Soils of the Lower Takaka Valley

Dr Iain Campbell
Land & Soil Consultancy Services
23 View Mount, Nelson

Introduction

At the request of the Tasman District Council, a survey of the soils of the Lower Takaka Valley was undertaken between July and December 2005. The purpose of the survey was to provide an updated soil map of lower Takaka Valley. The area covered, approximately 3000 ha, was the land on the northeast side of the Takaka River between Central Takaka Road and the coast. Adjacent hilly and steep lands were not examined. Areas of hilly land within the general survey area were given only cursory examination.

Survey Methods

Forty-four days were spent in field examinations of the soils. The soils were investigated by using an auger to extract soil material to a depth of 100cm where ever possible. Soil observations were made during traverses across terrain that was considered to be representative of the existing landforms. The traverses were positioned after a detailed study of some old 1940's aerial photographs. This greatly aids the interpretation of landform differences and assists in the identification of the soil patterns. A total of 620 auger observations were made as well as numerous examinations from various road cuttings and stream sections.

The soil material obtained in the auger borings was described in respect of the soil horizons, soil colours, soil texture; mottle patterns, consistence, stone content and hydrological features (where water was present). After completing the auger examinations, sites that were thought to be typical of the soil units identified were examined in detail in excavated soil pits. The location of all sites was recorded by GPS and a photographic record of the soil at each investigation site was also made. In the field, soil data were recorded with the help of an assistant using a hand held palm top, the data later being analysed to provide details of the characteristics and range of properties for each soil type identified.

Criteria for soil descriptions made during the survey are those given in the Soil Description Handbook (Milne et al. 1995) which is the official standard for New Zealand soils.

During the survey, auger observation sites were located on 1:8000 1984 aerial photo sheets and the soil boundaries were plotted on these. These boundaries were subsequently transferred by TDC staff onto an updated photogrametric base for compilation of the final soil map.

Landowner contact within the survey area was made prior to the start of the survey by Tasman District Council. Without exception, all of the landowners were very co-operative when subsequently visited to confirm their approval for soil inspections on their land, during the course of the survey.

Previous soil surveys of the area

The first soil survey of the area was probably conducted in the 1950's by Cawthron Institute staff, the map at a scale of one mile to the inch being undated. The data were never published however, and the only record of this work is a map showing the distribution of the various soil types that were identified. The 1:250,000 Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968) was at a more general scale and much of the information from the earlier survey was lost through the process of generalization. The later land Use Capability Survey was based on the 1:250, 000 General Soil Survey of South Island and did not provide any new soil information. A brief review of the soil pattern of lowland Takaka Valley was made by Obyrne (1983) but once again, no new soil information was gathered.

Reliability of the information

Soils are closely related to the landform on which they occur, but within a landform there are intrinsic variations in the soil properties due to variations in sedimentary processes (e.g. deep and shallow deposits on flood plain and terrace surfaces), variation in drainage conditions, differing erosion rates etc, differences in the composition of the soil materials etc. Given the time constraints for conducting a survey, it is not possible to produce an absolute resolution of the soil patterns and the information presented is therefore an interpretation based on limited observations and an understanding of soil and landscape processes.

Likewise, the assessment of the productive value of the soils is not based on actual land use within the district but is dependant on experience with soils with similar properties elsewhere. For the most part, the productive assessment given takes into account the nature of the limiting soil features. If these limitations are overcome (e.g. through drainage, flood protection, deep subsoiling, irrigation etc) the landuse rating class would be higher.

References

Agriculture New Zealand 1994. Classification System for Productive Land in the Tasman District. *Agriculture New Zealand, Richmond*.

Grindley, G W 1971. S 8 Takaka (1ST edition) Geological Map of New Zealand 1: 63,360. *Department of Scientific and Industrial research, Wellington, New Zealand.*

Mew, G 1980. Soils of Greymouth-Hokitika region, South Island, New Zealand. *N.Z Soil Survey Report 58.*

Milne, J D G, Clayden B, Singleton P L, Wilson A D. 1995. Soil Description Handbook. *Manaka Whenua Press Lincoln, Canterbury, New Zealand*

Obyrne, T N 1983. Lowland Soils of Takaka Valley. *Soil Bureau District Office Report NS 16. Department of Scientific and Industrial Research, New Zealand.*

Soil Bureau Staff 1968. General Survey of the Soils of South Island, New Zealand. *Soil Bureau Bulletin 27. New Zealand Department of Scientific and Industrial Research.*

Chittenden, E T, Hodgson, L, Dodson, K J. 1996. Soils and Agriculture of Waimea County New Zealand. Soil Bureau Bulletin 50. *New Zealand Department of Scientific and Industrial Research.*

Soil name and map symbol: Okari soils (Ok)

Concept and overview

Okari soils occupy 76 ha and occur on young coastal sand dunes alongside the coast. The soil material is derived from sands blown inland from the beaches and the soils occur principally in a long narrow strip within about 250 meters of the coast. The topography consists of low dunes, which in the Pohara area, have been widely built over for urban use.

Relationship to previously named soils

These soils were separated but un-named in the earlier unpublished soil map of the Takaka region. They were mapped within the lower rainfall (<1000mm) Tahunanui set (68c) in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968. They have a closer affinity with Okari soils which occur on young coastal dunes elsewhere in the region but under a higher rainfall (1000-2000mm).

Landform origin and history

The sands are derived from the granite, sedimentary, limestone and other rocks of the region. Coastal dunes are inherently unstable landforms with erosion or sedimentation fluctuating according to changes in the supply of sediment to the beaches. The dune sands of Okari soils are very recent, at most a few hundred years and have weakly developed soil profiles. The unconsolidated nature of the soil material makes Okari soils susceptible to wind and coastal erosion.

Key soil features

Okari soils have a thin weakly structured topsoil and an almost unweathered subsoil. They are sandy textured throughout and are loose and lack development of subsoil structure. They are excessively drained and lack significant moisture storage.

Identified variants

In places, the sand deposits are recent and lack a topsoil.

Associated and similar soils

Mahinapua soils formed on older sand dunes and with well developed soil profiles occur alongside Okari soils. Tahunanui soils are similar in having weakly developed profiles. They occur in the Tasman Bay region but under a lower rainfall.

Key physical properties

The A horizon is moderately deep and sandy textured with very weak soil strength. The B and C horizons are loose and unweathered and provide no restriction to plant rooting. The profile drainage is excessive and the plant available water is very low.

Versatility and land use ratings

Okari soils have a low versatility rating, the chief limitations being lack of structural development with susceptibility to wind erosion and excessive drainage with low soil moisture storage. These soils are grouped within class G of the Tasman District Council land classification scheme. However, provision of water at levels appropriate to specific plant requirements could result in their productive use.

\

Horizons	Depth cm	Description
A	0-20	Very dark grayish brown sand; very Weak soil strength; single grain structure; many roots
BC	20-45	Light yellowish brown sand; loose; single grain structure; few medium and coarse roots
C	45-100+	Pale olive sand; loose; single grain structure; few medium and coarse roots

Soil name and map symbol: Mahinapua soils (Ma)

Concept and overview

Mahinapua soils occupy only a small area, some 38 ha and occur in the Rototai area, a short distance inland from the coast. These are soils that have formed on sand dunes that are older than the dunes on which Okari soils are formed. The dunes have a gently rounded appearance which is a consequence of increased landscape stability and age. Because the soils are older, there is greater oxidation and breakdown of mineral material in the subsoil. Better soil structure and greater moisture storage than in the soils from the younger dunes adjacent to the coast allow horticultural crops to be more easily grown.

Relationship to previously named soils

Mahinapua soils were not identified in the early Takaka survey and in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968) they were included within the soils mapped as Tahunanui set (99c). The name Mahinapua is that used for older dune soils occurring on the South Island West Coast region (70c).

Landform origin and history

In coastal lands throughout New Zealand, there is evidence of numerous dune building periods going back several thousand years and relating to changes in climatic conditions and coastal sediment supply. Mahinapua soils in the Takaka region represent an early period of dune building, possibly 2-3000 years ago. The sand is somewhat coarser than that from which Okari soils have formed and this suggests that coastal conditions and climate may have been a little different from today. These dunes are stable and are not susceptible to wind erosion.

Key soil features

Mahinapua soils have a moderately deep to deep sand to loamy sand topsoil (average depth 25cm) which is predominantly dark reddish brown to black. The B horizon is medium to coarse sand and its depth averages 50cm. It is yellowish brown to dark brown coloured and slightly firm. Deeper horizons are generally olive coloured before passing into unweathered loose sand which in the lower subsoil is commonly coarse.

Identified variants

In some places, Mahinapua soils are moderately deep (45-90cm range), overlie gravel and may have impeded subsoil drainage. The lower B horizon may sometimes be weakly iron cemented.

Associated and similar soils

Mahinapua soils are associated with Okari soils which occur on younger sand dunes nearer to the coast. In places they merge into Karangarua soils where the sand thins and drainage becomes poorer.

Key physical properties

Mahinapua soils are moderately deep to deep, have sandy textures throughout and have a slightly firm subsoil. Soil structure is weakly developed and reflects the sandy textures. They are well drained, have moderately rapid permeability and have a deep rooting depth.

