SOIL SURVEY OF THE KOONYA DISTRICT

S. Davies[1] and P.D. McIntosh[2]

[1]University of Tasmania, Hobart
[2]Forest Practices Board, Hobart

AIM
The soil survey was conducted to determine the predominant soil types present and to assess their erodibility and sensitivity to forestry operations.

METHODS
After preliminary geological mapping and landscape assessment, soil profiles were described in pits and road cuttings in which the range of soil parent materials were exposed. Soil description was by the methods of McDonald et al. (1990). Soil classification was by the system of Isbell (1996). Soil erodibility ratings were estimated using the method of Laffan (2000) or by comparison with similar analysed soils.

RESULTS
The soils present are described in Appendix 1. The soil key (Table 1) is based on geological criteria and will enable soils at any point to be correlated with one of the eight soils described. A soil map was not produced, as soil distribution is largely controlled by the geological pattern. Further information on the two most extensive soils, from profile analyses outside the Koonya area, is given in Appendix 2.

Table 1. Key to soils and estimated soil erodibility in the Koonya district.

Soils in dolerite (*in situ* and colluvium)		
Under moist forest, well drained	Soil 1	Low erodibility
Under dry forest, well drained	Soil 2	Moderate erodibility
Soils in siltstone/mudstone (*in situ* and colluvium)		
Under moist forest, imperfectly drained	Soil 3	Moderate to high erodibility
Under dry forest, well drained	Soil 4	Moderate erodibility
Soils in sandstone (*in situ* and colluvium)		
Under moist forest, imperfectly drained	Soil 5	Moderate to high erodibility
Under moist forest, well drained	Soil 6	Moderate to high erodibility
Soils in mixed siltstone/mudstone/dolerite alluvium or colluvium		
Under moist forest, imperfectly drained	Soil 7	Moderate to high erodibility
Under dry forest, well drained	Soil 8	Moderate erodibility

DISCUSSION
This soils developed in dolerite (soils 1 and 2) are the most widespread within the study area as defined in the project proposal (McIntosh et al. 2002, figure 2) and in the summary report contained in this volume (McIntosh et al. 2003, figure 1). Soils 3–8 occur at the margins of the dolerite uplands. Analyses for similar soils are given in Appendix 2. Estimated soil erodibility ranges from low in soil 1 to moderate to high in sandy and/or imperfectly drained soils.

Soils in dolerite
Within the study area the dominant soils are those formed in in-situ dolerite or in dolerite talus, which is the most widespread parent rock (Forsyth 2003). These soils are chiefly represented by soil 1, with minor areas of soil 2 in the drier lower-altitude areas near Newmans Creek Road

and around the quarries east of the Koonya divide. Because these soils are by far the most widespread in the area, and all potential forestry operations will be on these soils, their properties are considered in some detail.

Soil characteristics

The soils contain either no gley mottles, or gley mottles are present only deep in the soil profile (see Appendix 1); Consequently the soils are well drained or imperfectly drained. They are classified as Ferrosols. Road cuttings indicate that soils 1 and 2 are generally >75 cm deep, and commonly >1 m deep (see Appendix 1) except around rock outcrops and on ridge crests. The soils have low or moderate erodibility. Roots penetrate deeply in these soils because of the well-developed soil structure, which is also indicated by the high percentage of water-stable aggregates in the soils (Appendix 1). Such structure means that water infiltration in upper layers of the soil (generally at least the top metre) is unimpeded. Consequently surface runoff in these soils is rare, except under extremely heavy rainfall, or where the soils overlie impermeable rocks such as subhorizontal sedimentary rocks.

