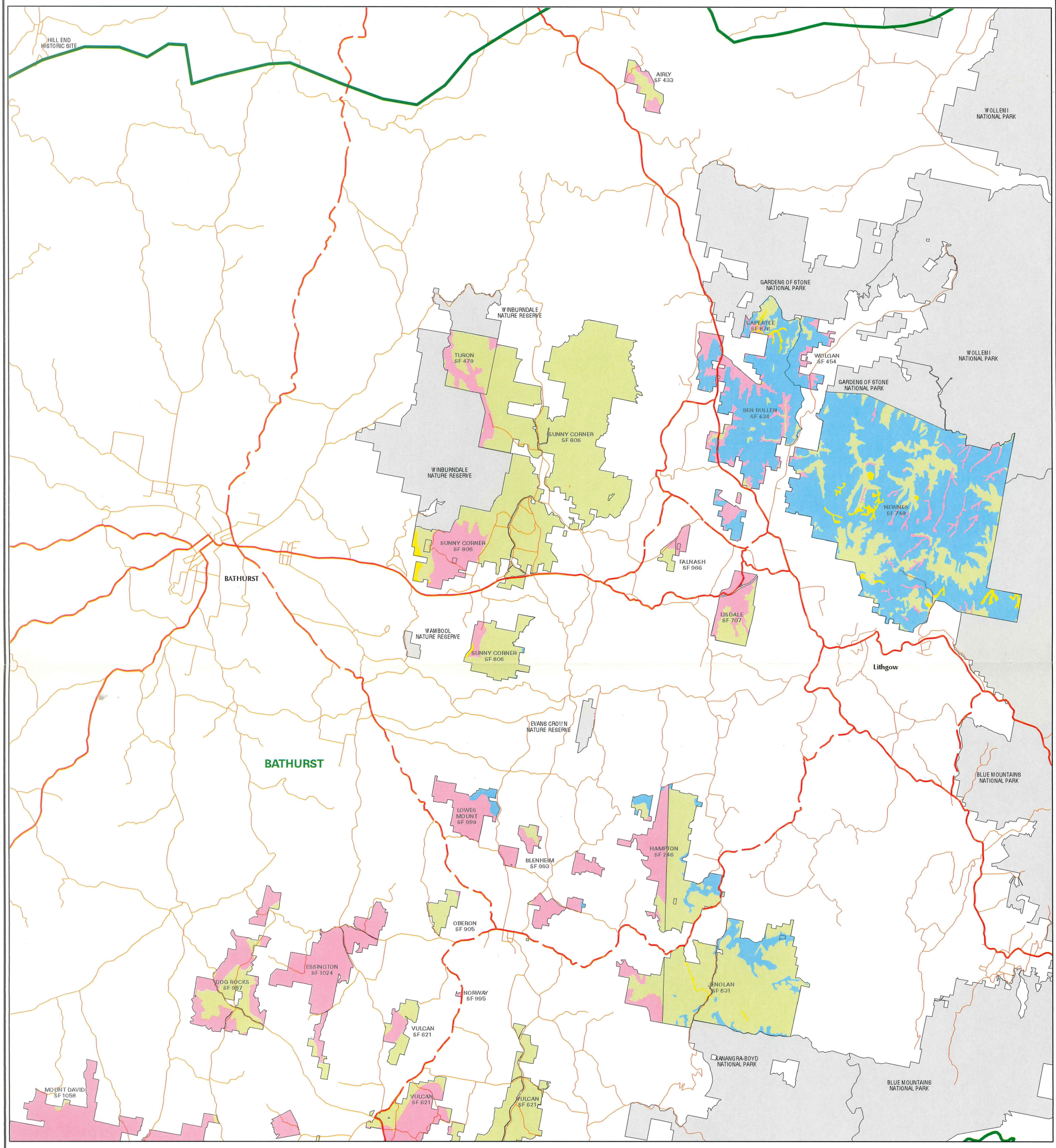
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 24