Versatility and land use rating

The versatility of Mahinapua soils is restricted somewhat by their sandy textures, weakly developed soil structures and moderately rapid permeability. They are never the less capable of growing a wide range of tree or vine crops. They are grouped in class B of the Tasman District Council land classification scheme.

Horizons	Depth cm	Description
A	0-23	Black loamy sand; weak soil strength; weakly developed polyhedral structure; many fine and medium roots
AB	23-34	Yellowish brown and black loamy sand; weak soil strength; weakly developed polyhedral and blocky structure; few to many fine and medium roots
Bw	34-50	Yellowish brown loamy sand; weak to slightly firm soil strength; weakly developed blocky structure; few fine roots
BC	50-78	Light olive brown sand; slightly firm to firm soil strength; massive; many yellowish red diffuse fe concentrations; few roots
C	78-100	Pale olive sand; loose; single grain structure; Few fine roots

Soil name and map symbol: Karangarua (Ka)

Concept and overview

Karangarua soils cover 112 ha and occur on low lying land adjacent to the Waitapu and Motupipi-Pohara estuaries. Up until the 1940's, much of this land was swampy and unused but construction of drains and stopbanks and lowering of the water tables improved the soil drainage and facilitated pastoral use of these soils for dairy cattle grazing.

Relationship to previously named soils

The early unpublished soil survey of the Takaka district separated these soils as unclassified swampy soils, while the later 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) grouped these soils within the Karamea set (99c). Karangarua soils are similar to soils of the same name that were mapped in low lying swampy areas in soil surveys of the West Coast in the 1980's (Mew 1980).

Landform origin and history

The low lying land around the estuary margins comprises alluvial sands and gravels deposited in deltaic and estuarine conditions. In places, a low terrace is present and probably represents a surface formed at a time when sea level was slightly higher. Thin deposits of wind-blown sand are present on some of the surfaces in the Rototai and Pohara areas. Much of the area was previously in lowland forest and decomposed woody material can be found buried in some of the soils, but nearer the coast, the conditions were estuarine.

Key soil features

Karangarua soils are poorly drained and have a dark reddish brown silt loam topsoil, although it is sometimes peaty. The subsoil is predominantly light grey, grey or olive grey generally with few mottles, while textures vary from silt loam to sand. Underlying gravel is present in most places at an average depth of 70cm. A water table was present in 64% of the observation sites at an average depth of 43 cm.

Identified variants

In some of the lowest lying areas, the surface horizons are peaty and buried peaty horizons are also occasionally present. Shallow soils (<45cm to gravel) occur over about 10% of the area. Where the water table is at a greater depth, the soil drainage is imperfect.

Associated and similar soils

Some patches of Mahinapua soils, which are formed from older sand dunes, occur with Karangarua soils in the Rototai area. Harihari soils are also poorly to imperfectly drained soils from river alluvium but they occur in low lying floodplain areas and in old river meander channels.

Key physical properties

Karangarua soils have a shallow to moderately deep rooting depth that is severely restricted by the presence of a water table. Underlying gravels are sometimes iron cemented and also restrict root penetration. The soils are poorly drained with severe reducing conditions in the subsoil. Textures are predominantly silt loam but sometimes sandy or clayey. Some flooding occasionally occurs.

Versatility and land use ratings

Under the present drainage conditions, Karangarua soils have a low versatility rating, the limitations being susceptibility to flooding, poor drainage and shallow to moderately deep rooting depth. They are included in class E of the Tasman District Council land classification scheme. Flood prevention and further drainage improvement with a lowering of the water table could raise the productive value of these soils to class C.

Horizon	Depth (cm)	Description
A	0-18	Dark reddish brown peaty loam; weak soil strength; weakly developed fine polyhedral structure; many fine roots
Of	18-22	Dusky red humic loam; very weak soil strength; very weakly developed fine polyhedral structure; few fine roots
Cr	22-50	Grey silt loam; massive; weak soil strength; few fine roots
Ch	50-65	Partly decomposed tree remains

Soil name and map symbol: Takaka (Ta)

Concept and overview

Takaka soils cover 313 ha and occur on the low river surfaces adjacent to the Takaka River and its principal overflow channel, the Motupipi River. These are young soils formed on the floodplain surfaces that have been frequently flooded and which show little soil development. The land surfaces often have gentle undulations and sometimes shallow gullies that have formed through river meandering and flood flows. Levees and some minor terracing occur adjacent to the rivers in some places.

Relationship to previously named soils

Soils on the floodplains were separated in the early unpublished survey of the Takaka district as Takaka sands, gravel and stony loams. In the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968), they were included within Karamea set (99c). In the present survey, Takaka soils are separated according to the original definition.

Landform origin and history

Geomorphically, the Takaka Valley appears to be a stable landscape system, as the height difference between the upper river terraces and the lower terraces and floodplain is relatively small. The present floodplain is probably greatly influenced by changes in vegetation and river sediment loads consequent upon the vegetation changes that followed European settlement. The frequent flooding on surfaces near the rivers is recorded by layers of buried soils in the sediments. Although the Motupipi River is essentially spring fed, overflows of the Takaka River have contributed to the development of floodplain, terrace and levee surfaces in this stream.

Key soil features

Takaka soils are well drained, predominantly deep soils (>90 cm over gravel) but with shallow silt loam topsoils (average 16cm). The upper subsoil is thin (average 19cm) and olive brown with variable sandy or loamy texture and weakly developed structure. It commonly overlies a buried A horizon (40% of observations), or in some cases several buried A horizons. The lower subsoil is unweathered and generally consists of olive brown to light olive brown friable to loose sandy loam or sand.

Identified variants

Takaka stony soils (gravelly at the surface), Takaka shallow soils (<45cm depth to gravel) and Takaka moderately deep soils (45-90cm to gravel) occur over about 45% of the area. The stony, shallow and moderately deep soils commonly have sandy or sandy loam textures. Weakly mottled soils occur in a few lower lying places where there is a slight drainage restriction.

Associated and similar soils

Tata soils, which occur on the flood plains of the streams flowing from the Pikikiruna Range also, have weakly developed soil profiles but they are formed from different materials. Takaka soils are closely associated with Karamea soils, the latter occurring at slightly higher levels on the valley floor and not having very recent additions of flood deposits. Harihari soils occur in association with Takaka soils in low lying old meander channels and are imperfectly drained.

Key physical properties

Takaka soils are predominantly deep and well drained. There are no restrictions to deep rooting. Topsoil and subsoil structure are weakly developed because of the recent soil age and lack of significant weathering. The presence of older buried A horizons is indicative of past sedimentation and a susceptibility to flooding. Moisture storage is limited by the sandy subsoil textures.

Soil versatility and land use rating

Takaka soils are moderately versatile, their potential use being restricted by susceptibility to flooding and weak soil structure, which could lead to compaction under intensive use. They are included in class B of the Tasman District Council land classification scheme but removal of the flood risk through stop bank protection could raise the productive value of these soilsto class A.

Horizons	Depth cm	Description
A	0-15	Brown to dark brown silt loam; very weak soil strength; weakly developed polyhedral structure; many fine and few medium roots
C1	15-64	Olive brown silt loam; weak soil strength; massive to single grain structure; many fine roots
C	64-110	Olive brown sandy loam; very weak soil strength; single grain structure; few fine roots

Soil name and map symbol: Karamea soils (Km)

Concept and overview

Karamea soils cover 398 ha and occur widely on the main valley floor. They are well drained but weakly developed soils that are formed on surfaces just above the floodplain of the Takaka River so are not subject to repeated flooding. The alluvium is derived from a wide range of rock types including granites, sandstones, limestone and marble. The upper layers are fine textured but pass into sands and gravels.

Relationship to previously named soils

In the early unpublished soil survey of Takaka district, Karamea soils were distinguished as Takaka loam and Takaka sand. In the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968), these soils were separated as Karamea set (99c) for soils from alluvium above the floodplain. This name is retained in the present survey.

Landform origin and history

Karamea soils are formed on the most extensive low terrace of the Takaka Valley. The weak profile development of Karamea soils indicates that the land surfaces are recent, perhaps only 2-300 years old. The occurrence of Karamea soils in the eastern part of the lower floodplain (between Takaka and Motupipi) indicates that the river outlet has varied between Motupipi and Waitapu in Recent times. Changes in the river course may result from changes in the sediment supply or in the flow conditions of the Waingaro and Anatoki Rivers.

Key soil features

Karamea soils are deep (>90cm) and well drained. The topsoil is moderately deep, dark yellowish brown silt loam (average 22.5cm) and overlies a pale subsoil (30cm light olive brown) which is friable with weakly developed structure. Below this, is predominantly unweathered loose fine to coarse sand.

Identified variants

Karamea shallow silt loam (<45cm over gravel) occurs over about 6% of the area, usually on shallow ridges between old drainage channels and Karamea moderately deep silt loam over 10% of the area. Soil texture is predominantly silt loam but heavy silt loam and sandy textured soils are sometimes present. In a few places, such as previous river channels soil drainage in the lower subsoil is restricted.