The water-holding capacity of these soils has not been measured but maybe inferred from profile characteristics, land use and comparison with other analysed profiles. Well-structured soils tend to have high values of plant-avilable water and clayey soils have high values of total moisture (to field capacity) but not all of this is available to plants because it is tightly held by clays. Similar well-drained clayey soils in New Zealand have up to 230 mm of total available water in the top metre of soil (Rosemarkie profile of McIntosh (1992)) and a Ferrosol near Burnie (DPIWE database information from B. Cotching, Devonport) has a measured total available water to 36 cm depth of 92 mm, indicating that a deep profile would hold 200–300 mm of water. These are high values compared with soils developed on sedimentary rocks. Water holding capacity will be greater in deeper soils, and for stony soils must be decreased in proportion to the volume of stones.

Land-use impacts

Ferrosols are among the most resilient soils in Tasmania with regard to machinery impacts, which is why stone-free Ferrosols are extensively used for intensive agricultural and horticultural crops in Tasmania. Stones impart to these soils an additional protection against machinery damage, since they help “armour” the soil surface. Widespread forestry operations on similar soils in Tasmania show that they are resistant to disturbance (Grant et al. 1995). On these soils harvest may occur on slopes up to 35^{o}, provided no landslide risk has been identified (Forest Practices Board 2000). These soils present few problems for commercial forestry, and provided operations are conducted according to the Forest Practices Code (Forest Practices Board 2000) and also adhere to the Dolerite Talus Guidelines (www.fpb.tas.gov.au), there is unlikely to be any significant soil erosion or any effect on the sustainability of production.

The land-use impacts of forestry operations on soils formed in dolerite have been studied by Pennington et al. (2001) and Williamson and Neilsen (2003). The former authors studied impacts on a burnt coupe in dolerite at Warra (a lowland site with a higher rainfall than Koonya) and the latter authors studied the impacts of machinery on a coupe in the Picton catchment (also higher rainfall than at Koonya).

Pennington et al. (2001) found that there was a significant increase ($P<0.05$) in soil bulk density in the 0–5 cm soil layer after harvest and burning. Soil bulk density increased from 0.58 Mg/m^3 to 0.70 Mg/m^3. There was no evidence of an increase of bulk density deeper in the soil. At 5–10 cm depth the mean of pre- and post-harvest measurements was 0.87 Mg/m^3, at 10–20 cm it was 1.00 Mg/m^3, and at 20-30 cm it was 1.03 Mg/m^3. These values follow the expected trend of a slight increase with increasing soil depth. The authors concluded that the increase in soil bulk density at 0–5 cm depth was caused by burning of soil organic matter. Ellis and Graley (1983) and Pennington and Gibbons (unpublished) have shown that these changes are reversed over time, as would be expected from the organic matter accumulation as vegetation re-establishes and faunal mixing occurs.

It is noted that Pennington et al. (2001) reported that bulk density values reached 0.70 Mg/m^3, after harvest, but this value is still well below the bulk density associated with soil "pans" that severely restrict soil permeability. Such pans generally have a bulk density of 1.5–1.8 Mg/m^3 (Joe and Watt 1983).

Williamson and Neilsen investigated compaction effects on pre-Code snig tracks in a coupe on soils derived from dolerite at Picton, under very high rainfall (1800 mm). They found that on these soils there was no detectable effect either 4 years or 9 years after snigging. At 20–30 cm depth bulk density values of both undisturbed and disturbed sites were 0.9–1.1 Mg/m^3

On pre-Code sites near Warra, Pennington (CSIRO unpublished report) found that under 17–23 year old snig tracks, soils formed in dolerite (Ferrosols) had a bulk density 20–23% higher than undisturbed soils, and that this higher bulk density inhibited tree growth. The lower production on the snig tracks was almost wholly compensated for by higher production on the disturbed soils adjacent to the snig tracks. Pennington remarked that "the implementation of a Forest Practices Code is likely to reduce these impacts".

None of the above authors noted erosion associated with snig tracks. As expected for soils with good structure and good infiltration properties, surface runoff is very rare on soils in dolerite, except after very high rainfall. Erosion has been noted by the author (PDM) in only three situations: (1) where subsurface channels have been disturbed by machinery; (2) where a stream was inadvertently diverted; (3) where the dolerite talus was thin and mixed with highly dispersible silty/fine sandy sediments.

