Land types of the Tasman District

Landcare Research
Manaaki Whenua

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Summary

Project and Client

- Landcare Research, Lincoln, delineated and documented land types of the Tasman District for the Tasman District Council in the period December 2011 to April 2012, as part of a wider Tasman District Landscape Study.

Objectives

- Describe and map land types at 1:250 000 scale for the Tasman District according to the protocol of previous work.
- Delineate the spatial distribution of the land types at 1:250 000 on NZTopo250 base maps and at 1:50 000 on NZTopo50 base maps which the Council digitised onto the their GIS.

Methods

- The following data sources were used to select key defining criteria for the land types: scientific papers, geological maps (at various scales), topographic maps, Protected Natural Area surveys and the Register of Protected Natural Areas, and Earth Science Society inventories.
- The process involved the following steps:
    - Subdivision of the landscape into 'natural segments' or land types on the basis of topography and geology.
    - Description of the landform components within land types.
    - Search of the literature to determine the specific geology, vegetation, rainfall, altitude etc. of landform components.
- Description of the land use potential and impacts of use within landform components from expert knowledge.

Results

- Twenty-two land types have been established for the Tasman District. The land types distinguish major physiographic landform units and are broadly equivalent to a 'land region' as defined for hierarchical land resource mapping in New Zealand (Lynn & Basher 1994). The land types depict largely lithologically-based macro relief units delineated at scales of 1:250 000 and 1:50 000.
- The key features of the landform components within land types are summarised in table format under the following headings:
    - Geological formation
    - Elevation (m)
    - Remnant native vegetation

- Present land use
- Agronomic potential
- Potential land use
- Potential impacts of land use on the landscape and environment.

Conclusions

- The 22 land types established at a scale of 1:250 000 and 1:50 000 for the Tasman District provide a geomorphologically-based assessment and grouping of the district's landscape.
- Although the land types have been designed primarily to assist in assessment of landscape appreciation and planning, they also provide an objective, physically-based subdivision of the Tasman District landscape suitable for resource monitoring, strategy planning, and land resource assessment and evaluation.

1 Introduction

Landcare Research, Lincoln, delineated and documented land types of the Tasman District for the Tasman District Council in the period December 2011 to April 2012 as part of a wider Tasman District Landscape Study.

2 Background

A hierarchical land systems approach was used for the Tasman District study, which follows a similar methodology to that used in the studies of the Canterbury regional landscape (Boffa Miskell & Lucas Associates 1993), Queenstown Lakes District (Lucas et al. 1995), Marlborough Sounds (Lucas et al. 1997; McRae et al. 2004), Bay of Plenty Region (Lucas et al. 1998), Marlborough District (Lynn 2009a) and the Masterton, Carterton and Southern Wairarapa Districts (Lynn 2009b).

'Land type' is the preferred term for geomorphologically-based land units distinguished at a scale of 1:250 000. This definition is given to overcome variation in the use of terminology between the landscape architects, planners and land-resource-based science professions.

The land types used in this study distinguish major physiographic landform units and are broadly equivalent to a 'land region' as defined for hierarchical land resource mapping in New Zealand by Lynn and Basher (1994). The land types depict largely lithologically-based macro relief units and are frequently bounded by structural dislocations or contrasting rock terranes.

2.1 Regional setting of the current study area

The main drivers of landscape form are uplift, rock type (composition, hardness-induration etc.), rainfall and climate.

The bulk of the Tasman district lies adjacent to the active plate boundary which passes through the West Coast of the South Island into Marlborough and the Hikurangi Trough off the East Coast of the North Island. Most of the district is part of the Australian plate whereas the southern part of the district straddles the boundary between the Australian and Pacific plates which are converging at about 40 mm per year (Rattenbury et al. 2006). The collision between the plates in this region is manifested by the uplift of the Southern Alps and the other ranges of the South Island. In the Tasman district much of the plate boundary movement is accommodated by olique dextral strike-slip along the Alpine Fault.

The basement rocks of the region are subdivided into fault-bounded, north-trending, tectonostratigraphic terranes (Figure 1).

