

This Technical Data Sheet describes the *typical average properties* of the specified soil.

It is essentially a summary of information obtained from one or more profiles of this soil that were examined and described during the Topoclimate survey or previous surveys. It has been prepared in good faith by trained staff within time and budgetary limits. However, no responsibility or liability can be taken for the accuracy of the information and interpretations. Advise should be sought from soil and landuse experts before making landuse decisions on individual farms and paddocks.

The characteristics of the soil at a specific location may differ in some details from those described here.

No warranties are expressed or implied unless stated.

Soil name: **Conical Hill**

Overview

Conical Hill soils occupy about 800ha on hills and downs in the Waipahi district of south Otago. These soils are formed into thin mixed loess and colluvium, overlying basic igneous rock at 40–90cm depth. Conical Hill soils are well drained, with a shallow to slightly deep rooting depth and moderate water holding capacity that is limited by the gravelliness and bedrock that typically occurs within 45cm depth. Present use is pastoral grazing with sheep and beef cattle. Climate is cool temperate with regular rain throughout the year. Shallower soils can be summer dry.

Soil classification

NZ Soil Classification (NZSC):

Typic Mafic Melanic; lithic, basaltic; silty.

Previous NZ Genetic Classification:

Strongly leached southern yellow brown earth.

Classification explanation

The NZSC of Conical hill soils has been reclassified because the soil properties are more similar to Melanic than to Brown soils. This is reflected in the dark coloured topsoils and moderate to strong structure throughout the profile. They typically have dark brown coloured subsoils, reflecting the influence of the volcanic rock. The underlying bedrock classifies as basaltic in the NZSC, but is basic igneous keratophyre and spilite of the Dun mountain ophiolite belt. Conical Hill soils are naturally fertile, with low P-retention, high base saturation and pH values of >5.8 throughout the profile. They typically have bedrock within 45cm depth, and textures are typically silt loam.

Soil phases and variants

Identified units in the Conical Hill soils are:

- Conical Hill rolling shallow (CcR3): has bedrock within 45cm depth; occurs on slopes of 7–15°
- Conical Hill hilly shallow (CcH3): has bedrock within 45cm depth; occurs on slopes° of 15–25
- Conical Hill steep shallow (CcS3): has bedrock within 45cm depth; occurs on slopes of >25°
- Conical Hill undulating shallow (CcU3): has bedrock within 45cm depth; occurs on slopes of 0–7°
- Conical Hill hilly moderately deep (CcH2): has gravels and/or bedrock between 45 and 90cm depth; occurs on slopes of 15–25°
- Conical Hill rolling moderately deep (CcR2): has gravels and/or bedrock between 45 and 90cm depth; occurs on slopes of 7–15°
- Conical Hill undulating moderately deep (CcU2): has gravels and/or bedrock between 45 and 90cm depth; occurs on slopes of 0–7°

The soil properties described in this Technical Data Sheet are based on the most common phase, Conical Hill rolling shallow (CcR3). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating, e.g., Conical Hill hilly shallow (CcH3).

Associated soils

Some soils that commonly occur in association with Conical Hill soils are:

- Arthurton: imperfectly drained Brown soil formed in deep loess
- Clinton: well drained Brown soil formed in deep loess; occurs on gently sloping fans adjacent to Clinton township
- Waikaka: well drained Brown soil formed in deep loess that has Brown-Pallic intergrade properties; occurs in rolling and hilly land grading between the downlands and the hill country

Similar soils

Some soils that have similar properties to Conical Hill soils are:

- Mandeville: shallow soil with tuffaceous greywacke bedrock within 45cm depth
- Kaihiku: shallow soil formed into gravelly tuffaceous greywacke colluvium

Typical profile features

The following is a 'generic' or composite profile description representing the most common combination of characteristics for this soil type. The actual profiles for which descriptions and data are available are listed at the end of this Technical Data Sheet.

Conical Hill profile	Horizon	Depth (cm)	Description
	Ap	0–21	Dark brown slightly gravelly silt loam; weak soil strength; moderately developed very fine polyhedral structure; fine subangular gravel; abundant roots.
	Bw	21–35	Dull yellowish brown very gravelly silt loam; common wormcasts; weak soil strength; strongly developed very fine polyhedral structure; medium subangular gravel; many roots.
	R	35–90+	Moderately weathered bedrock
	R	35–90+	Moderately weathered bedrock

Key profile features

Conical Hill topsoils are 15–20cm deep with a moderate to strong structure. Subsoils also have moderate to strong structure to the bedrock. Both the topsoils and subsoils have dark colours, reflecting the influence of the volcanic parent material.

