

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: **Waikoikoi**

### Overview

Waikoikoi soils occupy about 62,600 ha on terraces and downlands in the Gore, northern Southland, west and south Otago areas. They are formed in deep wind-deposited loess derived from greywacke and schist rocks. They have silty textures and are poorly drained, with a dense fragipan at a depth of about 50cm which restricts water drainage. These soils respond well to mole and tile drainage and are used for sheep and dairy production, with some cropping. Regular summer rain occurs and soils are seldom dry.

### Soil classification

**NZ Soil Classification (NZSC):**

Fragic Perch-Gley Pallic; stoneless; silty

**Previous NZ Genetic Classification:**

Yellow-grey earth.

### Classification explanation

The NZSC of the Waikoikoi soils is consistent with the previous classification. Waikoikoi soils are poorly drained, due to perching of water on a dense fragipan. The subsoil above the fragipan also typically has high density, which limits root growth. Waikoikoi soils also have silty textures and P-retention of <30% throughout the profile, and are typically stone free.

### Soil phases and variants

Identified units in the Waikoikoi soils are:

- Waikoikoi rolling deep (WqR1): has no gravel within 90cm depth; occurs on slopes of 7–15°
- Waikoikoi rolling moderately deep, gravelly subsoil variant (WqR2vg): has gravel between 45 and 90cm; occurs on slopes of 7–15°
- Waikoikoi hilly deep (WqH1): has no gravel within 90cm depth; occurs on slopes of 15–25°
- Waikoikoi steep deep (WqS1): has no gravel within 90cm depth; occurs on slopes of >25°
- Waikoikoi undulating deep (WgU1): has no gravel within 90 cm depth; occurs on slopes of 0–7°
- Waikoikoi undulating deep, argillic subsoil variant (WqU1vj): shows accumulation of clay in the subsoil; has no gravel within 90cm depth; occurs on slopes of 0–7°
- Waikoikoi undulating moderately deep, gravelly subsoil variant (WqU2vg): has gravel between 45 and 90 cm; occurs on slopes of 0–7°
- Waikoikoi undulating deep, imperfectly drained variant (WqU1vi): has no gravel above 90cm; occurs on slopes of 0–7°

The soil properties described in this Technical Data Sheet are based on the most common phase, Waikoikoi rolling deep (WqR1). 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., Waikoikoi hilly deep (WqH1).

## Associated soils

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

- Arthurton: imperfectly drained Brown soil that is associated with Pallic soils of northern Southland and west Otago.
- Crookston: well drained Brown soil, that is associated with Pallic soils of northern Southland and west Otago
- Jacobstown: poorly drained soil formed in alluvium; on floodplains with high groundwater
- Benio: shallow soil formed in old weathered gravely alluvium.

## Similar soils

Some soils that have similar properties to Waikoikoi soils are:

- Warepa: imperfectly drained equivalent of the Waikoikoi soil
- Athol: has perch-gley properties, but occurs where the fragipan is not within 90cm depth
- Glenure: poorly drained gley soils on terraces and downlands
- Pukemutu: have silty clay subsoil, and fragipan occurs below 60cm depth and does not have prismatic structure
- Hokonui: has clayey textures, and is formed in mixed loess and alluvium on fans from the Hokonui hills.

## 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.

Waikoikoi profile	Horizon	Depth (cm)	Description
	Apg	0–15	Greyish yellow-brown silt loam; few reddish brown mottles; weak soil strength; moderately developed medium polyhedral structure; abundant roots
	Apg/Bg	15–29	Greyish yellow silt loam; common orange mottles; many worm casts; weak soil strength; moderately developed medium polyhedral structure; many roots
	Bg	29–53	Greyish yellow silt loam; common yellowish brown mottles; few worm casts; slightly firm soil strength; weakly developed coarse polyhedral structure; common roots
	BCx	53–90	Dull yellowish brown silt loam; few greyish yellow veins with reddish brown selvedge; firm soil strength; weakly developed extremely coarse prismatic structure; few roots in veins
	BCx	53–90	Dull yellowish brown silt loam; few greyish yellow veins with reddish brown selvedge; firm soil strength; weakly developed extremely coarse prismatic structure; few roots in veins