North East Bathurst MA



Soil Regolith Stability Class

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Scale 1 : 320 000

0 1 2 3 4 5 10km

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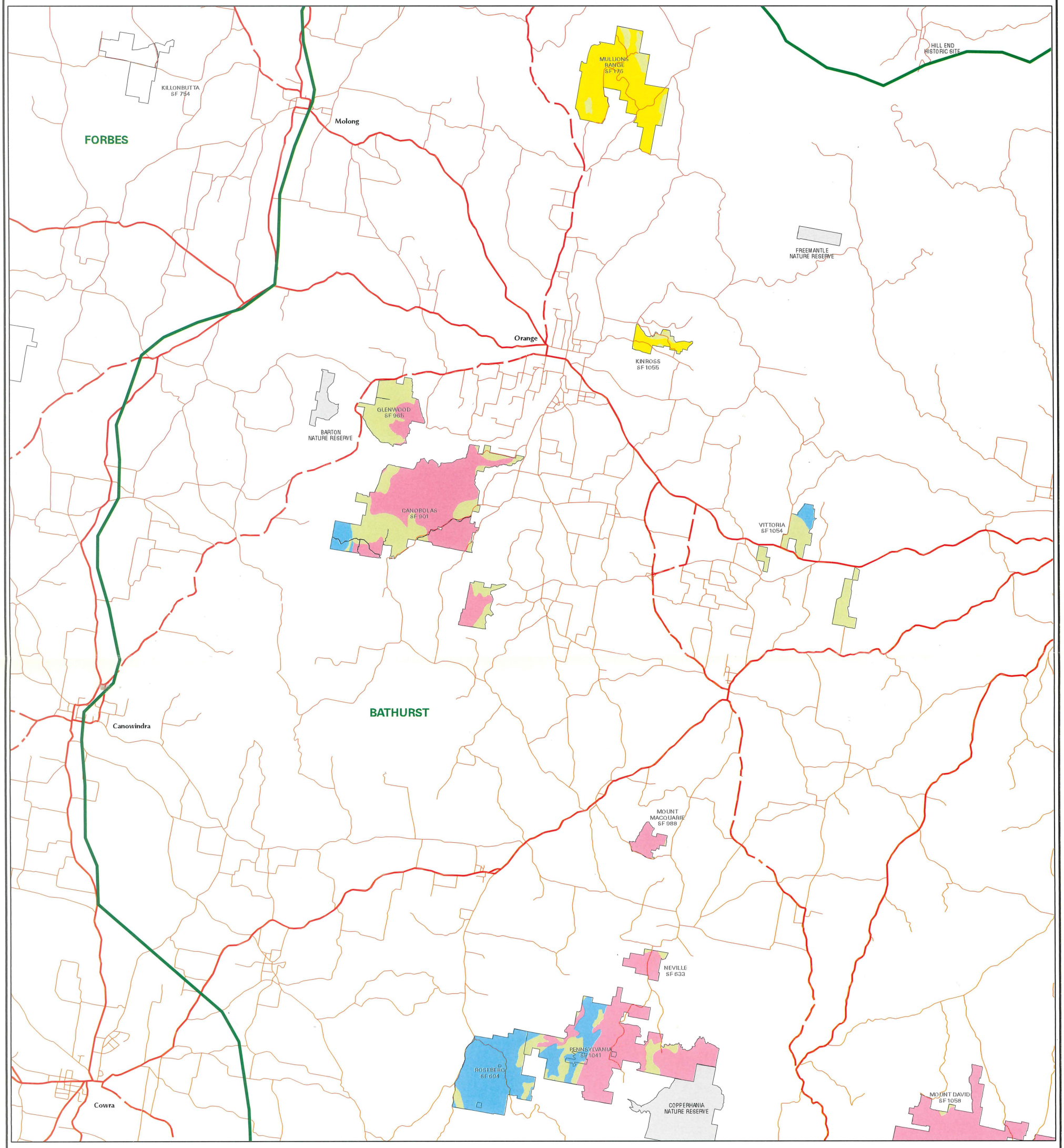
Road base supplied by AUSLIG
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 25

North West Bathurst MA



Soil Regolith Stability Class

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- Preserved Natural Forest
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Scale 1 : 320 000

