Soil name: Fleming

Overview

Fleming soils occupy about 3000ha on low angle fans, low terraces and slowly accumulating floodplains of rivers and minor streams in eastern and northern Southland and west Otago. They are formed into alluvium derived from greywacke and schist rock. Fleming soils are imperfectly to poorly drained, with a dense fragipan at 45–90cm depth which restricts water drainage, and can occasionally be flooded. At present they are used for intensive sheep, dairy and deer production, with some cropping. Regular rainfall occurs and soils are seldom dry.

Soil classification

NZ Soil Classification (NZSC): Fragic Perched-gley Pallic; stoneless, silty
Previous NZ Genetic Classification: Gley recent

Classification explanation

Fleming soils were previously classified as Recent soils, but were reclassified as Pallic soils due to the significant profile development, reflected in the presence of a fragipan. Fleming soils are predominantly poorly drained, due to perching of water on the dense fragipan. The subsoil above the fragipan also typically has high density, which limits root growth. Fleming 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 Fleming soils are:

- Fleming undulating deep (FmU1): has no stones within 90cm depth; occurs on slopes of 0–7°
- Fleming undulating deep imperfectly drained variant (FmU1vi): has imperfect drainage; has no gravel within 90cm depth; occurs on slopes of 0–7°
- Fleming undulating moderately deep (FmU2): has gravel between 45 and 90cm depth; occurs on slopes of 0–7°
- Fleming undulating moderately deep imperfectly drained variant (FmU2vi): has imperfect drainage; has gravel between 45 and 90cm; occurs on slopes of 0–7°

The soil properties described in this Technical Data Sheet are based on the most common phase, Fleming undulating deep (FmU1). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating.

Associated soils

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

- Jacobstown: poorly drained Gley soil due to high groundwater; has no fragipan
- Ardlussa: well drained, deep or moderately deep Brown soils
- Gore: well drained, shallow stony Brown soils
- Mataura: well drained, deep or moderately deep recent soils found on the accumulating floodplain

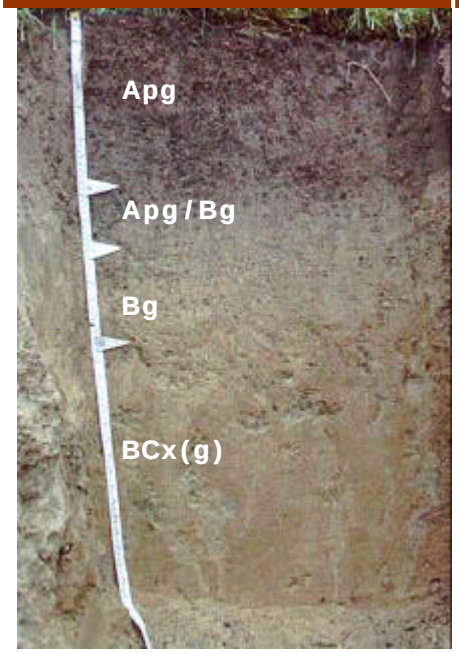
Similar soils

Some soils that have similar properties to Fleming soils are:

- Waikoikoi: formed in wind deposited loess on downlands.
- Athol: formed in wind deposited loess on downlands; has perch-gley properties, but no fragipan
- Pukemutu: formed in wind deposited loess on downlands; have silty clay subsoil
- 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.