## Key profile features

Waikoikoi soils have a 15–25cm deep topsoil that has moderately developed structure. Subsoil structure is moderate to weak in the upper subsoil, abruptly changing in the lower subsoil to the weakly developed extremely coarse prismatic of the fragipan. Greyish colours are dominant in the upper subsoil, indicating the poor drainage caused by water perching on the fragipan.

## Typical physical properties

Note: values in *Italics* are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
<b>Apg</b>	<b>0–15</b>	Moderate – High	<i>Moderate</i>	Silt loam	Gravel free
<b>Apg/Bg</b>	<b>15–29</b>	Moderate – High	<i>Moderate</i>	Silt loam	Gravel free
<b>Bg</b>	<b>29–53</b>	Moderate – High	<i>Slow</i>	Silt loam	Gravel free
<b>BCx</b>	<b>53–90</b>	High	<i>Slow</i>	Silt loam	Gravel free

**Profile drainage:** Poorly drained

**Plant readily available water:** *Moderately high*

**Potential rooting depth:** Slightly deep

**Rooting restriction:** Fragipan

## Key physical properties

Waikoikoi soils have a slightly deep potential rooting depth that is severely restricted by the fragipan at 45–60 cm depth. The soils are poorly drained, with very slow permeability in the subsoil and limited aeration during sustained wet periods. Textures are typically silt loams, but range between loamy silt and heavy silt loam (15–30% clay). Topsoil clay content is typically 20–25%, and stone free. The moderately deep variants have gravels between 45 and 90cm depth.

## Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
<b>Apg</b>	<b>0–15</b>	Moderate	Low	Moderate	High	High	Very low	Very low	Very low
<b>Apg/Bg</b>	<b>15–29</b>	Moderate	Low	Low	Moderate	Low	Very low	Very low	Very low
<b>Bg</b>	<b>29–53</b>	Moderate	Low	Low	Moderate	Low	Very low	Very low	Low
<b>BCx</b>	<b>53–90</b>	Moderate	Low	Low	Moderate	Low	Moderate	Very low	Low

## Key chemical properties

Topsoil organic matter levels are 5–7%; P-retention values mostly under 30%; pH values are moderate and tend to decrease down the profile. Cation exchange values are moderate to low and base saturation values moderate. Available calcium magnesium and potassium levels are usually low. Reserves of phosphorus are low and there is some increase in sulphate sulphur levels in the subsoil. Micro-nutrient levels are generally adequate, although boron responses in brassicas and molybdenum responses in legumes can be expected.

## 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
<b>Structural compaction</b>	Very severe	These soils have a very severe vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage, low clay and P-retention in the topsoil that results in low structural stability.
<b>Nutrient leaching</b>	Slight	These soils have a slight vulnerability of leaching to groundwater. This rating reflects the moderately high water-holding capacity and slow permeability of the fragipan, but leaching risk can be increased by lateral mole and tile drains.
<b>Topsoil erodibility by water</b>	Moderate	Due to the low clay content, the topsoil erodibility of these soils is moderate. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
<b>Organic matter loss</b>	Slight	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).
<b>Waterlogging</b>	Severe	These soils have a severe vulnerability to waterlogging during wet periods. This rating reflects the poor drainage and slow permeability of the subsoil.

## General landuse versatility ratings for Waikoikoi 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.

### WqR1 (Waikoikoi rolling deep)

### WqR2vg (Waikoikoi rolling moderately deep gravelly subsoil variant)

Versatility evaluation for soil WqR1, WqR2vg		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Inadequate aeration during wet periods; restricted rooting depth.
Arable	Limited	Inadequate aeration during wet periods; rolling slopes
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rain; rolling slopes
Forestry	Limited	Inadequate aeration during wet periods; restricted rooting depth.