Associated and similar soils

Waingaro soils occur with Karamea soils on the same land surfaces but in sites such as old back swamps where soil drainage is imperfect. On the lower part of Takaka Valley towards the coast, Karamea soils merge into Waingaro soils as drainage on the low lying surfaces becomes impeded. TeTahu soils are of a similar age as Karamea soils and occur on terraces of the small streams (Dry River and Rameka Creek) flowing from the Pikikiruna Range.

Key physical properties

Karamea soils are deep soils with silt loam passing into sandy loam or sand in the lower subsoil. The subsoil structure is weakly developed and reflects the youthful age of the soil. They have good moisture storage and the soil drainage class is well drained. There is no rooting depth restriction.

Soil versatility and land use rating

Karamea soils have few limitations for intensive use, but weak subsoil structure may make them susceptible to compaction under some forms of use. They are included within class A of the Tasman District Council land rating scheme.

Horizons	Depth cm	Description
A	0-18	Brown to dark brown silt loam; weak soil strength; moderately developed medium polyhedral structure; abundant roots
B	20-46	Light olive brown silt loam; weak soil strength; weakly developed polyhedral and blocky structure; many fine roots
C	46-100	Olive brown loamy sand; loose, single grain structure; many to few fine roots

Soil name and map symbol: Harihari soils (Ha)

Concept and overview

Harihari soils cover a small area, approximately 15 ha and are the imperfectly to poorly drained equivalent of the flood prone Takaka soils They occur on the Takaka River flood plain in low lying depressions and are formed from river alluvium deposited as a consequence of recent flood events. They are found mainly in small narrow strips of land that were previous river channels.

Relationship to previously named soils

Harihari soils were not separated in the in previous unpublished soil survey of the Takaka district and they were included within the soils mapped as Karamea soils ((99c) in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968). Harihari soils have been widely mapped in the West Coast region as imperfectly drained soils from recent alluvium (Mew 1980).

Landform origin and history

The Takaka River is a graded river that responds quickly to changes in discharge or bed load parameters. This is reflected in its meander pattern in the lower reaches. Recent floods have given rise to river channel changes with some meanders having been cut off. The former river channels form low lying curved depressions with imperfectly drained Harihari soils.

Key soil features

Harihari soils are imperfectly drained with a water table commonly present in the lower subsoil or rising nearer the surface at times of high river levels. The topsoil is shallow (average 16cm) with weak structure and soil strength. It overlies unweathered grey to olive grey subsoil with light grey and reddish brown mottles, which indicate variable oxidation and reducing conditions. The subsoils are generally sandy textured and are loose and without structural development. Buried A horizons are present in places.

Associated and similar soils

Harihari soils occur within the same landform system as Takaka soils which are found on the well drained sites. Karangarua soils are also imperfectly to poorly drained soils but occur in the low lying wetland areas bordering the coastal estuaries. Waingaro soils also occur in lower lying areas associated with Karamea soils.

Identified variants

Soils with buried horizons are present in a few places. Shallow (<45cm to gravel) and moderately deep (45-90cm to gravel) may also occur.

Key physical properties

Harihari soils have weakly developed soil structure, have imperfect drainage and a moderate rooting depth that is restricted by the water table.

Soil versatility and land use rating

Harihari soils have a low versatility, their use being restricted by the presence of groundwater, imperfect drainage and consequent restricted rooting depth. Frequency of flooding and ponding of flood waters are additional limitations. The soils are grouped in class F of the Tasman District Council land classification scheme.

Horizon	Depth cm	Description
A	0-13	Brown to dark brown silt loam; very weak soil strength; weakly developed fine polyhedral structure; many fine and few medium roots
Cg1	13-40	Olive silt to silt loam; common medium distinct yellowish red mottles; weak soil strength; massive; few fine roots
Cg2	40-71	Greyish brown fine sandy loam; common fine faint yellowish red mottles; weak soil strength; massive; few fine roots
Cg3	70-95+	Light brownish grey sand; few medium distinct mottles; very weak soil strength; single grain; no roots

Soil name and map symbol: Waingaro soils (Wa)

Concept and overview

Waingaro soils cover 62 ha and occur in several small areas on lower lying parts of the lower terraces of the Takaka river system. They are the imperfectly drained equivalent of Karamea soils. Their drainage status is a result of their location in either a) back swamp locations where surface drainage and subsoil drainage may be impeded, b) in drainage channels or in lower parts of the valley where ground water is near the surface, or c) adjacent to hill slopes where there is excess water from runoff.

Relationship to previously named soils

Waingaro soils were not previously identified or separated in the previous survey of Takaka Valley or the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968) and were included within the Karamea set (99c).

Landform origin and history

The main Takaka Valley alluvial surface is a little above the present floodplain surface and lower lying areas are influenced by high ground water or by surface water ponding during extreme flood events. These sites intrinsically have soil drainage restrictions. Drainage improvements since European settlement including flood protection and construction of drains and deepening of drainage channels have improved the hydrological character of these soils through lowering of the water tables and a reduction in the frequency of surface flooding.

Key soil features

Waingaro soils are deep but imperfectly drained. They have a moderately deep topsoil (average 22cm) with predominantly silt loam textures. The upper subsoil is olive coloured and passes into firm olive to light olive brown silt loam or clay loam with many distinct reddish brown or strong brown coloured mottles. The mottle pattern is a result of iron segregation due to water table fluctuations (which may be present) and variation in oxidizing and reducing conditions. The deeper subsoil commonly has sandy or sandy loam texture.

Identified variants

Waingaro soils are occasionally shallow (<45cm to gravel) or moderately deep (45-90cm to gravel). In places, a water table is present in the lower subsoil and the soils are imperfectly to poorly drained.

Associated and similar soils

Waingaro soils are associated with Karamea soils which are well drained. Valley floor drainage channels often have Waingaro soils with Karamea soils on the broad surfaces between. In the lower parts of Takaka Valley near Rototai and Waitapu, Waingaro soils merge with Karangarua soils, which are poorly drained with a higher water table.

Key physical properties

Waingaro soils are imperfectly drained with water at times rising into or being retained in the subsoil. The potential rooting depth is moderate where a water table is present but moderate to deep where profile drainage has been improved. Subsoil structure is weakly developed and commonly massive in the lower horizons. Severe topsoil poaching may occur with stock grazing under wet conditions.

Soil versatility and land use rating

Waingaro soils are moderately versatile, their use being restricted by their impeded drainage and susceptibility to occasional surface water ponding. In most areas, drainage has already raised the productive capacity of these soils. They are included within class C of the Tasman District Council land rating scheme.

Horizons	Depth cm	Description
A	0-27	Brown to grayish brown heavy silt loam; weak soil strength; weakly developed fine polyhedral structure; many fine and medium roots
BCg	27-53	Olive heavy silt loam; common medium distinct yellowish red mottles; very weak soil strength; weakly developed blocky structure; few fine roots
Cg	53-85+	Olive grey heavy silt loam; many dark grayish brown and yellowish red fine distinct mottles; weak soil strength; weakly developed fine blocky structure; few fine roots

Soil name and map symbol: Tata soils (Ta)

General concept and overview

Tata soils cover 24 ha (101 ha including complex with Te Tahu soils) and are found to the south east of Takaka on the flood plain and low terraces of narrow stream channels of Rameka Creek and Dry River. They are soils with weakly developed profiles that are formed on recent deposits of stream alluvium in these water courses. They are distinguished from Takaka and Karamea soils, also weakly developed soils from young alluvium, in having slightly darker colours resulting from mineral assemblages derived from the granite, diorite and marble rocks of the Pikikiruna Range.

Relationship to previously named soils

Tata soils, along with the newly recognised Te Tahu soils of the present survey, were mapped in the early soil survey of the Takaka district as "miscellaneous soils" along with a range of other soils from alluvial deposits. They were not separated in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff) and were mapped within the Rameka set (80b).

Landform origin and history

Rameka Creek and Dry Stream discharge from narrow gorges cut into limestone and marble rocks of the Pikikiruna Range. They have dissected older Kaituna and Bainham Formation terrace gravels (Grindley 1971) forming incised narrow winding channels that grade to and discharge across the present Takaka floodplain system. Both Rameka Creek and Dry Stream have several discontinuous terraces marking stages in the down cutting of these streams. Tata soils are found on the floodplains of these streams with the alluvium being deposited in post European time, largely as a consequence of vegetation change and erosion in the stream catchments.

Key soil features

Tata soils have weakly developed profiles and are predominantly deep with a moderately deep (average 22cm) dark yellowish brown topsoil. The B horizon, where present (<50%) is shallow (average 22cm) and is very friable with weakly developed soil strength. The C horizon which underlies either the A or B horizons is olive brown to dark yellowish brown and is very friable or loose. Underling gravel at a depth of <60cm is present in 50% of the soils. Textures throughout are dominantly sandy to sandy loam. The soils are well drained to somewhat excessively drained. Buried soil horizons are frequently found (25% occurrence).

Identified variants

Tata soils include some shallow and stony soils (<45cm to gravel,15%) and moderately deep soils (45-90cm to gravel 30%). Soils with slightly impeded drainage are occasionally present.