The Koonya coupes are drier than the coupes studied by the above authors. As a result, potential soil impacts are likely to be less, particularly if precautions are taken to limit machinery impacts. The cording and matting prescription employed during forest harvest at Newmans Creek (McIntosh 1999) prevented contact of harvesting machinery with the soil. Minimal soil damage and no erosion was evident. Similar prescriptions are routinely applied in ground-based coupes and if applied to the Koonya coupes will reduce the risk of soil damage. Thus over most of the harvest areas, natural or near-natural infiltration rates are likely to be maintained.

Soils in siltstone, mudstone and sandstone

Soils in siltstone, mudstone, sandstone and mixed siltstone/mudstone and dolerite (Soils 3-8) occur on the slopes on either side of Firetower Road, in places on steep slopes associated with landslides. The geological map (Forsyth 2003) indicates where these soils may be found on sedimentary parent rocks. The soils occur either on private land or land not planned for harvest. Land use options on these soils in the Koonya study area have therefore not been assessed.

Soil 7

Soil 7 has similar properties to soil 13.1 described by Grant et al. (1995). It is estimated to have moderate to high erodibility. It occurs on rolling land immediately upstream of the spring "Koonya B" and was described on an alluvial fan at a site 6 m north of the stream which is the source of the Koonya B spring. Tunnel-gully erosion is evident in the stream channel which is partly underground. The field evidence (Figure 1) indicates that the subsurface stream channel has periodically collapsed. During collapse silty clays are likely to have entered the stream. Both silt and aggregated clay is likely to have moved downstream in suspension. The effect of soil 7 on stream water quality is further discussed by McIntosh and Haywood (2003).

Figure 1. Tunnel gully erosion in soil 7. The stream channel is flowing underground from just left of centre on the top edge of the photograph to just right of centre on the lower edge. Water is visible in the "hole" 25 cm to the left of the spade blade. The hole has probably formed by collapse of the roof of a subsurface channel. This stream flows into the Koonya B spring used as a water supply by Firetower Road residents.

CONCLUSIONS

The area proposed for commercial forestry has soils correlating mostly with soil 1, which is highly suitable for this land use (Forest Practices Board 2001a). Similar soils are widely used for production forestry throughout Tasmania (Grant et al. 1995). Soil 1 is suitable for plantation use, provided soils are not excessively stony or bouldery. Soil 2 is less extensive and confined to drier areas. It is less suitable for plantation use because of limitations of low moisture availability and lower total P and N (Forest Practices Board 2001b). Soil erodibility is moderate, which indicates little risk of erosion provided forestry land use follows Code provisions.

The stream feeding the Koonya B spring flows through an area of tunnel gully erosion in soil 7, which is an imperfectly drained soil with silty clay texture, and is estimated (from analysis of a similar soil) to have moderate to high erodibility. There is evidence that this silty soil material has periodically collapsed into the stream channel, probably during periods of high rainfall and water flow. Normal bank erosion is also likely to contribute to suspended silt in the stream.

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APPENDIX 1. Soil profile descriptions.

1. Gradational soil in dolerite

Author: S. Davies (University of Tasmania)
Date: 12 December 2002
Location: Cutting along Clarks Cliffs track, Koonya
Map reference: Port Arthur (Sheet 5522) 564717 5227415
Landform: Hillslope
Vegetation: Damp *Eucalyptus* spp. forest
Parent material: Jurassic dolerite
Drainage: Well drained
Slope: 24^{o}
Aspect: Northeast
Altitude: 339 m
Australian Soil Classification: **Brown Ferrosol**
Estimated soil erodibility rating: Low

A1	0-30 cm	Brown (7.5YR4/4) (moist) loam (15% clay estimate); very weak; weak 1-10 mm polyhedral structure; common fine roots.
B1	30-40 cm	Brown (7.5YR5/4) (moist) clay loam (30% clay estimate); firm; moderate 1-20 mm polyhedral structure; common fine roots
B2	40-80+ cm	Reddish brown (7.5YR6/6) (moist) light clay (40% clay estimate); very firm; moderate 2-30mm polyhedral structure; few fine roots.