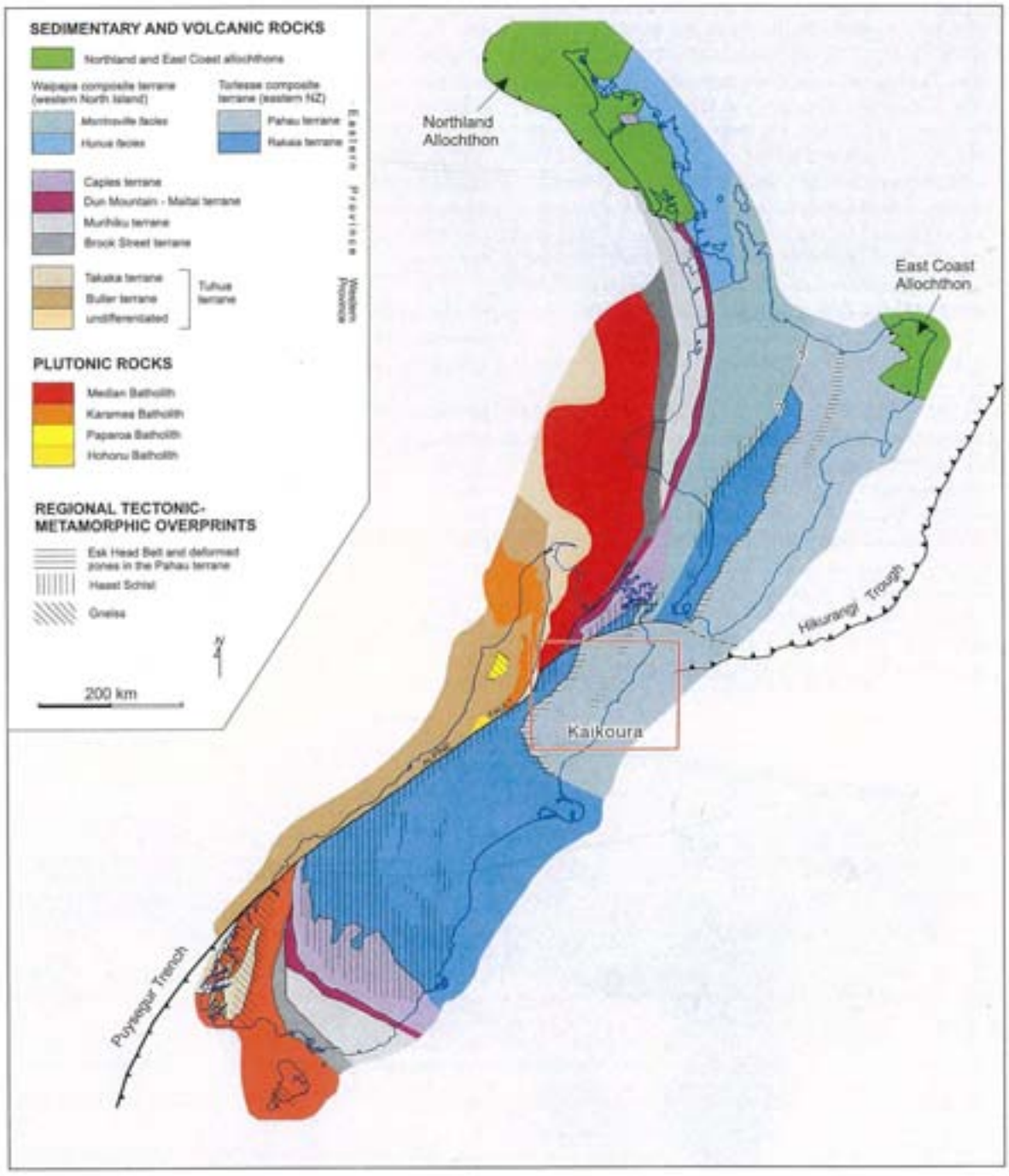


Figure 1 Pre-Cenozoic basement rocks subdivided into tectonostratigraphic terranes and batholiths (from Rattenbury et al. 2006).

The ages of the rocks range in age from Cambrian to Devonian in west Nelson, Carboniferous to Early Cretaceous largely in east Nelson, and Late Cretaceous and Tertiary sedimentary rocks and Quaternary sediments elsewhere.

In the context of this report 'hard' and 'soft' rock are defined as:

- 'hard rock': includes indurated and moderately indurated rock—rocks that have acquired an element of hardness and strength through induration relating to depth of burial or through grain overgrowths and/or cementation to the extent that grain disintegration (grain fracturing) dominates over disaggregation (separation along existing grain boundaries). They have been deformed by brittle fracture and shearing, ring when struck with a hammer, and require a strong blow to fracture.
- 'soft rock': includes weakly indurated rocks which are consolidated, with minor or insignificant cementation, and are of low strength. They disintegrate with a mild to strong hammer blow, or are crushable by hand. They deform by plastic flow and produce regoliths dominated by fine-grained materials with high clay contents that lack cohesion and strength. They are frequently dispersive and have poor drainage characteristics. They are susceptible to mass movement forms of erosion.