Associated and similar soils

Tata soils are associated with TeTahu soils, which occur on surfaces that are a little higher and older in the same stream systems and which have greater soil development. Tata soils are similar to Takaka soils which occur on the main valley floodplain but they are likely to have a differing soil chemical composition because of their formation from differing rock types.

Key physical properties

Tata soils are deep and well drained with a deep rooting depth. Structure is weakly developed and soil strength is weak. In places, they are subject to occasional flooding.

Soil versatility and land use rating

Tata soils are versatile soils with few limitations to intensive use (apart from the discontinuous narrow gully floor areas) where flooding may occasionally occur. Where they occur discontinuously with TeTahu soils, intensive use is not practical. They are included in class A of the Tasman District Council land classification scheme.

Horizons	Depth cm	Description
A	0-24	dark brown to brown heavy silt loam; moderately developed fine polyhedral structure; many fine and medium roots
AB	24-36	Light olive brown and brown silt loam to fine sandy loam; weak soil strength; weakly developed medium blocky structure; many fine and medium roots
BC	36-53	Light yellowish brown to light olive brown loamy sand; very weak soil strength; weakly developed medium blocky structure; few medium roots
C	53-92+	Olive brown fine sand; loose; single grain structure; few medium roots

Soil name and map symbols: Te Tahu (Tt, Tt1)

General concept and overview

Te Tahu soils cover 34 ha and are found to the south east of Takaka in stream channels, terraces and outwash surfaces of Rameka Creek and Dry River. They are soils with weakly to moderately developed profiles, often shallow or stony, that are formed on deposits of stream alluvium above the flood plain and on the terraces and older surfaces that occur in these water courses. They are distinguished from Tata in having more distinctly developed soil profiles. Like Tata soils, they are derived from granite, diorite and marble rocks from the Pikikiruna Range.

Relationship to previously named soils

Te Tahu soils, along with the newly recognised Tata soils of the present survey, were mapped in the early soil survey of the Takaka district as "miscellaneous soils" along with a range of other soils from alluvial deposits. They were not separated in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff (1968) and were included within the Rameka set.

Landform origin and history

Rameka Creek and Dry Stream discharge from narrow gorges cut into limestone and marble rocks of the Pikikiruna Range. They have dissected older Kaituna and Bainham Formation terrace gravels (Grindley 1971) forming incised narrow winding channels that grade to and discharge across the present Takaka floodplain system. After the formation of the intermediate level Kaituna gravel plain and terrace, Rameka Creek and Dry Stream subsequently cut channels through these surfaces. The alluvium on the upper terrace and outwash surfaces of these streams is above the floodplain and marks stages in the stream down cutting.

Key soil features

Te Tahu soils are moderately deep (45-90cm to gravel) but in places, gravel occurs within 20cm of the surface (Te Tahu shallow soils, Tt1). The topsoil is moderately deep (average 22cm) dark yellowish brown fine sandy loam and overlies a thin B horizon (average 23cm) that is olive brown to yellowish sandy loam. The B horizon merges into a C horizon of unweathered loose gravel or sandy loam.

Identified variants

Te Tahu shallow soils occur near Central Takaka Road to the south of the Hospital, and have a stony topsoil and a stony subsoil. TeTahu deep soils (>90cm to gravel) are also found.

Associated and similar soils

Associated with TeTahu soils are Tata soils which occur on the lower lying floodplain surfaces of Rameka Creek and Dry Stream and which are younger soils with weakly developed soil profiles. Hamama soils resemble Te Tahu soils in respect of their stoniness but they are somewhat older and have browner subsoil colours.

Key physical properties

Te Tahu soils are well drained, with the TeTahu shallow soils being somewhat excessively drained. The soil strength in the upper horizons is predominantly weak. The subsoil gravels are not compact or cemented and do not restrict root penetration. Soil moisture storage is high in the deeper soils but medium to low in the stony soils. The soils are not susceptible to flooding or surface drainage impediment.

Soil versatility and land use rating

The deeper Te Tahu soils are versatile soils with few soil limitations for intensive use. Their patchy occurrence in stream gullies, however limits their potential use. Limitations in the shallow TeTahu soils include their shallow profiles and stony subsoils with soil moisture deficiency. Te Tahu moderately deep and deep soils are included in class A of the Tasman District Council land classification scheme and TeTahu stony soils in class B.

Horizons	Depth cm	Description
A	0-25	Dark yellowish brown silt loam weak soil strength; moderately developed fine polyhedral structure; few unweathered stones; abundant fine and medium roots
AB	25-35	Dark yellowish brown and dark yellowish brown to olive brown silt loam; weak soil strength; moderately developed fine polyhedral structure; common unweathered stones; many fine and medium roots
BC	35-57	Olive brown sandy loam; weakly developed coarse blocky structure; many unweathered stones; few fine roots
C	57-90+	Olive sandy gravel; loose; single grain structure; many unweathered stones; few fine roots

Soil name and map symbol: Clifton (Cf)

General concept and overview

Clifton soils occupy about 93 ha and occur on the bottoms of the small gullies, secondary channels and minor drainage depressions, largely towards the eastern side of the survey area. The soils in these stream courses are formed from sediments that are derived through hill slope erosion of nearby Tarakohe Formation sedimentary rocks and also reworked gravely materials from the old alluvial deposits of the higher terrace formations. The alluvium is predominantly fine textured and for the most part, the soils have imperfect to poor drainage. However, sedimentary and drainage conditions on the floors of the gullies are highly variable.

Relationship to previously named soils

The soils formed on sediments in small gullies were not separated in the early unpublished soil survey of the Takaka district and in part were included with "miscellaneous soils on alluvial depositions" Neither were these soils separated in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968). In the early unpublished survey of the soils of Takaka district, the name Clifton was used for a small area of soils from older fan deposits in the Clifton area but the name is used differently in the present survey.

Landform origin and history

The erosion and sedimentation history of the small streams and gullies in which Clifton soils occur are different from the larger Rameka Creek and Dry River which have their headwaters in the Pikikiruna Range. While these minor streams today lack significant water flows, the extent of some of the gullies indicates that gully erosion in the past has been active, most probably during periods in which rainfall was much greater than present. In some places, only a thin layer of alluvium lies over underlying Tarakohe Formation sedimentary rock. The gully floor sediments, having been derived from adjacent hill slopes are predominantly fine grained and the soils are largely heavy textured. In the Clifton area, most of the small gullies have originated from springs that have emerged on the lower surfaces of sloping fan deposits.

Key soil features

Clifton soils are moderately deep (45-90cm above gravel or sedimentary rock) and the topsoil (average depth 23cm) is brown to dark brown heavy silt loam and overlies a yellowish brown clay loam B horizon (average 22cm) that often contains some darker coloured mottles. Below, the subsoil is light yellowish brown to olive clay loam with increasing proportions of grey and reddish brown mottles. Underlying gravel is present over about 50% of the area, but at variable depths, and is generally compact. A water table is sometimes present.

Identified variants

Near small streams, the soils may be shallow (approximately 30%) with gravel sometimes at the surface. In some locations, shallow or moderately deep soils overlie sedimentary rock. In some gullies where springs or seepages occur, the soils are poorly drained and the topsoils are peaty.

Associated and similar soils

In the Clifton area, Clifton soils are associated with Motupipi and Pohara soils, Motupipi soils occurring on well drained upper fan surfaces and Pohara soils on lower fan surfaces. Glenview soils are also imperfectly drained but have an underlying iron pan.

Key physical properties

Clifton soils are moderately well drained to imperfectly drained. They have clayey subsoil textures with slow permeability that gives rise to subsoil reducing conditions, which occasionally extend to near the soil surface. The potential rooting depth is moderate and is restricted by the underlying compact gravel. Some flooding occasionally occurs on the gully floors.

Soil limitations and land use rating

Clifton soils have moderate limitations for intensive use, their imperfect drainage, restricted rooting depth and occasional surface flooding limiting their potential. Their physiographic location and attenuated distribution also limit intensive use. They are included in class E of the Tasman District Council land classification scheme.

Horizon	Depth	Description
A	0-23	Very dark greyish brown silt loam; weak soil strength; moderately developed fine polyhedral structure; few medium stones; many fine and few medium roots
AB	23-34	Very dark grayish brown and light olive brown heavy silt loam; weak soil strength moderately developed medium blocky structure; few medium stones; many fine and few medium roots
Bwg	34-48	Olive heavy silt loam; common brownish yellow fine distinct mottles; weak strength; weakly developed coarse blocky structure; few fine roots
Bg2	48-60	Light brownish grey loamy sand; many yellowish brown medium distinct mottles; weak soil strength; weakly developed coarse blocky structure; few medium stones; very few fine roots
C	60-85+	Light grey to grey loamy sand; few fine olive brown mottles; firm soil strength; massive; many medium and coarse stones; no roots

Soil name and map symbol: Hamama soils (Ha)

Concept and overview

Hamama soils cover 107 ha. In the present survey area, they occur predominantly in the area east of Rototai Road, between the High School and the Takaka dairy factory and also in some other small scattered patches. They are older than the more extensive floodplain and lower terrace soils and are formed on the uppermost of the low alluvial terrace system of the Takaka Valley. The soils are well drained and are characterised by gravelly subsoils with the gravel occurring anywhere between shallow to moderate depths.

