

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: Fortification

Overview

Fortification soils occur on about 1200 ha on undulating to steep slopes east of the lower Mataura river in southern Southland. They are formed in a moderately deep layer of loess overlying tuffaceous greywacke bedrock. Fortification soils are imperfectly to moderately well drained. They have slightly deep rooting depth and moderately high water holding capacity that is limited by the graveliness and bedrock that commonly occurs within in the lower subsoil. They are strongly leached soils with acidic subsoils, high P-retention, and low available nutrients. At present they are used for pastoral farming with sheep and beef cattle. Climate is cool temperate with regular rainfall. Soils seldom dry out.

Soil classification

NZ Soil Classification (NZSC):

Acidic Orthic Allophanic; moderately deep on rock, tuffaceous sandstone; clayey

Previous NZ Genetic Classification:

Strongly leached yellow-brown earth

Classification explanation

The NZSC of Fortification soils is consistent with the previous classification. They are strongly leached soils with low bulk density, P-retention of >85% and subsoil pH of less than 5.5. Fortification soils have silty clay textures, and tuffaceous greywacke bedrock typically occurs at 45–90cm depth.

Soil phases and variants

Identified units in the Fortification soils are:

- Fortification hilly moderately deep (FoH2): has gravel between 45 and 90cm depth; occurs on slopes of 15–25°
- Fortification undulating moderately deep (FoU2): has gravel between 45 and 90cm depth; occurs on slopes of 0–7°
- Fortification rolling moderately deep (FoR2): has gravel between 45 and 90cm depth; occurs on slopes of 7–15°
- Fortification steep moderately deep (FoS2): has gravel between 45 and 90cm depth; occurs on slopes of >25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Fortification hilly moderately deep (FoH2). 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., Fortification undulating moderately deep (FoU2).

Associated soils

Some soils that commonly occur in association with Fortification soils are:

- Pukerau: well drained, shallow Allophanic soil; with bedrock at <45cm depth
- Otaraia: well drained, deep Brown soil; with no bedrock within 90cm depth
- Haldane: imperfectly drained, deep Brown soil; with no bedrock within 90cm depth
- Scrubby Hill: imperfectly drained, deep Brown soil with podzolised properties; has thin iron pans and is strongly acid with pH of <4.9

Similar soils

Some soils that have similar properties to Fortification soils are:

- Craigdale : Brown soil that is moderately leached, with P-retention of 40–60%
- McNab: Brown soil that has a strongly acid subsoil (pH <4.9); bedrock is more weathered.
- Waiarikiki: Brown soil that is strongly leached, with P-retention of >85%; often formed onto gravelly 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.

Fortification profile	Horizon	Depth (cm)	Description
	Ap	0–28	Brownish black silty clay; few bright yellowish brown mottles; slightly firm soil strength; strongly developed very fine to fine polyhedral structure; abundant roots
	Bw(g)	28–65	Bright yellowish brown silty clay; few greyish yellow and very few dark reddish brown mottles; few worm casts; weak soil strength; moderately developed medium polyhedral grading vertically to coarse prismatic structure; many roots
	R	65–90+	Orange moderately weathered tuffaceous greywacke bedrock; hard soil strength; massive structure; few roots

Key profile features

Fortification soils have a 21–28cm deep topsoil with a strongly developed structure. Subsoil structure is moderately developed and grades to coarse gravelly colluvium and bedrock below 45cm. The degree of bedrock weathering is variable.

Typical physical properties

Note: values in *Italics* are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–28	Low – Moderate	<i>Moderate</i>	Silty clay	Gravel free
Bw(g)	28–65	Low	<i>Moderate</i>	Silty clay	Gravel free
R	65–90+	—	—	—	Extremely gravelly

Profile drainage: Moderately well

Plant readily available water: *Moderately high*

Potential rooting depth: Slightly deep

Rooting restriction: Subsoil graveliness and/or presence of bedrock

Key physical properties

Fortification soils have a slightly deep rooting depth that is restricted by bedrock. Plant available water capacity is moderately high, with good aeration and permeability. Texture is a silty clay loam in all horizons. Topsoil clay content is 30–38%. Soils are slightly gravelly in the upper horizons, grading to extremely gravelly subsoil and bedrock between 45 and 90cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–28	Moderate	High	High	Low	Moderate	Moderate	Low	Moderate
Bw(g)	28–65	Low	High	Moderate	Very low	Very low	Very low	Very low	Low
R	65–90+	Low	High	High	Very low	Very low	Low	Very low	Moderate

Key chemical properties

Topsoil organic matter levels are 11–14%; P-retention 75–90%; pH moderate (high 5s) in the topsoil. Subsoil pH values tend to decrease (<5.5). Cation exchange values are high but base saturation is low. Available calcium and magnesium levels are moderate in the topsoil but low in the subsoil. Potassium and reserve phosphorus levels are low. Micronutrient levels 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	minimal	These soils have a minimal vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the good drainage, high clay, organic matter, and P-retention levels.
Nutrient leaching	moderate	These soils have a moderate vulnerability to leaching to groundwater. This rating reflects the moderately high water-holding capacity, offset by the good drainage, and permeability of the soil.
Topsoil erodibility by water	minimal	Due to the high organic matter and clay content, topsoil erodibility in these soils is minimal. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	minimal	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.

General landuse versatility ratings for Fortification 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.

FoH2 (Fortification hilly moderately deep)

Versatility evaluation for soil FoH2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slope
Arable	Unsuitable	Hilly slope
Intensive pasture	Limited	Hilly slope
Forestry	Limited	Restricted rooting depth

FoS2 (Fortification steep moderately deep)

Versatility evaluation for soil FoS2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Steep slope
Arable	Unsuitable	Steep slope
Intensive pasture	Limited	Steep slope
Forestry	Limited	Steep slope; restricted rooting depth

FoU2 (Fortification undulating moderately deep)

Versatility evaluation for soil FoU2		
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; subsoil acidity.
Forestry	Limited	Restricted rooting depth

FoR2 (Fortification rolling moderately deep)

Versatility evaluation for soil FoR2		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Restricted rooting depth
Arable	Limited	Rolling slope
Intensive pasture	Moderate	Vulnerability to leaching to groundwater; subsoil acidity.
Forestry	Limited	Restricted rooting depth

Management practices that may improve soil versatility

- Management of nutrient applications so as to minimise leaching losses

Soil profiles available for Fortification soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
FoH2	NT6	30	✓	✓	✓	✓
FoU2	ST3	29	✓	✓	✓	✓

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