3 Objectives

- Describe and map land types at 1:250 000 scale for the Tasman District according to the protocol of previous work.
- Delineate the spatial distribution of the land types at 1:250 000 on NZTopo250 base maps and 1:50 000 on NZTopo50 base maps which the Council digitised onto the their GIS.
- Summarise the key features of the landform components within land types in a table format under the following headings:
    - Geological formation
    - Elevation (m)
    - Remnant native vegetation
    - Present land use
    - Agronomic potential
    - Potential land use
    - Potential impacts (of land use on the landscape and environment).

4 Methods

The following data sources were used to select key defining criteria for the land types: scientific papers (as listed in References), geological maps (at various scales, e.g. Johnston 1983; Rattenbury et al. 1998; Nathan et al. 2002; Rattenbury et al. 2006), and topographic maps. The process involved the following steps:

- Subdivision of the landscape into ‘natural segments’ or land types on the basis of topography and geology.
- Description of the landform components within each land type.
- Search of the literature to determine the specific geology, vegetation, rainfall, altitude etc. of each landform component.
- Description of the land-use potential and impacts from the author’s experience and local knowledge.

The Protected Natural Area (PNA) programme (McEwen 1987), the Register of Protected Natural Areas, and the inventory and maps of important geological sites and landforms (Hayward et al. 1999) were used as additional data sources.

In the summary tables, ‘agronomic potential’, ‘potential land use’ and ‘potential impacts’ are based on an assessment of the factual information recorded in columns 1 to 5, and an evaluation of current trends. Agronomic potential is qualitatively ranked as high, medium, low or nil. Potential land use identifies current land uses that are considered to become dominant or that will become more widespread on that landform component in the foreseeable future. Potential impacts identify the major consequences on the landscape and environmental qualities of those projected land uses.

Due to the time constraints imposed on the study, information on the remnant native vegetation is indicative, and is intended to flag areas or communities that are potentially at risk. The remnant vegetation entries should be checked and modified by an ecologist. Detailed descriptions and locations of sites of rare and endangered communities or species are available from Landcare Research and PNA Programme reports.

5 Results

Twenty two land types have been established for the Tasman District and delineated at 1:250 000 scale on NZTopo250 and at 1:50 000 scale on NZTopo50 topographic base maps. The constraints of map scale and time mean that the land type boundaries are indicative. For land types that occur in narrow valleys, individual land types are frequently nested within each other. Accurate delineation, more appropriate for individual site or ‘local-level’ assessment and planning, would require detailed precision mapping at scales greater than 1:50 000. The 1:250 000 maps are shown in the Appendix of this report.

The following land types were established:

1. Western Coastal Tertiary ‘Soft’ Rock Land Type
2. Barrier Spit Land Type
3. Upper Cretaceous Coal Measures Land Type
4. Western Granite Land Type
5. Old ‘Hard’ Rock Mountain Land Type
6. Western Inland Valley Floor Land Type

7. Western Lowland Major River Valley Land Type
8. Golden Bay Coastal Fringe Land Type
9. Golden Bay 'Soft' Rock Tertiary Hills Land Type
10. Coastal Separation Point Land Type
11. Inland Intrusives Land Type
12. Northern Mt Arthur Marble Land Type
13. Southern Mt Arthur Marble Land Type
14. Moutere Gravels Land Type
15. Eastern Lowland Major River Valley Land Type (Motueka and Waimea)
16. Ultramafics Land Type
17. Eastern Hill and Mountain Land Type
18. Greywacke Mountains East of the Alpine Fault Land Type
19. South-western Granite Land Type
20. South-western Tertiary Rock Land Type
21. Matiri Land Type
22. Major Southern High Country Valley Fill Land Type

To convey the general characteristics and appearance, and to compare and contrast respective land types, some illustrations have been included. They have been sourced from either Rattenbury et al. 1998, Rattenbury et al. 2006, the internet. or the author's personal collection. Some of the illustrations are located adjacent to the current study region from areas into which the respective land types extend.

Detailed land type descriptions and tables of the respective land types follow.