Relationship to previously named soils

In the early unpublished survey of the soils of the Takaka district, Hamama soils were originally mapped as Takaka gravel and stony loams where they occurred chiefly in the Hamama and East Takaka districts on the prominent old river valley terrace surface. However, in the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968) they were named as Hamama soils (43a), this name being retained in the present survey.

Landform origin and history

The terrace surface on which Hamama soils occur represents a major period of gravel aggradation in Takaka Valley about the end of the Last Glaciation around 10-12,000 years ago. At the end of the glacial period, the supply of detritus from the steeper largely vegetation free slopes was reduced after forest was re-established on mountain slopes. With a reduced supply of gravel, the rivers cut down through the accumulated gravels and formed the low fluvial and floodplain surfaces, leaving remnants of the glacial outwash aggradational terrace gravels in the lower part of Takaka Valley.

Key soil features

Hamama soils are well drained soils that have a well developed dark grayish brown moderately deep A horizon with underlying yellowish brown to dark yellowish brown B horizons with predominantly silt loam textures. Coarse unconsolidated gravel is present at an average depth of 50cm with unweathered olive brown gravel (C horizon) at about 80cm, but some stones may occur throughout.

Identified variants

Hamama shallow silt loam (depth to gravel <45cm) occurs over 55% of the area and Hamama moderately deep silt loam (depth to gravel 45-90cm) over 45% of the area. Some deeper soils may have slightly impeded drainage.

Associated and similar soils

TeTahu soils, which are formed on small terraces in the channels of streams from the Pikikiruna Range occasionally have similar profiles but they are derived from a wider variety of rock types and are likely to have a different soil chemistry.

Key physical properties

Hamama soils have well developed structure with predominantly silt loam texture. There are generally less than 5% stones in horizons above the gravel. The soils are well drained and have little restriction to rooting.

Versatility and land use rating

Hamama soils have a moderately high versatility rating, the chief limitation being the comparatively shallow depth to gravel and the associated moderate water holding capacity. With irrigation, the productive value is high. They are included in class A of the Tasman District Council land rating scheme.

Horizon	Depth cm	Description
A	0-21	Dark yellowish brown silt loam; weak to slightly firm soil strength; moderately developed fine polyhedral structure; many fine and medium roots
AB	21-38	Yellowish brown and dark yellowish brown silt loam; weak to slightly firm soil strength; moderately developed medium polyhedral structure; very few unweathered stones; many fine and medium roots
Bw	38-63	Yellowish brown heavy silt loam; slightly firm soil strength; weakly developed medium blocky structure; few unweathered stones; many fine roots
BC	63-84	Yellowish brown fine sandy loam; slightly firm soil strength; weakly developed fine blocky structure; few unweathered stones
C	84-100+	Olive brown to brown sandy gravel; loose; single grain structure; stones coarse and unweathered; very few fine roots

Soil name and map symbol: Rototai soils (Ro)

Concept and overview

Rototai soils cover 224 ha and occur on gently sloping land in the Rototai and Motupipi areas. They are formed on land surfaces that lie on the lower slopes of adjacent hilly land where the sandy sedimentary rocks of the Motupipi Coal Measures occur. The soil materials have been derived from erosion of these sedimentary rocks and have slowly accumulated as down slope sedimentary wash (colluvium).

Relationship to previously named soils

The earlier unpublished survey of the soils of the Takaka district separated these soils as Clifton clay loam. In the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968) these soils were not separated but were included within Karamea set (99c).

Landform origin and history

The gently sloping land beneath the adjacent hills may once have been a river or coastal terrace surface. Subsequently, erosion of the sedimentary rocks on the adjacent hills has resulted in the slow accumulation of sediments on the lower slopes since the last glacial period. Apart from an increase in sand in the lower subsoil (about 1m) the soil material does not show distinct sedimentary stratification.

Key soil features

Rototai soils have a moderately deep to deep topsoil with a silt loam to sandy clay loam, light olive brown subsoil. In the lower subsoil, some orange mottles are present. At greater depth, the subsoil becomes firm and both orange and grey coloured mottles are present. The subsoil colour patterns indicate that at times there may be temporary reducing conditions due to slow water movement, possibly in a lateral direction.

Identified variants

The main variation in Rototai soils is in respect of their soil drainage. Some profiles on higher ground have few subsoil mottles and are well drained. On the lowermost slopes where the land surface merges with Karangarua soils, the soils are imperfectly drained.

Associated and similar soils

Rototai soils are associated with Waitapu soils which occur on adjacent hilly land. On the lowermost slopes where they occur, they merge into Karangarua soils.

Key physical properties

Rototai soils are deep soils with clay loam subsoil textures, moderately developed soil structure, good rooting depth, and good soil moisture storage. The deep subsoil is weakly structured and may be massive. Rototai soils occur on gently sloping land and are free from surface flooding. The soil drainage class is moderately well drained.

Soil limitations and land use rating

The main limitations are the variable and somewhat impeded drainage status of the lower subsoil. A compact lower subsoil horizon may sometimes restrict downward water movement but this would probably be overcome through drainage improvements. Rototai soils are included in class B of the Tasman District Council and classification scheme but with drainage improvement could be included in class A.

Horizons	Depth cm	Description
A	0-26	Dark yellowish brown silt loam; weak soil strength; moderately developed fine polyhedral structure; many medium and few fine roots
Bw1	26-51	Yellowish brown to light olive brown silt loam; weak soil strength; weakly developed coarse blocky structure; many fine roots
Bw2	51-72	Light yellowish brown heavy silt loam; few strong brown fine distinct mottles; moderate soil strength; weakly developed coarse blocky structure; few fine roots
Bw3	72-95+	Light yellowish brown heavy silt loam to clay loam; common yellowish brown and light yellowish brown fine distinct mottles; firm soil strength; massive; very few fine roots

Soil name and map symbol: Motupipi (Mo)

General concept and overview

Motupipi soils cover 353 ha and occur widely between Motupipi and Pohara. They are formed on the younger outwash and alluvial terrace deposits of Dry Creek and on the fan deposits of the smaller streams to the north. The soils are deep and well drained and unlike Psigah and Rameka soils which are underlain by weathered or partly weathered gravel, the gravel underlying Motupipi soils is unweathered. Near Motupipi, there is a distinct terrace system associated with Dry Creek and the land surface is broad and flat to gently sloping, but further north, the fan surfaces are sloping and partly dissected.

Relationship to previously named soils

Motupipi soils were mapped in the Motupipi area in the earlier unpublished survey of the soils of the Takaka district as mature alluvial soils. They were not separated in the 1:250,000 General Survey of the Soils of South Island (NZ Soil Bureau Staff 1968) and were included within the Rameka and Puramahoi sets.

Landform origin and history

Motupipi soils occur on terrace and fan sediments of the Bainham Formation (Grindley 1971). The deposits are gravels that were derived from erosion in the Pikikiruna Range during the Last Glacial period around 12-40k years ago. In the vicinity of Dry River, there was initially a large outpouring and accumulation of gravelly sediment but when this ceased, river flows continued and were sufficient to allow a distinct terrace to be cut into the gravels. Further to the north, flows from Kite Te Tahu Creek, Gibson Creek and Ellis Creek were much less and probably more intermittent with the streams accumulating sediments as fan deposits rather than as an alluvial floodplain system. In a few places on the terrace surfaces there are some deep depressions that have probably originated through formation of sinkholes in underlying marble and subsequent collapse of the surface sediments.

Key soil features

Motupipi soils are well drained, predominantly deep soils (>90cm to underlying gravel) but moderately deep and shallow soils also occur. The topsoil is moderately deep (average 21cm) and the colour is variable and ranges from brown to dark brown or dark yellowish brown to very dark grayish brown. The B horizons are friable or very friable yellowish brown silt loam to heavy silt loam and average approximately 60cm in thickness, then pass into a transitional BC horizon then into underlying unweathered gravel at around 100cm depth. Some stones may occur throughout the profile.

Identified variants

Shallow soils (depth to gravel <45cm) occur over about 25% of the area and in a few areas, the soils are gravelly to the surface. Moderately deep soils (depth to gravel 45-90cm) occur over approximately 30% of the area. A few mottles

associated with weathering rock fragments are occasionally present in the lower subsoil.

Associated and similar soils

Motupipi soils are associated with Pohara soils, the latter occurring mainly on lower lying parts of the fan or terrace surfaces where there is impeded soil drainage. Rameka soils have a similar appearance in the upper part of the soil but have clayey texture and are underlain by weathered gravel. Hamama soils are also similar to Motupipi soils but they occur on the main terrace surface of the Takaka River, have alluvium with a lesser content of ferromagnesian rich rocks and have underlying unweathered gravel at around 80cm depth.

Key physical properties

Motupipi soils are well drained. They have a deep rooting depth with underlying gravel not providing a significant restriction. Soil structure is well developed ant the soils have good moisture storage.

Soil limitations and land use rating

There are no significant limitations to intensive use of Motupipi soils. The shallow and moderately deep soils will have a somewhat lower moisture capacity and may have a moisture deficiency in drier months. The soils are rated as class A in the Tasman District Council land classification scheme.