Similar soil
Wielangta soil (a Red Ferrosol) (Forest Practices Board 2001a). See Appendix 2.

2. Gradational soil in "mealy" dolerite

Author: S. Davies (University of Tasmania)
Date: 12 December 2002
Location: Road cutting along Newman's Creek Road, Koonya
Map reference: Port Arthur (Sheet 5522) 567539 5228464
Landform: Hillslope
Vegetation: Dry *Eucalyptus* spp. forest
Parent material: Jurassic dolerite
Drainage: Well drained
Slope: 22^{o}
Aspect: Northeast
Altitude: 161 m
Australian Soil Classification: **Grey Dermosol**
Estimated soil erodibility rating: Moderate

A1	0-30 cm	Light brown (7.5YR6/3) (moist) light clay (40% clay estimate); 5% reddish yellow (5YR6/6) mottles 5 mm diameter; very firm strength; strong 2-40 mm polyhedral structure; few fine and very fine roots; <5% 2-5 mm subrounded gravels.
B2	30-80 cm	Brown (7.5YR5/2) (moist) medium clay (50% clay estimate); 10% reddish yellow (7.5YR6/6) mottles 2-5 mm diameter; firm; strong 3-60 mm polyhedral structure, few fine and very fine roots.
BC	80+cm	Brown (7.5YR5/4) gritty silty loam becoming clay loam when rubbed; weathered dolerite with intact crystal fabric); few fine roots penetrate down cracks and fissures (see photograph).

Similar soil
Driscoll soil (Forest Practices Board 2001b). Because of its A1 horizon texture, Driscoll soil is a Chromosol. See Appendix 2.

3. Texture-contrast soil in siltstone/mudstone, imperfectly drained phase

Author: S. Davies (University of Tasmania) and P. D. McIntosh (FPB)
Date: 11th December 2002
Location: Road cutting along Fire Tower road, Koonya
Map reference: Port Arthur (Sheet 5522) 565027 5227255
Landform: Hillslope
Vegetation: Moist *Eucalyptus* spp. forest
Parent material: Triassic siltstone/mudstone
Drainage: Imperfectly drained
Slope: 17°
Aspect: West
Altitude: 300 m
Australian Soil Classification: **Grey Kurosol**
Estimated soil erodibility rating: Moderate to high

A1	0-3 cm	Very dark greyish brown (10YR3/2) (moist) organic loam (<10% clay estimate); loose; <1mm single grains; common fine roots.
B21	3-50 cm	Brownish yellow (10YR6/6) (moist) silty clay loam (20% clay estimate); 40% white (2.5Y8/1) mottles 2-5mm diameter; firm; moderate 1-50 mm polyhedral structure; common fine roots.
B22	50-100+ cm	White (2.5Y8/1) (moist) silty clay loam (20% clay estimate); 30% brownish yellow (10YR6/6) mottles 2-5mm diameter; very strong; moderate 1-70 mm polyhedral structure; few fine roots.

Similar soil
O'Connor soil (Forest Practices Board 2001c). Note that O'Connor soil is classified as a Kandosol because it does not have a texture-contrast profile and has more weakly developed structure in the B horizon.