1. Western Coastal Tertiary 'Soft' Rock Land Type

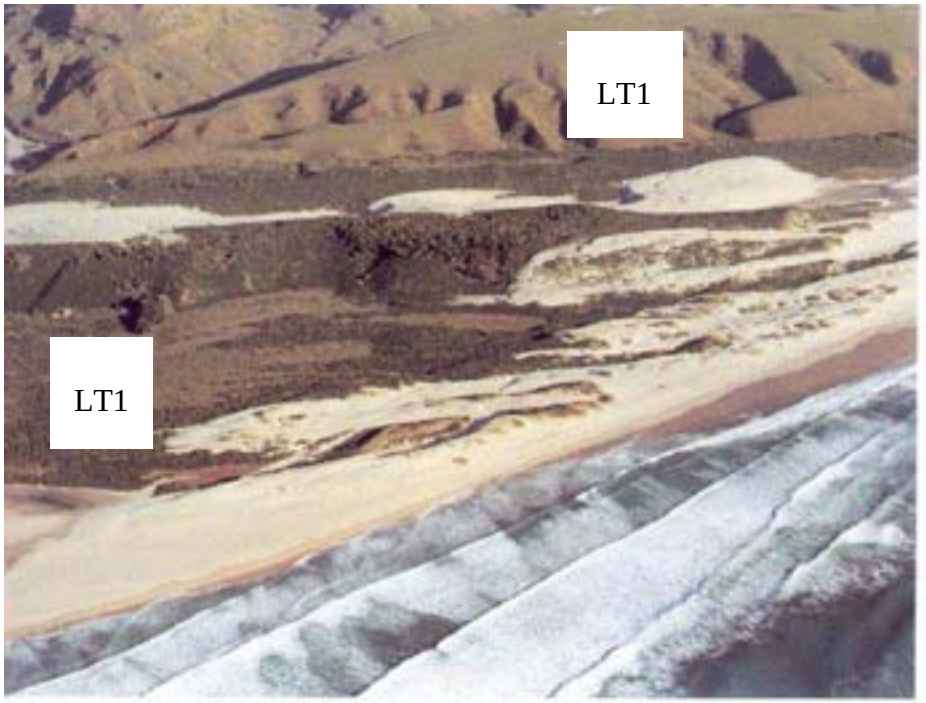
The Western Coastal Tertiary 'Soft' Rock Land Type consists of moderately steep to steep, low elevation, dissected, structurally controlled coastal hill country developed on weakly indurated Tertiary rocks. These Tertiary rocks are arkosic sandstones, mudstone, siltstones, conglomerates, thin coal seams, hard crystalline and sandy prominent escarpments, and cliff-forming limestone, with caves, sinkholes and disappearing streams. The land type also includes the associated narrow coastal strip of remnant raised beaches, coastal cliffs, narrow sandy beaches, indented narrow inlets, bays, lagoons and river valleys; and extensive coastal dune belts, some of which bar the drainage of smaller valleys, causing lakes and swamp deposits to accumulate behind them, e.g. Lake Otuhie, between Kahurangi Point and the base of Farewell Spit. Elevation ranges from sea level to 300 m, rainfall ranges from 1200 to 2000 mm per year, and strong coastal winds are common (warm, wet and windy climate). The original native vegetation of podocarp-hardwood forest (rimu, kahikatea, and mataī) has been cut over or selectively logged, leaving significant areas of secondary vegetation. There is beech forest (hard beech and silver beech predominate) on lower fertility sites. Alluvial valleys south of Whanganui Inlet formerly contained kahikatea forest, northern rātā and pukatea.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use
1	Moderately steep to steep structurally-controlled 'soft' rock hill slopes	Tertiary sandstones, mudstone, siltstones, conglomerates and limestone	10–300	Podocarp-hardwood forest	Semi intensive and extensive grazing, cut over native forest, scrub, conservation
2	Steep to very steep cliffs and escarpments	Tertiary limestone, conglomerate, sandstone and mudstone	0–300	Coastal and podocarp-hardwood forest	Conservation, native forest
3	Remnant raised beaches	Moderately weathered beach sand and gravels	5–30	Coastal and podocarp-hardwood forest, coastal scrub	Extensive grazing, conservation

Agronomic potential	Potential land use	Potential impacts
Low	Semi intensive grazing, exotic forestry, native forest reserve, conservation	Tracking, fencing, loss of native vegetation, buildings
Nil–very low	Native forest reserve, conservation, recreation	Loss of native vegetation, exotic weeds, recreation
Low	Semi intensive grazing, stabilisation, recreation	Fences, shelter belts, wind erosion, recreation, loss of native vegetation

4	Extensive coastal and inland creeping dunes belts	Holocene and Recent dune sand	0–100	Pingao, sedge land, spinifex, coastal scrub	Extensive grazing, conservation, stabilised wasteland	Low	Semi intensive grazing, stabilisation, recreation	Fences, stabilisation, wind erosion, increase in exotic and loss of native species, recreation
5	Swamps, e.g. Mangarakau swamp	Holocene swamp deposits	2–20	Flax, sedges, wetland vegetation	Wetland, conservation, wildlife reserve	Nil–very low	Conservation, wetland, wildlife reserve	Drainage, loss of native vegetation, exotic weeds
6	Recent beaches and beach-dune complexes	Holocene and Recent beach sands	0–10	Pingao, sedge land, spinifex	Extensive grazing, conservation, stabilised wasteland	Very low	Stabilisation, recreation, extensive grazing	Wind erosion, recreation, loss of native vegetation, exotic weeds
7	River valleys, floodplains and terraces	Holocene and Recent fine grained alluvium	2–30	Kahikatea, northern rātā and pukatea forest, scrub, flax	Semi-intensive grazing, cut over native forest, scrub, conservation land	Medium	Semi intensive grazing, native forest reserve, conservation land	Fencing, tracking, loss of native vegetation
8	Backswamps between beach dunes or ridges and landward terraces	Holocene and Recent beach, lagoon and swamp deposits	0–4	Flax, sedges wetland vegetation, dune slacks	Conservation, wetland, extensive grazing,	Low	Conservation, wetland, extensive grazing	Drainage, recreational impacts, loss of native vegetation
9	Lagoons and lakes	Holocene and Recent lagoon deposits	0–10	Pingao, sedge land, spinifex	Conservation, wildlife reserve	Nil–very low	Conservation, wildlife reserves	Drainage, loss of native vegetation, exotic weeds