Typical physical properties

Note: values in *Italics* are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–21	Moderate	<i>Moderate</i>	Silt loam	Slightly gravelly
Bw	21–33	—	<i>Moderate</i>	Silt loam	Very gravelly
R	33–90	—	—	—	Extremely gravelly

Profile drainage: Well

Plant readily available water: *Moderate*

Potential rooting depth: Shallow

Rooting restriction: Subsoil gravelliness and presence of bedrock

Key physical properties

Conical Hill soils have a shallow rooting depth, restricted by the gravelliness and bedrock in the subsoil, and moderate available water. These soils are well drained, with good aeration and permeability throughout the soil. Texture is silt loam in all horizons, but does vary according to the proportion of loess in the soil. Topsoil clay content is about 25–30%. The soils are gravelly throughout, and typically have at least 35% gravel and bedrock within 45cm depth. The moderately deep phases will have bedrock between 45–90cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–21	Moderate	Moderate	High	High	High	Very high	Very low	Moderate
Bw	21–33	Moderate	Moderate	High	High	High	Very high	Very low	Moderate
R	33–90+	—	—	—	—	—	—	—	—

Key chemical properties

Topsoil organic matter content is about 5–6%, P-retention 40% and pH moderate (high 5s to low 6s). Cation exchange and base saturation values are high. Available calcium values are high, magnesium very high, with potassium values low. Soil reserve phosphorus levels are low. Micronutrient values are generally adequate.

Vulnerability to environmental degradation

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	moderate	These soils have a moderate vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the good drainage, but moderate clay, organic matter and P-retention values.
Nutrient leaching	very severe	These soils have a very severe vulnerability to leaching to groundwater. This rating reflects the good drainage, with moderate permeability and moderate water holding capacity.
Topsoil erodibility by water	slight	Due to the moderate clay and organic matter content, topsoil erodibility in these soils is slight. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	moderate	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties and highly dependent on management practices (e.g., crop residue management and cultivation practices).
Waterlogging	slight	These soils have a slight vulnerability to waterlogging during wet periods. This rating reflects the good drainage and permeability. Hilly phases will have nil vulnerability.

General landuse versatility ratings for Conical Hill soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive landuse. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification.

Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

CcR3 (Conical Hill rolling shallow)

CcU3 (Conical Hill undulating shallow)

Versatility evaluation for soil CcR3, CcU3		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Restricted rooting depth; vulnerability to leaching to groundwater
Arable	Limited	Restricted rooting depth; vulnerability to leaching to groundwater; rolling aspect for rolling phase.
Intensive pasture	Limited	Restricted rooting depth; vulnerability to leaching to groundwater; rolling aspect for rolling phase.
Forestry	Unsuitable	Shallow rock depth

CcH3 (Conical Hill hilly shallow)

CcS3 (Conical Hill steep shallow)

Versatility evaluation for soil CcH3, CcS3		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly and steep slopes
Arable	Unsuitable	Hilly and steep slopes
Intensive pasture	Limited	Hilly and steep slopes; restricted rooting depth
Forestry	Unsuitable	Shallow rock depth

CcR2 (Conical Hill rolling moderately deep)

Versatility evaluation for soil CcR2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Limited	Rolling slopes.
Intensive pasture	Moderate	Vulnerability to leaching to groundwater; restricted rooting depth
Forestry	Limited	Shallow rock depth; restricted rooting depth.

CcH2 (Conical Hill hilly moderately deep)

Versatility evaluation for soil CcH2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes.
Forestry	Limited	Shallow rock depth; restricted rooting depth.

CcU2 (Conical Hill undulating moderately deep)

Versatility evaluation for soil CcU2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Moderate	Vulnerability to leaching to groundwater; restricted rooting depth.
Intensive pasture	Moderate	Vulnerability to leaching to groundwater; restricted rooting depth
Forestry	Limited	Shallow rock depth; restricted rooting depth.

Management practices that may improve soil versatility

- Careful management of fertiliser nutrient applications to avoid runoff and leaching.

Soil profiles available for Conical Hill soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
CcH3	WCT4	34	✓	✓	✓	✓
CcR3	WCT3	34	✓	✓	✓	

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