Fleming profile	Horizon	Depth (cm)	Description
	Apg	0–23	Dark greyish yellow silt loam; few bright brown mottles; weak soil strength; moderately developed fine to coarse polyhedral structure; abundant roots
	Apg/Bg	23–33	Olive yellow silt loam;many worm casts; weak soil strength; moderately developed very fine to coarse polyhedral and blocky structure; many roots
	Bg	33–48	Olive yellow silt loam; common bright yellowish brown and few dull yellow mottles; slightly firm soil strength; moderately developed very fine to coarse blocky structure; common roots
	BCx(g)	48–90	Dull yellowish brown silt loam; few worm casts; common bright brown and common grey mottles; grey veins and bright brown selvedge between prisms; firm soil strength; weakly developed extremely coarse prismatic structure; few roots in veins

Key profile features

Fleming soils have an 18–28cm 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 structure 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
Apg	0–28	Moderate – High	*Moderate*	Silt loam	Gravel free
Apg/Bg	28–38	Moderate – High	*Moderate*	Silt loam	Gravel free
Bg	38–53	Moderate – High	*Slow*	Silt loam	Gravel free
BCx(g)	53–90	High	*Slow*	Silt loam	Gravel free

Profile drainage: Poor

Plant readily available water: *Moderately high*

Potential rooting depth: Slightly deep

Rooting restriction: Fragipan

Key physical properties

Fleming soils have a slightly deep potential rooting depth that is severely restricted by the fragipan. Plant available water is moderately high. The soils are imperfect to poorly drained, with slow permeability in the subsoil and limited aeration during sustained wet periods. The imperfectly drained variant often has better drainage, with only a thin fragipan. Textures are silt loams, but range between loamy silt and heavy silt loam. Topsoil clay content is 20–35%, and sandy lenses are common in the subsoil. The moderately deep phases have gravels between 45 and 90cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Apg	0–28	Low	Low	Moderate	Low	Moderate	Moderate	Very high	Low
Apg/Bg	28–38	Moderate	Moderate	Moderate	Moderate	Low	Moderate	High	Low
Bg	38–53	Moderate	Low	Low	Moderate	Low	Moderate	Moderate	Low
BCx(g)	53–90+	Moderate	Low	Low	Moderate	Low	Moderate	Very low	Low

Key chemical properties

Topsoil organic matter levels are 4–8%; P-retention values 20–40% (mostly 20–30%) and pH moderate (high 5s). Cation exchange values are moderate and base saturation moderate to low. Available calcium and magnesium levels are moderate, with potassium levels high. Soil reserves of phosphorus and sulphur 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	severe	These soils have a severe vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage and low P-retention.
Nutrient leaching	slight	These soils have a slight vulnerability to leaching to groundwater. This rating reflects the slow subsoil permeability and high water holding capacity. The imperfectly drained variant is likely to have a moderate vulnerability.
Topsoil erodibility by water	slight	Due to the moderate clay and organic matter levels, topsoil erodibility in these soils is slight. Erodibility is highly dependent on management, particularly when there is no vegetation cover.
Organic matter loss	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).
Waterlogging	severe	These soils have a severe vulnerability to waterlogging during wet periods. This rating reflects the poor drainage and slow permeability.

General landuse versatility ratings for Fleming 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.

FmU1 (Fleming undulating deep)

FmU2 (Fleming undulating moderately deep)

FmU1vi (Fleming undulating deep, imperfectly drained variant)

FmU2vi (Fleming undulating moderately deep, imperfectly drained variant)

Versatility evaluation for soil FmU1, FmU2, FmU1vi, FmU2vi		
Landuse	**Versatility rating**	**Main limitation**
Non-arable horticulture	Limited	Inadequate aeration during wet periods; restricted rooting depth
Arable	Limited	Inadequate aeration during wet periods; short-term waterlogging risk after heavy rainfall.
Intensive pasture	Limited	Short-term water logging risk after heavy rainfall
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 of subsurface mole and tile drains will reduce the risk of short-term waterlogging.
- If compaction occurs, aeration at the correct moisture condition and depth can be of benefit.

Soil profiles available for Fleming soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
FmU1	RT5	11	✓	✓	✓	✓
FmU2	VT9	2	✓	✓	✓	✓
FmU1	H7	3	✓	✓	✓	✓
FmU1	G525	4	✓	✓	✓	
Fmu1	M123	1	✓	✓	✓	
FmU1	M3156	1	✓	✓	✓	✓
FmU1vi	GG/GW103	35	✓			

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