a. [GNS image]



b. [GNS image]

LT1 at the base of Farewell Split, comprising Tertiary aged sandstones, mudstones siltstones and conglomerates, 'soft rocks', is shown in the foreground of image (a). LT1 at the mouth of the Turimawiwi River is shown in image (b), including the longitudinal dunes in the foreground.

Structurally controlled moderately steep to steep coastal hill country of LT1.

Sandstone coastal cliffs of LT1.

2. Barrier Spit Land Type (Farewell Spit)

The Barrier Spit Land Type consists of the 25 km long Farewell Spit, extending eastwards from Triangle Flat to the lighthouse at Bush End Point, and includes The Shellbanks. Formed by the northerly transport of sediment along the west coast of the South Island, the spit is composed of barchan dunes over 22 m high along the northerly aspect, sand sheets over 1 km wide, linear vegetated dunes (southern aspect), dune slacks, ephemeral freshwater lakes, shell banks, and intertidal sand flats on the Golden Bay or southerly aspect. Westerly winds predominate, with rainfalls of approximately 1200 mm per year. Prior to human settlement, coastal shrubland composed of *Cassinia*, grasses, pingao, *Spinifex* and flax is thought to have dominated the spit, with a forest of *Podocarpus totara* occurring at its western end (Ramsar 1992; Petyt 1999). Vegetation has been extensively modified by fire and stock grazing and the introduction of marram grass as a stabilisation measure.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Northern open-ocean beach with high tide swash bars	Well sorted Holocene sand	To mean high water spring	nil	Wildlife reserve, recreation	Nil	Wildlife reserve, recreation	Vehicle tracks / disturbance, wave erosion
2	Shell banks (on the southern side of the swash berm)	Consolidated mollusc shellbeds	0–2	nil	Wildlife reserve, recreation	Nil	Wildlife reserve, recreation	Vehicle tracks / disturbance, wave erosion
3	Raw barchan dunes and deflation hollows, and associated sand sheets	Well sorted Holocene sand	0–22	Sub aerial unvegetated mobile sand	Wildlife reserve, recreation	Nil	Conservation / wildlife reserve, recreation	Vehicle tracks / disturbance, wind erosion
4	Linear and parabolic vegetated dune systems	Well sorted Holocene sand	5–14	Mānuka, kānuka, flax, toetoe, bracken	Wildlife reserve, recreation	Nil-very low	Conservation / wildlife reserve, recreation	Fire, invasive weeds, vehicle tracks / disturbance, erosion
5	Ephemeral freshwater lakes and swamps in deflation hollows between dune ridges	Well sorted Holocene sand	0–2	Ephemeral aquatic life, dune slack	Wildlife reserve, recreation	Nil	Conservation / wildlife reserve, recreation	Disturbance, recreation
6	Intertidal sand flats (extend up to 8 km into Golden Bay) and salt marsh (Stockyard Point to Bush End Point)	Very well sorted medium to fine Holocene sand and mud	0.3–1.5	Rushes, *Isolepis nodosa*, *Juncus maritimus*, *Leptocarpus simplex*, *Salicornia australis*	Wildlife reserve, recreation	Nil	Conservation / wildlife reserve, recreation	Disturbance, recreation

The acruate 25 km-long Farewell Spit comprising fixed and mobile dunes with swamp deposits (LT2), and the Tertiary aged 'soft rocks', sandstones, mudstones siltstones and conglomerates of the western coastal hills of Land Type 1 (LT1) in the foreground. [GNS image]

Farewell Spit: a view from the base of the spit to the lighthouse (middle distance), barchan dunes on the northerly aspect (left) and broad intertidal flats on the southerly aspect.

Active and partially vegetated sand dunes, Farewell Spit (LT2).