0 1 2 3 4 5 10km

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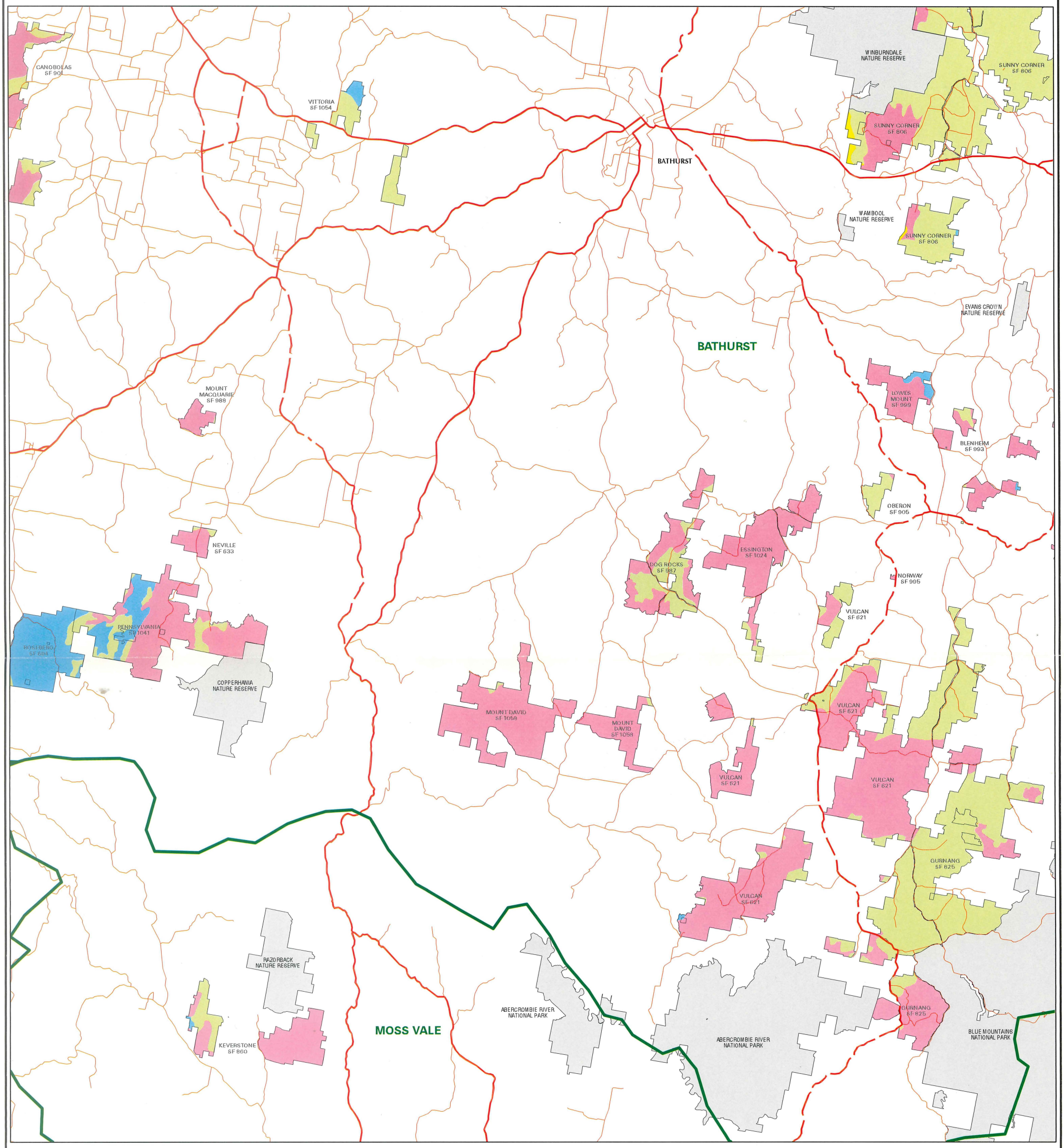
National Parks Data supplied by NPWS

SOIL REGOLITH STABILITY - STATE FORESTS OF NSW

MAP 26

South Bathurst MA



Soil Regolith Stability Class

- R1
- R2
- R3
- R4

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