4. Uniform soil in siltstone/mudstone

Author: S. Davies (University of Tasmania)
Date: 12 December 2002
Location: Road cutting along access track on private property (Giblin) off Fire Tower road, Koonya
Map reference: Port Arthur (Sheet 5522) 565432 5227562
Landform: Hillslope
Vegetation: Moist *Eucalyptus* spp. forest
Parent material: Triassic siltstone/mudstone
Drainage: Well drained
Slope: 22^{o}
Aspect: West
Altitude: 379 m
Australian Soil Classification: **Brown Dermosol**
Estimated soil erodibility rating: Moderate

A1	0-20 cm	Brown (7.5YR4/3) (moist) clay loam (25% clay estimate); weak; weak 1-2mm polyhedral structure; few fine roots; <5% 1-10mm subangular gravels.
B21	20-40 cm	Brown (7.5YR5/4) (moist) clay loam (25% clay estimate); firm; moderate 2-30 mm polyhedral structure; few fine roots; 5-10% 2 mm subangular gravels.
B22	40-80+ cm	Brown (7.5YR5/4) (moist) clay loam (25% clay estimate); very firm; strong 10-50 mm polyhedral structure; few fine roots; >50% 2-5 mm subangular gravels.

Similar soil
No similar soils have been described or analysed.

5. Texture contrast soil in sandstone, imperfectly drained phase

Author: S. Davies (University of Tasmania)
Date: 11 December 2002
Location: Along cut track ~30 m east of Fire Tower road, Koonya
Map reference: Port Arthur (Sheet 5522) 564900 5227150 (estimated)
Landform: Hillslope
Vegetation: Moist *Eucalyptus* spp. forest
Parent material: Triassic sandstone
Drainage: Imperfectly drained
Slope: 15^{o}
Aspect: Northwest
Altitude: 310 m
Australian Soil Classification: **Yellow Kurosol**
Estimated soil erodibility rating: Moderate to high

A1	0-5 cm	Black (10YR2/1) (moist) organic sandy loam (10% clay estimate); weak; loose 1-3 mm peds polyhedral structure; common fine-small roots.
B1	5-8 cm	Very dark greyish brown (10YR3/2) (moist) sandy loam (20% clay estimate); firm; moderate 1-10 mm polyhedral structure; few small roots.
B21	8-60 cm	Light yellowish brown (2.5Y6/4) (moist) sandy clay loam (30% clay estimate); 20% brown (7.5YR4/4) mottles 2-3mm diameter; weak; moderate 2-20 mm polyhedral structure; few fine roots.
B22	60-80+ cm	Reddish yellow (7.5YR6/8) (moist) medium clay (45% clay estimate); 50% light grey (2.5Y7/1) mottles 5 mm diameter; very firm; strong 5-30 mm polyhedral structure; few very fine roots.

(no photograph)

Similar soil
Soil 14.2 (Sandspit soil) described in Grant et al. (1995) is a Brown Kurosol and has a similar profile.

6. Uniform soil in Triassic sandstone

Author: S. Davies (University of Tasmania)
Date: 12 December 2002
Location: Road cutting along driveway to private property off Fire Tower road, Koonya
Map reference: Port Arthur (Sheet 5522) 565623 5228802
Landform: Hillslope
Vegetation: Moist *Eucalyptus* spp. forest
Parent material: Triassic sandstone
Drainage: Well drained
Slope: 16^{o}
Aspect: West
Altitude: 264 m
Australian Soil Classification: **Bleached Orthic Tenosol**
Estimated soil erodibility rating: Moderate to high

A1	0-20 cm	Dark grey (2.5Y4/1) (moist) sandy loam (<10% clay estimate); weak; loose <1mm single grains; many fine to coarse roots.
A2	20-55 cm	Light grey (2.5Y7/1) (moist) sand (<10% clay estimate); weak; loose <1mm single grains; common very fine to coarse roots; <5% 2-5mm subangular gravels.
B2	55-80cm	Yellow (2.5Y7/6) (moist) sand (<10% clay estimate); weak; loose <1mm single grains; few very fine roots.

Similar soil
Catgut soil (Forest Practices Board 2001d) is very similar and has the same classification.