Horizon	Depth cm	Description
A	0-25	Very dark grayish brown silt loam; very weak soil strength; moderately developed fine polyhedral structure; very few medium and coarse unweathered stones; many fine and few medium roots
Bw1	25-38	Dark yellowish brown silt loam; weak soil strength; moderately developed fine polyhedral structure; very few medium and coarse unweathered stones; many fine roots
Bw2	38-90	Yellowish brown heavy silt loam; weak soil strength; weakly developed coarse blocky structure; few medium and coarse unweathered stones; few fine roots
BC	90-97+	Light olive brown sandy clay loam; very weak soil strength; weakly developed blocky structure; abundant unweathered coarse stones; few roots

Soil name and map symbol: Pohara (Po)

General concept and overview

Pohara soils together with Motupipi soils (Po + Mo) cover 162 ha and occur in the Pohara and Motupipi districts. They are soils that have formed on alluvial fan and minor stream deposits of late last glacial age outwash and which have impeded subsoil drainage. The soils occur predominantly on the lower parts of fan surfaces which are mostly gently sloping. The drainage impediment is largely due to lateral transmission of water along subsoil layers.

Relationship to previously named soils

The name Pohara was used in the earlier unpublished soil survey of the Takaka district as the soils formed on the Miocene aged Takaka Limestone with the soils on the fan surfaces mapped as Clifton soils. In the 1:250,000 General Survey of the Soils of South Island (NZ Soil Bureau Staff 1968), the soils separated as Pohara soils in this survey were included within the Puramahoi set (43b).

Landform origin and history

Pohara soils occur on the fan sediments of the Bainham Formation (Grindley 1971) in the Pohara district. The deposits are gravels and silts that were derived from erosion during the Last Glacial period around 12-40k years ago in the Ellis Creek catchment at the north end of the Pikikiruna Range. From the size of this fan, it is evident that it has been built as a result of past very large outpourings of sediments and water. The absence of a distinctively incised stream channel suggests that flows and aggradation of the deposits have been intermittent. The sediments of the upper slopes of the fan contain coarse boulders indicating past high intensity storm activity. The intermediate and lower slopes of the fan surface have numerous narrow, shallow and generally wet depressions or drainage channels. These appear to have originated from subsurface seepages from water that has entered the fan deposits on the higher slopes.

Key soil features

Pohara soils have a moderately deep very dark grayish brown to dark brown silt loam friable topsoil (average 24cm) that overlies a friable B horizon that is at first well drained predominantly yellowish brown heavy silt loam (average 26cm). At about 60cm, the upper B horizon becomes somewhat firm and paler and passes into light olive brown heavy silt loam to clay loam with reddish brown to yellowish brown mottles, with the proportion of grey mottles increasing with increasing depth. The mottled B horizon passes into a transitional BC horizon at approximately 80cm with underlying gravel usually present at greater than 95cm. Iron/manganese concretions may occur in the lower horizons. A water table is sometimes present in the lower subsoil.

Identified variants

Moderately deep Pohara soils (45-90cm to gravel) occur over about 30% of the area and shallow soils are present in a few places. Soil drainage is

extremely variable and this is reflected in the wide range of colours that are found in the subsoil. Some of the soils are moderately well drained.

Associated and similar soils

Pohara soils are associated with Motupipi soils which have better drainage and occur on the upper well drained surfaces of the fan deposits. Often, Pohara soils grade into Motupipi soils depending on subsurface drainage conditions. Pohara soils are also associated with Clifton soils which form in the secondary drainage channels within the same landscape, where drainage is imperfect to poor and water seepages occur.

Key physical properties

Pohara soils have a moderately deep rooting depth, well to moderately developed structure in the upper horizons but the lower subsoil is weakly structured or massive. They are imperfectly drained.

Soil limitations and land use rating

The main limitation for intensive use of Pohara soils is the subsurface drainage impediment and compact subsurface layers that restrict the effective rooting depth. Deep subsurface drainage may intercept subsurface water flows and allow more intensive use of the soils. This soil is included within class D of the Tasman District Council land classification scheme.

Horizons	Depth cm	Description
A	0-25	Brown to dark brown silt loam; weak soil strength; moderately developed fine polyhedral structure; many fine and few medium roots
Bw	25-47	Light olive brown silt loam; weak soil strength; moderately developed coarse polyhedral structure; few dark reddish brown iron/manganese concretions; few fine roots
Bg	47-64	Olive yellow clay loam; abundant yellowish red coarse prominent mottles; slightly firm soil strength; weakly developed coarse blocky structure; few coarse stones; very few roots
BCg	64-90+	Light yellowish brown to yellowish brown clay loam; many light grey medium distinct mottles; firm soil strength; massive; no roots

Soil name and map symbol: Rameka (Ra)

General concept and overview

Rameka soils cover 204 ha and occur on intermediate terrace levels associated mainly with alluvial deposits from Rameka Creek and Dry River. They are soils formed from old alluvial gravels with deep profiles that usually pass into partly weathered gravel between about 1.2-1.5m. Stones may occur throughout the subsoil but these are predominantly well weathered and crumbly. Rameka soils are formed from granite, diorite and limestone rocks from the Pikikiruna Range and the subsoil commonly has an intense brown colour, in part resulting from the high proportion of iron bearing minerals in the parent rocks. The land surfaces slope gently to the northwest and are partly dissected.

Relationship to previously named soils

Rameka soils were mapped in the early soil survey of the Takaka district as the soils on old terraces covering the entire area mostly from north of Rameka Creek to Dry Stream. In the 1:250,000 General Survey of the Soils of South Island (Soil Bureau Staff 1968), this name was retained (Rameka set 80b).

Landform origin and history

The landform and terrace deposits on which Rameka soils are found belong to the Kaituna Formation, the second oldest or intermediate terrace deposits identified in the Takaka district by Grindley (1971). These represent aggradational deposits relating to the second last glacial period (Waimean) approximately 120k years ago. The extent of these deposits and the size of boulders in the gravels indicate that there were very large outpourings of sediments from the Pikikiruna Range via Rameka Creek and Dry Stream in the former glacial times. Subsequent to the formation of this terrace, it has been partly dissected and eroded on the western margin by the Takaka River, leaving a distinct terrace scarp which extends intermittently from Dodson's Road to Motupipi.

Key soil features

Rameka soils are well drained soils with a dark brown to brown moderately deep silt loam to heavy silt loam topsoil (average 23cm). This overlies a B horizon that is at first yellowish brown heavy silt loam or clay loam, then passes into yellowish brown or strong brown clay loam to clay. A few weathered or partly weathered stones may occur throughout the subsoil with weathered stones or gravel occurring at an average depth of 55cm (range 20-110cm). The upper horizons are friable and become firm with increasing depth and soil structure is well developed. Subsoil reddish mottles are sometimes present and these are generally associated with weathering rock fragments.

Identified variants

Rameka shallow soils (<45cm to gravel and average depth to gravel 32cm) are scattered throughout the area. Deep soils (>90cm to gravel) are found in 20% of the area.

Associated and similar soils

Glenview soils occur within the same landform and on the same parent materials as Rameka soils but have impeded drainage due to the presence of an iron pan in the underlying gravel. As the landscape drainage changes, Rameka soils grade into Glenview soils. Motupipi soils are similar to Rameka soils in the upper soil horizons but they are younger soils from younger terrace alluvium and they usually pass into unweathered gravel at a shallower depth.

Key physical properties

Rameka soils are free from flooding, are well drained and have good topsoil and subsoil structure. Although some stones may occur throughout the soil, these are generally weathered and are interspersed with fine material and do not limit root penetration. Rameka soils have good moisture storage.

Soil versatility and land use rating

Rameka are versatile soils with few limitations for intensive use. They are included in class A of the Tasman District Council land classification scheme.

Horizon	Depth cm	Description
A	0-24	Dark yellowish brown heavy silt loam; very weak soil strength; moderately developed fine polyhedral structure; very few coarse weathered stones; many fine and medium roots
Bw1	24-53	Dark yellowish brown to yellowish brown heavy silt loam; weak soil strength; moderately to strongly developed fine polyhedral structure; few coarse weathered stones; many fine and medium roots
Bw2	53-75	Dark yellowish brown to strong brown clay loam; weak to slightly firm soil strength; moderately developed coarse blocky structure; few coarse weathered stones; few fine roots
Bw3	75-95+	Strong brown to dark yellowish brown clay loam; slightly firm soil strength; weakly developed coarse blocky structure; many coarse weathered stones; few fine roots

Soil name and map symbol: Glenview (Gv)

General concept and overview

Glenview soils cover about 88 ha and occur mainly in an area to the north of Central Takaka Road. They occur on the partly dissected and gently northward sloping intermediate terrace or outwash surface that is associated with alluvial deposits from Rameka Creek. They are formed from old alluvial gravels and differ from Rameka soils in that their drainage is impeded due to the presence of a subsoil iron pan. The pan typically occurs in the upper portion of the underlying gravels which are moderately weathered. Glenview soils are formed from granite, diorite and limestone rocks from the Pikikiruna Range.