**WqU1 (Waikoikoi undulating deep)****WqU1vj (Waikoikoi undulating deep argillic variant)****WqU2vg (Waikoikoi undulating moderately deep gravelly subsoil variant)**

<b>Versatility evaluation for soil WqU1, WqU1vj, WqU2vg</b>		
<b>Landuse</b>	<b>Versatility rating</b>	<b>Main limitation</b>
Non-arable horticulture	Limited	Inadequate aeration during wet periods; restricted rooting depth.
Arable	Limited	Inadequate aeration during wet periods; restricted rooting depth.
Intensive pasture	Limited	Vulnerability of topsoil to structural degradation by cultivation and compaction; risk of short-term waterlogging after heavy rain.
Forestry	Limited	Inadequate aeration during wet periods; restricted rooting depth.

**WqU1vi (Waikoikoi undulating moderately deep imperfectly drained variant)**

<b>Versatility evaluation for soil WqU1vi.</b>		
<b>Landuse</b>	<b>Versatility rating</b>	<b>Main limitation</b>
Non-arable horticulture	Limited	Inadequate aeration for sustained periods; restricted rooting depth.
Arable	Limited	Vulnerability of topsoil to structural degradation by cultivation and compaction; vulnerability to sustained waterlogging.
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rain.
Forestry	Limited	Restricted rooting depth.

**WqH1 (Waikoikoi hilly deep)****WqS1 (Waikoikoi steep deep)**

<b>Versatility evaluation for soil WqH1, WqS1.</b>		
<b>Landuse</b>	<b>Versatility rating</b>	<b>Main limitation</b>
Non-arable horticulture	Unsuitable	Hilly to steep slopes
Arable	Unsuitable	Hilly to steep slopes
Intensive pasture	Limited	Vulnerability of topsoil to structural degradation by cultivation and compaction.
Forestry	Limited	Inadequate aeration during wet periods; restricted rooting depth.

**Management practices that may improve soil versatility**

- Careful management after heavy rain and wet periods will reduce the impact of short-term waterlogging. Intensive stocking, cultivation and heavy vehicular traffic should be minimised during these periods.
- Installation and maintenance of sub-surface mole and tile drains will reduce the effects of short-term waterlogging, but may increase the risk of nutrient leaching to groundwater.
- If compaction occurs, aeration at the correct depth and soil moisture can be of benefit.

## Soil profiles available for Waikoikoi soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
WqU1	TT4	23	✓	✓	✓	✓
WqU1	B5	12	✓	✓	✓	✓
WqU1vi	B7	12	✓	✓	✓	✓
WqU1	OT03	42	✓	✓	✓	✓
WqU1	FT10	15	✓	✓	✓	✓
WqU1	GG/GW/72	35	✓	✓		
WqU1	GMT2	27	✓	✓	✓	✓
WqU1	GT3	4	✓	✓	✓	✓
WqU1	H9	3	✓	✓	✓	✓
WqR1	H10	3	✓	✓	✓	✓
WqU1	M102R	1	✓	✓		
WqU1	M3159	1	✓	✓		
WqU1	PCT07	33	✓	✓	✓	✓
WqU1	PCT13	33	✓	✓	✓	✓
WqU1	PCT14	33	✓	✓	✓	✓
WqU1	RT2	11	✓	✓	✓	✓
WqU1	RT3	11	✓	✓	✓	✓
WqU2vg	RT7	11	✓	✓	✓	✓
WqR1	SB09118	27	✓	✓		
WqU1	TT5	23	✓	✓	✓	✓
WqU1	TT6	23	✓	✓	✓	✓
WqU1	TT7	23	✓	✓	✓	✓
WqU1	WCT1	34	✓	✓	✓	✓
WqU1vj	WT8	24	✓	✓	✓	✓

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Crops for Southland  
PO Box 1306, Invercargill. New Zealand



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