7. Gradational soil in fan alluvium of siltstone and minor dolerite, imperfectly drained

Author: P. D. McIntosh (FPB) and S. Davies (University of Tasmania)
Date: 9 December 2002
Location: About 50 m upstream from location of Koonya B spring, behind old cottage; 6 m north of the stream with tunnel gully erosion
Map reference: Port Arthur (Sheet 5522) 565300 5228000
Landform: Midslope of fan 100 m wide
Vegetation: *Pomaderris apetala, Coprosma quadrifida, Olearia lirata, Polystichum proliferum*
Parent material: Mixed alluvium from Triassic siltstone and minor Jurassic dolerite
Drainage: Imperfectly drained
Slope: 8°
Aspect: West
Altitude: 270 m
Australian Soil Classification: **Brown Mesotrophic Acidic-Mottled Kandosol**
Estimated soil erodibility: Moderate to high

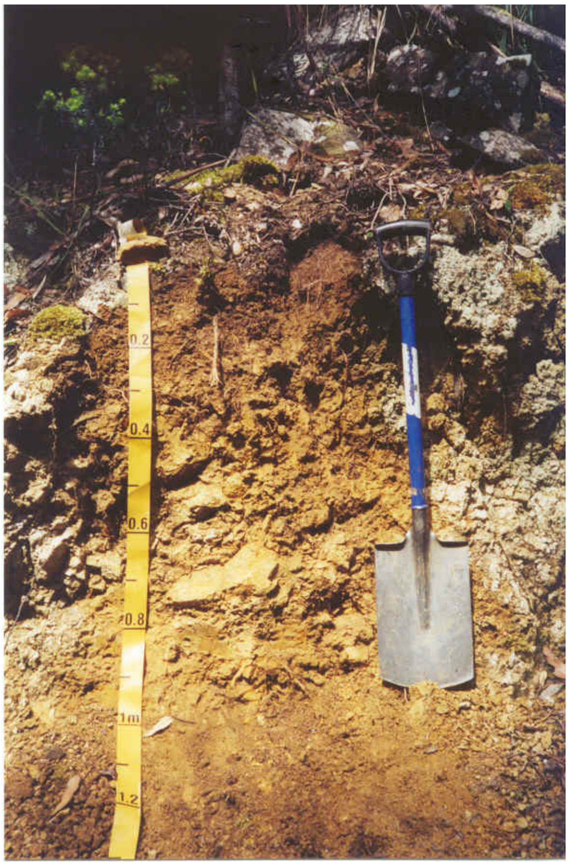
A1	0-8 cm	Dark greyish brown (10YR4/2) (moist) loam (20% clay estimate); loose; strong 1-2 mm crumb and 2-10 mm subangular blocky structure; common fine and medium roots.
B1	8-19 cm	Yellowish brown (10YR5/4) (moist) silty clay loam (28% clay estimate); firm; moderate 40 mm subangular blocky structure; common fine and medium roots.
B2	19-43 cm	Yellowish brown (10YR5/8) (moist) silty clay (45% clay estimate); 40% brown (10YR5/3) mottles 6 mm diameter; very firm strength; moderate 50-100 mm blocky structure; yellowish brown (10YR5/4) silt coats on ped surfaces; few medium roots.
B2g1	43-70 cm	Light grey (5Y7/1) (moist) clay (60% clay estimate); 55% brownish yellow (10YR6/8) mottles 8 mm diameter; firm; weak 100 mm blocky structure; 20% subangular dolerite gravels 100 mm diameter, lying on flat surfaces; few fine roots.
B2g2	70-75+cm	White (5Y8/1) (moist) medium clay (50% clay estimate); 50% yellowish brown (10YR5/6) mottles 8 mm diameter; firm; massive; few fine roots.

Similar soil
Blackwell soil (Soil 13.1 of Grant et al. 1995) is similar but is classified as a Kurosol.