Relationship to previously named soils

Glenview soils were not separated in the earlier survey of the soils of the Takaka district or in the 1:250,000 General Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968). Other soils in the district that have an iron pan present are Onahau and Kotinga soils, however, these soils usually have a pale coloured horizon immediately below the topsoil and they are formed predominantly from silica rich rather than iron rich rocks.

Landform origin and history

The landform and terrace deposits on which Glenview soils occur belong to the Kaituna Formation, the second oldest set of terrace deposits identified in the Takaka district by Grindley (1971). These represent aggradational deposits relating to the second last glacial period (Waimean) approximately 120k years ago. The extent of these deposits and the size of boulders in the gravels indicate that there were large outpourings of sediments from the Pikikiruna Range via Rameka Creek in the former glacial times. Glenview soils occur on the lower part of the terrace surface where an earlier drainage impediment may have facilitated the initial formation of the iron pan. The iron pan is not present around the terrace margin where surface drainage is better.

Key soil features

The topsoil is well drained moderately deep silt loam (average 23cm). The upper B horizon is also predominantly well drained and overlies a paler coloured and mottled clay loam textured lower B horizon that often has a perched water table present during spring months. An iron pan is commonly present in the underlying gravel at around 70cm and iron concretions associated with weathering rock fragments are common. Some stones may be present throughout the soil and the stone content increases with depth, the stones being weathered in the upper horizons and less weathered in the deeper subsoil.

Identified variants

Shallow soils (depth to gravelly subsoil <45cm) were found in approximately 30% of the area while in a few places, the depth to gravel exceeds 90cm. In some locations, the soils are poorly to imperfectly drained and the water table is less than 50cm from the surface.

Associated and similar soils

Glenview soils are closely associated with Rameka soils which occur on the better drained parts of the intermediate terraces. Clifton soils are imperfectly drained soils but occur in gully sediments and do not have an iron pan.

Key physical properties

Glenview soils are moderately well drained to imperfectly drained. The potential rooting depth is moderate and is restricted by the iron pan. The impeded drainage and excess soil water in the wetter months can give rise to pugging and damage to the topsoil structure while the soils may be droughty in the drier months due to the restricted rooting depth.

Soil versatility and land use rating

The versatility of Glenview soils is restricted by the presence of the iron pan and the associated drainage impediment which limit rooting depth. In its present state, Glenview soils are included in class D of the Tasman District Council land classification scheme. However, deep ripping to improve the soil drainage could increase the versatility and productive potential of these soils to class C.

Horizons	Depth cm	Description
A	0-22	Dark brown silt loam; weak to slightly firm soil strength; moderately developed fine polyhedral structure; many fine and medium roots
AB	22-38	Dark brown and yellowish brown heavy silt loam; weak to slightly firm soil strength; strongly developed fine polyhedral structure; many fine and medium roots
Bw	38-52	Yellowish brown clay loam; weak soil strength; strongly developed fine polyhedral structure; many fine roots
Bwg	52-70	Light olive brown clay loam; common medium distinct yellowish red and pale olive mottles; slightly firm soil strength; moderately developed medium polyhedral structure; few medium stones; few fine roots
Bfm	70-75	Dark reddish brown irregular iron pan; hard soil

strength; many medium stones; no roots

BC 75-90+ Strong brown sandy gravel; compact; single grain structure no roots

Soil name and map symbol: Pisgah soils (Ps)

General concept and overview

Pisgah soils cover 108 ha and occur on the flattish hilltop surfaces of ancient alluvial terraces, mainly between Motupipi and Rameka Creek. These old terrace remnants are predominantly broadish ridge tops with smooth undissected surfaces that gently slope towards the northwest. The soils are formed on old weathered coarse gravel deposits derived from the Pikikiruna Range.

Relationship to previously named soils

Pisgah soils were not differentiated in the earlier unpublished survey of the soils of the Takaka district and were included with Rameka soils. Likewise in the 1:250,000 general Survey of the Soils of South Island (New Zealand Soil Bureau Staff 1968) they were not separated and were included with Rameka soils (80b) from terraces and fans. In the present survey, Psigah soils are separated as the soils formed on the oldest ancient terrace deposits recognizable within the present survey area.

Landform origin and history

The terrace deposits on which Psigah soils are formed belong to the Rockville Formation (Grindley 1971) which is outwash gravels dating to the third last glaciation more than 200k years ago. The gravels (from marble, granite and diorite) were laid down on top of the Tarakohe Formation as a large gravel plain or fan that extended from Rameka Gorge to Takaka. Subsequent erosion has left remnants of the Tarakohe Formation as a dissected hilly terrain with scattered gravel remnants on ridges. The gravels are coarse and bouldery in the east near Rameka Creek and become finer to the west. They are indicative of a large outpouring of sediment from the Pikikiruna Range under greatly differing climate conditions from today.

Key soil features

Psigah soils are well drained with good structure and have a moderately deep dark brown to dark yellowish brown silt loam topsoil and a deep clay loam to clay subsoil that is yellowish brown that becomes a little redder with increasing depth. Weathered stones may occur throughout but compact weathered bouldery gravel is generally present at an average depth of 50cm. Iron concretions, derived from weathering of iron rich rocks are common in the lower subsoil.

Identified variants

Psigah soils are mostly moderately deep (depth to gravel 45-90cm) and to the east, the gravelly subsoil is predominantly weathered and bouldery. In some

locations, the soils are shallow with the depth to compact weathered gravel less than 45cm while in other places, drainage is slightly impeded and grey colours are present in the subsoil.

Associated and similar soils

Psigah soils are associated with Tadmore hill soils which occur on adjacent hilly land below the terrace remnants. Rameka soils resemble Psigah soils but occur at lower elevation on a lower terrace system. They differ from Psigah soils in that the lower subsoil passes into weakly weathered gravel.

Key physical properties

Psigah soils are well drained to moderately well drained and moderately deep with a moderately deep effective rooting depth. Although the lower subsoil has moderately firm soil strength and is stony or bouldery, some root penetration still occurs. The topsoils are very friable to friable and liable to become platy under continuing cultivation.

Soil versatility and land use rating

Psigah soils are moderately versatile, the main limitations being the moderately deep rooting depth and topsoil structure instability. They are included in class B of the Tasman District Council land classification scheme.

Horizon	Depth cm	Description
A	0-21	Dark yellowish brown clay loam; weak soil to moderate strength; weakly developed polyhedral structure; many fine and medium roots
Bw1	21-32	Yellowish brown clay loam; slightly firm soil strength; moderately developed medium polyhedral structure; few medium weathered stones; many fine and medium roots
Bw2	32-53	Yellowish brown clay loam; few yellowish red firm concretions; slightly firm soil strength; moderately developed medium polyhedral structure; few medium weathered stones; many fine roots
Bw3	53-80	Yellowish brown clay; common yellowish red firm concretions; slightly firm to firm soil strength; moderately developed coarse blocky structure; few to many medium weathered stones; few fine roots
Bw4	80-100+	Yellowish brown to strong brown clay loam;

firm soil strength; weakly developed blocky structure; many medium and coarse weathered stones; few fine roots

Soil name and map symbol: Tadmore (TmH, Tm)

General concept and overview

Tadmore soils cover approximately 241 ha in the survey area. They are the soils that are formed on predominantly hilly land and on the Miocene aged siltstone and silty sandstone sedimentary rocks of the Tarakohe Formation. The rocks outcrop chiefly to the southeast of Takaka and are also found in some of the gully floors where they underlie thin deposits of young alluvium. Typically, the soil consists of a cover of weathered sedimentary rock that passes into consolidated and partly fragmented sedimentary rock. These soils have not been examined in detail in the course of this survey.

Relationship to previously named soils

In the earlier unpublished soil survey of the Takaka district, the soils from Miocene sedimentary rocks were mapped as Tadmore loams. In the 1:250,000 General Survey of the Soils of South Island (NZ Soil Bureau Staff 1968), they were not mapped separately within in the present survey area, but were included within the Tarakohe and Pikikiruna soil mapping units although were mapped elsewhere (44cH). Tadmore soils were also mapped in the survey of the soils of Waimea County (Chittenden et al. 1966) as soils from siltstone or sandstone (T, TH).

Landform origin and history

The Tarakohe Formation overlies the Takaka Limestone and the Motupipi Coal Measures Formations and was formerly more widespread, covering much of the area to the east of the Takaka River. Being a comparatively soft rock, it was more easily eroded and now occurs as remnants against the Pikikiruna Range to the north of Rameka Creek and in a few smaller outliers. Outcrops of Tarakohe Formation, north of Rameka Creek are capped with old terrace gravels and as erosion and wearing away of the gully sides has continued, the old gravels have become incorporated into the soil weathering mantle on the hill sides. The hill country topography is extremely variable with slopes ranging from steep to rolling. The landform is a result of continuing erosion and wearing away but this process is accelerated in periods of major climate change (for example interglacial to glacial periods) when vegetation and climate changes induce greater slope instability.