3. Upper Cretaceous Coal Measures Land Type

The Upper Cretaceous Coal Measures Land Type consists of steep to very steep hill slopes developed on predominantly indurated Upper Cretaceous coal measures of the Rakopi and North Cape Formations of the Pakawau Group, comprising interbedded sandstones, siltstone and conglomerates, and thin coal seams forming the westerly faces of the Burnett Range. The regional westerly dip towards Whanganui Inlet imparts strong structural control with long rectilinear slopes, dissected narrow incised gorges (e.g. the North and South branches of the Wairoa River), and a strongly rolling summit plateau south of Knuckle Hill. Elevation ranges from 0 to 500 m, and rainfall from 2000 to 4000 mm annually. Vegetation consists of extensively cut over indigenous podocarp forest, with canopy rimu, kawaka, kahikatea, miro, and tānekaha, over a sub-canopy of kāmahi and toro. There is hard and silver beech at higher elevations.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Steep to very steep upper hill slopes	Upper Cretaceous interbedded sandstones, siltstones, conglomerates and thin coal seams	260-500	Indigenous podocarp and beech forest	Native forest, conservation land, recreation	Low	Native forest, exotic forestry, conservation, recreation	Tracking, exotic forestry, recreation, feral animals
2	Steep lower hill slopes	Upper Cretaceous interbedded sandstones, siltstones, conglomerates and thin coal seams	0-260	Indigenous podocarp forest	Native forest, conservation land, recreation	Low	Native forest, exotic forestry, conservation, recreation	Tracking, exotic forestry, recreation, feral animals
3	Steep spur crests and summits	Upper Cretaceous interbedded sandstones, siltstones, conglomerates and thin coal seams	150-500	Indigenous podocarp and beech forest	Native forest, conservation land, recreation	Low	Native forest, exotic forestry, conservation, recreation	Tracking, recreation, exotic forestry, feral animals
4	Strongly rolling summit plateaux	Upper Cretaceous interbedded sandstones, siltstones, conglomerates and thin coal seams	280-360	Indigenous beech forest and scrub	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation, exotic forestry	Tracking, recreation, exotic forestry, feral animals
5	Very steep incised narrow steep gorges	Upper Cretaceous interbedded sandstones, siltstones, conglomerates and thin coal seams	40-480	Indigenous beech-podocarp forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Recreation, feral animals

A westerly view from Knuckle Hill, a small outlier of Separation Point granite, down the dip of the Upper Cretaceous coal measures (LT3) to the southern arm of Whanganui Inlet (middle distance), with the coastal structurally controlled hills (LT1) in the far distance.

4. Western Granite Land Type

The Western Granite Land Type encompasses the moderately steep to steep hill and mountain slopes inland of Kahurangi Point, including the incised gorges of the lower reaches of Big River, which are developed on Devonian aged Karamea suite granites. It also includes the steep to very steep mountain slopes of the Gouland Range draining to the upper Spey catchment, and the slopes of Mt Olympus and the Boulder Lake region, which are developed on Cretaceous aged Separation Point suite granites. Cirque basins with bare rock and tarns are present on Mt Olympus and Clarke Peak. Elevation ranges from 200 to 1630 m, and rainfall from 2800 to 5600 mm annually. The vegetation is largely unlogged native forest of rātā, kahikatea, rimu, and red and silver beech at lower elevations, mixed beech-podocarp-hardwood forest on mid-slopes, and silver and mountain beech forests at higher altitudes. Subalpine scrub, tussock land and alpine herb-fields are the vegetation covers above the bushline.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Steep upper mountain slopes	Karamea and Separation Point Suite granites	600–1300	Silver and mountain beech forest	Conservation, protected native forest, recreation	Very low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals
2	Moderately steep lower mountain slopes	Karamea and Separation Point Suite granites	200–600	Mixed beech-podocarp-hardwood forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Recreation, tracking, loss of native species, feral animals
3	Mountain spur crests and summits	Karamea and Separation Point Suite granites	200–1300	Mixed beech-podocarp-hardwood forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals
4	High mountain spur crests and summits	Karamea and Separation Point Suite granites	1300–1630	Subalpine scrub, tussock land, alpine herb-fields	Conservation, recreation, feral animal grazing	Low	Conservation, recreation	Recreation, tracking, feral animals
5	Moderately steep to steep hill slopes	Karamea and Separation Point Suite granites	200–600	Podocarp and podocarp-beech forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Recreation, tracking, loss of native species, buildings etc.
6	Strongly rolling remnant relict stripped surfaces at high elevations	Karamea and Separation Point Suite granites	600–900	Stunted forest and scrub, mountain beech, pygmy pine and mānuka, red tussock, bracken	Conservation, recreation	Low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals
7	Very steep gorges	Karamea and Separation Point Suite granites	100-1000	Podocarp-beech forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Feral animals, recreation, tracking