8. Texture-contrast soil in mixed colluvium from mixed siltstone/mudstone and dolerite

Author: S. Davies (University of Tasmania)
Date: 12 December 2002
Location: Road cutting along Fire Tower Road, Koonya
Map reference: Port Arthur (Sheet 5522) 565432 5227562
Landform: Hillslope
Vegetation: Dry *Eucalyptus* spp. forest
Parent material: Triassic siltstone/mudstone and Jurassic dolerite
Drainage: Well drained
Slope: 22^{o}
Aspect: West
Altitude: 379 m
Australian Soil Classification: **Yellow Kurosol**
Estimated soil erodibility rating: Moderate

A1	0-20 cm	Brown (10YR5/3) (moist) loam (20% clay estimate) very weak; weak 1-3 mm polyhedral structure; common fine roots.
B2	20-40 cm	Light yellowish brown (2.5Y6/4) (moist) light clay (40% clay estimate) brownish yellow (10YR6/6) mottles 2 mm diameter; very firm strength; moderate 2-50mm polyhedral structure, few fine roots; 10% 2-4 mm subangular gravels.
B3	40-80+ cm	Brownish yellow (10YR6/6) (moist) light clay (40% clay estimate); strong 2-100 mm polyhedral structure, few fine roots; >50% 2-100 mm subangular gravels



Similar soil
No similar soils have been described.

APPENDIX 2. Detailed information on analysed profiles in dolerite.

Wielangta soil (Forest Practices Board 2001a)
Authors: MDL and PDM
Date: 22.9.00
Location: North side of turnoff to N road, off the main Wielangta Road, east of gate across road
Map reference: Sheet 5626 (Kellevie) 686 695
Landform: Midslope in rolling landscape.
Vegetation: *Eucalyptus regnans*, *E. globulus*, *Pomaderris apetala*, *Bedfordia salicina*, *Olearia lirata*, *Gahnia* sp., ferns
Parent material: Strongly weathered dolerite
Drainage: Well drained
Slope: 15°
Aspect: Southeast
Altitude: 330 m
Photographs: PDM 10-00-24 (site); PDM 10-00-16 (profile)
Australian Soil Classification: **Red Eutrophic Ferrosol***

A1	0-13 cm	Dark brown (7.5YR3/2) (moist) silty clay loam; 20% subangular gravels 100-300 mm diameter; weak strength; moderate 5-10 mm granular structure; abundant fine and many coarse roots; NaF 0/5.
AB	13-28 cm	Brown (7.5YR4/3) (moist) silty clay; weak strength; moderate 5-15 mm blocky structure; common medium and few coarse roots; NaF 0/5.
B21	28-57 cm	Yellowish red (5YR5/6) (moist) medium clay (60% clay, estimate); firm strength; weak 20-40 mm blocky structure; few coarse roots; NaF 0/5.
B22	57-110+cm	Red (2.5YR5/6) (moist) medium clay (60% clay, estimate); 10% brownish yellow (10YR6/6) mottles 10-120 mm diameter (strongly weathered dolerite gravels); few coarse roots; NaF 0/5.

Laboratory Analyses

Horizon	Depth (cm)	pH (H_2O)	Total C (%)	Total N (%)	C/N	Colwell P (mg/kg)	Total P (mg/kg)	P retn. (%)	SO_4-S (mg/kg)	Water-stable aggreg. (%)
	0-30	*5.5*	*4.51*	*0.26*	*17*	*12*	*398*	*53*	*7*	*n.d.*
A1	0-13	5.6	5.71	0.32	18	8	444	50	9	75
AB	13-28	5.5	2.20	0.15	15	7	358	57	14	91
B21	28-57	5.3	1.60	0.10	16	n.d.	216	54	23	86
B22	57-110+	5.5	0.59	0.04	14	n.d.	215	51	24	81

Horizon	Depth (cm)	Exch. Ca (cmol(+)/kg)	Exch. Mg (cmol(+)/kg)	Exch. K (cmol(+)/kg)	Exch. Na (cmol(+)/kg)	CEC (cmol(+)/kg)	BS (%)
	0-30	*6.66*	*4.05*	*1.48*	*0.24*	*26.4*	*47*
A1	0-13	8.16	3.67	1.46	0.25	27.3	50
AB	13-28	4.13	3.70	1.37	0.22	21.6	44
B21	28-57	4.12	4.33	1.09	0.34	26.1	38
B22	57-110+	5.12	5.65	1.25	0.44	28.5	44

* Citrate-dithionite Fe = 6.0 and 5.5% in B21 and B22 horizons respectively
Analytical methods were those of Blakemore et al. (1987), Laffan et al. (1996) and Rayment and Higginson (1992), with variation of methods for C, N and SO_4-S (details available from P. D. McIntosh, Forest Practices Board).