Key soil features

Tadmore soils are predominantly deep (>90cm to underlying bedrock) well drained soils with a moderately deep to deep (average 25cm) very dark grayish brown to dark brown friable A horizon. The subsoil is firm yellowish brown well structured silt loam to clay loam, becoming paler near the base. The transition to underlying sedimentary rock is usually abrupt with the rock typically being firm to very firm and partly fragmented, rather than very hard

and massive. Oxidised reddish rock material may be present at the base of the soil and small partly oxidized sedimentary rock fragments may occur throughout the soil.

Identified variants

Hill soils typically have a wide range of variation with a range from shallow to deep soils and well drained to imperfectly drained, depending on the position on the slope. On some of the upper slopes below the terrace cover deposits, stones and boulders commonly occur. Where the land surfaces are gently sloping rather than hilly, the soils have been separated as Tadmore (Tm) rather than Tadmore hill soils.

Associated and similar soils

Otere soils are similar to Tadmore soils but are formed from consolidated sandstone or silty sandstone and have sandier textures. Waitapu soils are formed from coarser consolidated sandstone rocks. They have sandier textures and an inherent lower natural fertility.

Key physical properties

Tadmore soils are deep and well drained with a deep rooting depth, good structure and good moisture storage. Where the underlying sedimentary rock is fragmented, deeper penetration of roots is possible.

Soil limitations and land use rating

The main limitations to intensive use of Tadmore soils are slope and land surface variation which restricts the potential use. Potential soil instability is another limitation as shallow slipping or earth flows are possible under extreme rainfall events. Tadmore soils are grouped in class E of the Tasman District Council land classification system but could be included in class D with selection of appropriate tree crops.

Horizon	Depth cm	Description
A	0-24	Brown to dark brown heavy silt loam; slightly firm soil strength; moderately developed medium polyhedral structure; occasional stones; many fine and few medium roots
Bw1	24-48	Light olive brown clay loam; common yellowish red mottles on ped faces; slightly firm soil strength; moderately developed fine polyhedral structure; few fine roots
Bw2	48-70	Light olive brown clay loam; weak to slightly firm soil strength; coarse blocky structure; few fine roots
BC	70-90	Light olive brown clay loam; grayish brown and yellowish red medium distinct mottles

in rock fragments; weak to slightly firm soil strength; coarse blocky structure; common weathered rock clasts; few fine roots

Cw 90-105+ Light grey and yellowish brown very firm sedimentary rock, partly weathered

Soil name and map symbol: Waitapu (WtH)

General concept and overview

Waitapu soils cover about 192 ha and are the soils on hilly topography and they are formed on the dominantly sandy textured rocks of the Motupipi Coal Measures Formation. They occur on the hilly land mainly to the east of Rototai Road and to the north of Motupipi. Unlike Tarakohe soils where there are extensive rock outcrops, the sandstones seldom outcrop at the surface. Sediments of the Motupipi Coal Measures Formation are predominantly quartz sand with bands of grey mudstone, thin coal seams and some gravels. The areas separated as Waitapu soils have not been examined in any detail in this survey.

Key soil features

Waitapu soils are deep soils with a moderately deep to deep (average 24cm) dark yellowish brown topsoil overlying a deep (average 65cm) firm B horizon subsoil of yellowish brown to strong brown silt loam to clay loam. Below this is a BC horizon of partly weathered sandy sedimentary rock which is commonly firm.

Landform origin and History

The Motupipi Coal Measures Formation is a comparatively weakly consolidated formation. It underlies the harder Takaka Limestone which has protected it from geological erosion. Being a softer rock, where it occurs it is relatively easily dissected and a landscape of rounded ridges and some steeper slopes has evolved. The soils are generally deep and well weathered on ridges and upper slopes but on lower slopes where seepages and weathered detritus have accumulated, they are extremely variable and may be imperfectly drained or stony.

Relationship to previously named soils

Waitapu soils were mapped in the earlier unpublished survey of the soils of the Takaka district as the soils from the predominantly quartz sand rocks of the Motupipi Coal Measures Formation. In the 1:250,000 General Survey of the Soils of South Island (1968) these soils were included with Pakawau hill soils (62bH) which are from arkosic feldspar-rich sandstone. In the present survey, Waitapu soils are mapped as they were first identified.

Identified variants

Lower hill slope soils contain mixtures of materials derived from rocks further up slope and sometimes have coarse rock fragments, organic materials from the coal beds and impeded drainage where water seepages occur. On eroded sites, the soils have shallower profiles.

Associated and similar soils

Waitapu soils are associated with Tarakohe soils and the intermittent outcrops of Takaka Limestone that occur with the coal measure sands. Tadmore soils are formed on siltstone or silty sandstone and have clayey subsoil texture and typically pass into rubbly sedimentary rock.

Key soil properties

Waitapu soils are deep and well drained with a deep rooting depth. Some slopes are unstable and subject to earth flow. Slopes are predominantly between 15and 25 degrees.

Soil limitations and land use rating

The main limitations for intensive use of Waitapu hill soils are the hill slopes and varied and uneven topography. Soil moisture deficiency can occur under low rainfall conditions. These soils are included in class E of the Tasman District Council land classification system.

Horizon	Depth	Description
A	0-19	Dark grayish brown heavy silt loam; weak soil strength; moderately developed fine polyhedral structure; many fine and medium roots
AB	19-29	Dark grayish brown and brownish yellow clay loam; weak to slightly firm soil strength; moderately developed medium polyhedral structure; many fine and medium roots
Bw1	29-79	Yellowish brown clay loam; weak soil strength; weakly developed fine blocky structure; few fine roots
Bw2	79-110+	Yellowish brown sandy clay; weak soil strength; weakly developed fine blocky structure; few fine roots

Soil name and map symbol: Tarakohe (ThH, Th)

General concept and overview

Tarakohe soils cover approximately 403 ha and are formed on the Takaka Limestone Formation. They include several small areas where the limestone outcrops, chiefly as undulating land (Tarakohe Th) but they are formed predominantly on hilly land that is dominated by rock outcrops. Soils on the steeply sloping land on the lower slopes of the Pikikiruna Range where Tarakohe Limestone occurs have not been examined or included in the present survey. The areas separated as Tarakohe soils have not been investigated in any detail in this survey.

Relationship to previously named soils

In the earlier unpublished survey of the soils of the Takaka district, soils on Takaka Limestone formation were named Pohara soils. In the later 1:250,000 General Survey of the Soils of South Island (NZ Soil Bureau Staff 1968), soils formed on the Takaka Limestone Formation were mapped and named Tarakohe hill soils (73bH). Smaller occurrences were not mapped separately but were included within other mapping units.

Landform origin and history

The Takaka Limestone is a relatively thin formation (<75m) that is calcareous, crystalline and at times sandy rock. Because it is hard, it is resistant to erosion and thus generally forms prominent outcrops where it occurs. Erosion of the rock is largely by dissolution rather than through physical disintegration and since this does not occur uniformly across the landscape, the surface topography is extremely variable. The presence of the limestone beneath the surface gravels is in places indicated by sinkholes where dissolution activity has been concentrated. The soils formed on the Takaka Limestone are extremely variable. In many places, a weathering soil mantle is absent and rock outcrops may cover as much as 80% of the ground surface. Elsewhere, the cover of soil material may vary from less than 10cm over limestone to greater than 2m.

Key soil features

Tarakohe soils, where deeper profiles occur, have a very friable dark yellowish brown to yellowish brown moderately deep (average 22cm) silt loam topsoil, overlying a deep (average 55cm), friable, yellowish brown B horizon with textures of clay loam to clay. This passes into olive brown to yellowish brown silt loam to sandy loam often with small limestone fragments. If underlying rock is present, the transition is abrupt.

Identified variants

Tarakohe stony soils have a thin stony soil cover (<20cm) overlying limestone. Tarakohe shallow soils and moderately deep soils (Th), (rock between 20-45cm and 45-90cm) also occur. The transition from rock outcrop, through shallow and moderately deep soils can occur over a distance of less than 10m.

Associated and similar soils

Waitapu soils are associated with Tarakohe soils and are formed from sandstones that occur in conjunction with the Takaka Limestone Formation. Pikikiruna soils on steep land are similar soils that are formed on the crystalline calcareous rocks of the Arthur Marble Formation.

Key soil properties

Tarakohe soils are friable well drained soils with the soil depth and rooting depth varying from shallow to deep. Rock outcrops are extensive and dominate the landscape.

Soil limitations and land use rating

Intensive or extensive use of Tarakohe soils is restricted by the highly variable surface topography and proportion of rock outcrop that covers the landscape. Overall, Tarakohe soils are grouped in class F of the Tasman District Council Land classification Scheme but small pockets are potentially highly productive and are included in class C.

Horizon	Depth cm	Description
A	0-15	Dark yellowish brown silt loam; weak soil strength; moderately developed fine polyhedral structure; many fine and medium roots
Bw1	15-32	Yellowish brown silt loam; weak soil strength; strongly developed coarse polyhedral structure; many fine and medium roots
Bw2	32-56	Yellowish brown clay loam; weak to slightly firm soil strength; strongly developed coarse blocky and fine polyhedral structure; many fine and few medium roots
Bw3	56-95+	Yellowish brown clay loam; slightly firm soil strength; weakly developed coarse blocky structure; few fine limestone fragments; few fine roots