Glacial features, e.g. “U-shaped” and hanging valleys are common at high elevations in the Western Granite land type. The valley and Grindley Ridge (just to the south of the district boundary) are comprised of Karamea Suite granite. [GNS image]

Strongly rolling remnant relict stripped surfaces at high elevation developed largely on granitic rocks. These are the Mackay Downs (foreground, largely outside the district boundary), and the Gouland Downs (left background). The numerous faults and persistent regional joint sets have created a mesh-like topographic pattern. [GNS image]

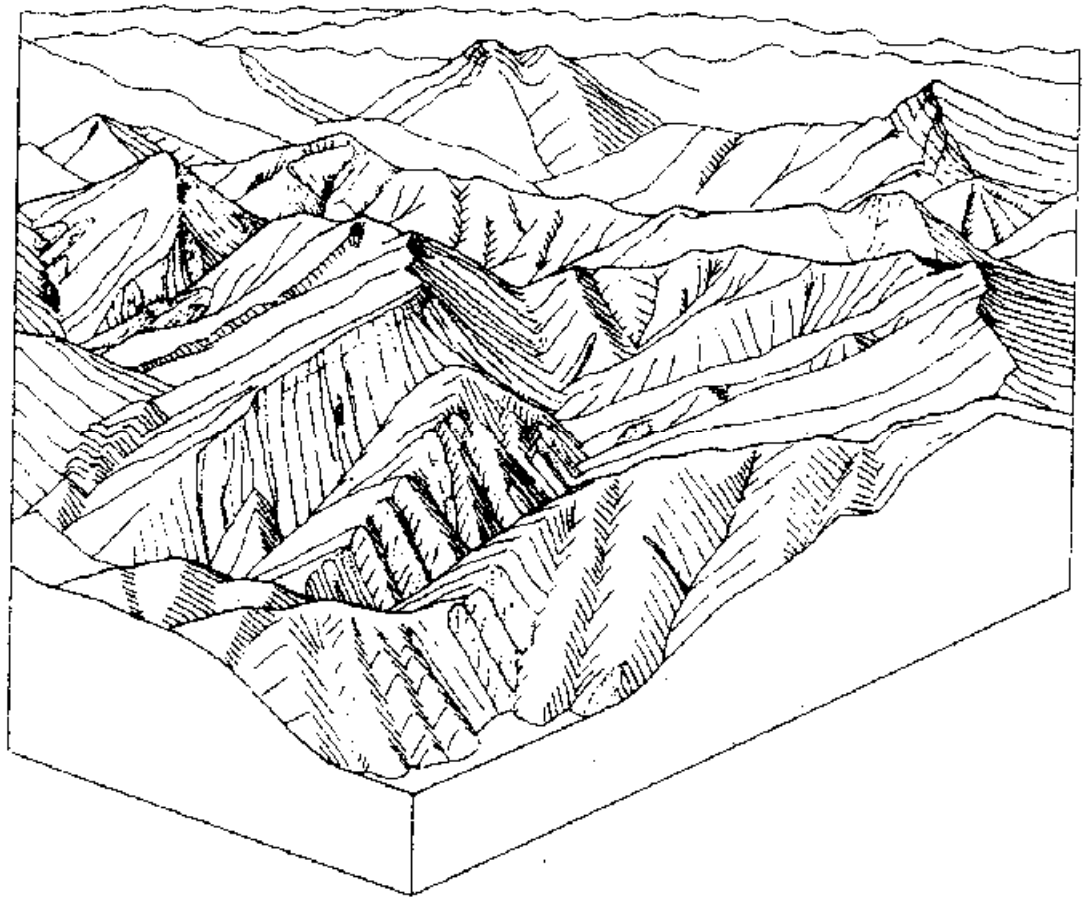
5. Old 'Hard' Rock Mountain Land Type

The Old 'Hard' Rock Mountain Land Type consists of steep to very steep, often deeply dissected, upper and lower mountain slopes, summits (formerly cirque glaciated with tarns and extensive rock outcrop), ridge crests and gorges. It also includes U-shaped valleys and morainic deposits as well as remnant relict stripped surfaces and outliers of Tertiary cover rocks which are preserved on strongly rolling summits to the south-west and on the foothills of the ranges. The land type is developed on Palaeozoic sedimentary sandstone, siltstone mudstone and slates, and associated conglomerates (e.g. Lockett Conglomerate), and encompasses parts of the Wakamarama Range, the Tasman Mountains, the Haupiri, Anatoki, and Devil Ranges, and parts of the Arthur Range in both Golden and Tasman Bays. Elevation ranges from 40 to 1860 m and rainfall from 4000 to 6400 mm annually. Vegetation consists of heavily forested slopes to 1300 m, with open snow grass meadows and rocky mountain peaks above. Low stunted forest and scrub, mountain beech, pygmy pine, mānuka, and red tussock are present on relict stripped surfaces of both the Gouland and Mackay Downs.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use
1	Steep upper mountain slopes	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	600–1300	Silver and mountain beech forest	Conservation, protected native forest, recreation
2	Moderately steep lower mountain slopes	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	40–600	Mixed beech-podocarp-hardwood forest	Conservation, protected native forest, recreation
3	Mountain spur crests and summits	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	1300–1860	Subalpine scrub, tussock land, alpine herb-fields	Conservation, recreation
4	Strongly rolling remnant relict stripped surfaces at high elevations	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	600–900	Stunted forest and scrub, mountain beech, pygmy pine and mānuka, red tussock, bracken	Conservation, recreation