Driscoll soil (Forest Practices Board 2001b)
Author: MDL and PDM
Date: 21.9.00
Location: West side of Buckland Road, Driscolls Hills, 4.5 km north of Buckland
Map reference: Sheet 5428 (Buckland) 563 866
Landform: Midslope of hilly gully side 100 m long
Vegetation: *Eucalyptus globulus, Acacia dealbata*, saggs, native cherry, grasses
Parent material: Dolerite colluvium on in-situ dolerite, with aeolian quartz sand in A horizon
Drainage: Well drained
Slope: 18°
Aspect: Northeast
Altitude: 150 m
Photographs: PDM 10-00-4 (site); 9-00-13a (profile)
Australian Soil Classification: **Eutrophic Brown Chromosol**

A1	0-21 cm	Dark greyish brown (10YR4/2) (moist) silty loam; 15% subrounded gravels 10-40 cm diameter; weak strength; weak 1-2 mm subangular blocky structure; abundant fine roots; NaF 0/5.
B2	21-40 cm	Brown (7.5YR4/3) (moist) medium clay; 15% subrounded gravels 10-40 cm diameter; weak strength; strong 5-15 mm blocky structure; prominent dark brown (7.5YR3/2) clay skins on block faces; many fine roots; NaF 0/5.
B3	40-60 cm	Brown (7.5YR4/4) (moist) coarse sandy loam; 10% subrounded gravels 10 cm diameter; firm strength; weak 3-8 mm blocky structure breaking to 2 mm blocky; prominent dark brown (7.5YR3/2) clay skins on block faces; common fine roots; NaF 0/5.
C	60-100 cm	Strong brown (7.5YR5/6) (moist) coarse sandy loam; 30% light olive brown (2.5Y5/3) mottles 20 mm diameter, below 80 cm depth; firm strength; massive; 10% subrounded gravels 10 cm diameter; few roots; NaF 0/5; in situ weathered rock.

Laboratory Analyses

Horizon	Depth (cm)	pH (H_2O)	Total C (%)	Total N (%)	C/N	Colwell P (mg/kg)	Total P (mg/kg)	P retn. (%)	SO_4-S (mg/kg)	Water-stable aggreg. (%)
	0-30	*6.2*	*3.22*	*0.20*	*16*	*4*	*170*	*15*	*1*	*n.d.*
A1	0-21	6.0	5.13	0.30	17	6	205	17	1	47
B2	21-40	6.5	1.95	0.15	13	3	89	30	1	64
B3	40-60	6.7	0.40	0.04	10	n.d.	266	19	0	65
C	60-90	7.1	0.13	0.02	8	n.d.	243	14	0	62

Horizon	Depth (cm)	Exch. Ca (cmol(+)/kg)	Exch. Mg (cmol(+)/kg)	Exch. K (cmol(+)/kg)	Exch. Na (cmol(+)/kg)	CEC (cmol(+)/kg)	BS (%)
	0-30	*14.68*	*4.71*	*0.25*	*0.20*	*18.4*	*108*
A1	0-21	15.68	4.38	0.34	0.19	22.0	94
B2	21-40	16.31	8.04	0.08	0.41	23.7	105
B3	40-60	12.12	6.54	0.05	0.69	17.5	111
C	60-90	11.71	6.74	0.02	0.61	16.2	118

Analytical methods were those of Blakemore et al. (1987), Laffan et al. (1996) and Rayment and Higginson (1992), with variation of methods for C, N and SO_4-S (details available from P. D. McIntosh, Forest Practices Board).