Agronomic potential	Potential land use	Potential impacts
Very low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals
Low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals
Nil	Conservation, recreation	Recreation, tracking, feral animals
Low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals

5	Strongly rolling remnant relict stripped surfaces at low elevations	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	40-500	Scrub, bracken fern	Conservation, semi intensive grazing, recreation	Low	Semi intensive grazing, exotic forestry, protected native forest, recreation	Loss of native vegetation, fencing, tracking, exotic weeds
6	Strongly rolling outliers of Tertiary cover rocks	Mid Oligocene limestone and associated rocks	600-920	Stunted forest and scrub, mountain beech, mānuka, red tussock, bracken	Conservation, recreation	Low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals
7	Cirque basins	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	1300–1800	Subalpine scrub, tussock land, alpine herb-fields	Conservation, recreation	Nil	Conservation, protected native forest, recreation	Recreation, tracking, feral animals
8	Very steep gorges	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	100-1500	Mixed beech-podocarp-hardwood forest	Conservation, protected native forest, recreation	Very low-nil	Conservation, protected native forest, recreation	Recreation, tracking, feral animals



Land Type 5: Old ‘Hard’ Rock Mountain (from Whitehouse and Pearce 1992)

Glaciated tops and steep to very steep upper mountain slopes of the Anatoki Range formed on old hard sedimentary rocks of (LT5). [GNS image]

Strongly rolling remnant relict stripped surfaces of LT5 at low elevations—the lower eastern side of the Aorere Valley. [GNS image]

6. Western Inland Valley Floor Land Type

The Western Inland Valley Floor Land Type consists of the glaciated U-shaped valleys of the Tasman Mountains including the Haupiri, Anatoki, Snowden and Lockett Ranges, along with the headwall cirque basins and tarns, active and recently active riverbeds, meander floodplains, backswamps, low terraces, coalescing valley-side fans and scree aprons, landslide and moraine-dammed lakes (e.g. Lakes Cobb and Stanley). Elevation ranges from 200 to 1100 m with rainfall from 1800 to 5500 mm annually. Largely within the Kahurangi National Park, vegetation comprises predominately indigenous forest with short tussock grassland, wetland and sedges.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Meandering floodplain valley fill	Holocene fluvial deposits	300–1000	Short tussock grassland, matagaouri scrub, beech forest, rushes and sedges	Conservation, recreation, feral animal grazing	Low	Conservation, recreation	Recreation impacts, tracking, feral animals, exotic weeds
2	Floodplain terraces	Late Pleistocene and Holocene fluvial deposits	300–900	Beech forest, short tussock grassland, matagaouri scrub, rushes and sedges	Conservation, recreation, feral animal grazing	Low	Conservation, recreation	Recreation impacts, tracking, buildings, feral animals, exotic weeds
3	Coalescing valley side fans and scree aprons	Late Pleistocene and Holocene fan deposits	300–900	Beech forest, short tussock grassland, matagaouri scrub	Conservation, recreation, feral animal grazing	Low	Conservation, recreation	Recreation impacts, tracking, buildings, feral animals, exotic weeds
4	Valley floor swamps	Holocene fluvial and swamp deposits	300–900	Sedge, turf, reed and rushlands, red tussock and raupō	Conservation, recreation, feral animal grazing	Low	Conservation recreation	Conservation, recreation, feral animal grazing
5	Minor valley head moraine and landslides	Holocene moraine and landslide deposits	380–1000	Scrub, matagouri, tussock grassland, beech forest, gravel fields	Conservation, feral animal grazing	Very low	Conservation, recreation	Conservation, recreation, feral animal grazing
6	Moraine and landslide dammed lakes and lake shorelines	Late Pleistocene and Holocene fluvial deposits	400–800	Scrub, matagouri, tussock grassland, beech forest, gravel fields	Conservation, feral animal grazing	Nil- to low	Conservation, recreation	Conservation, recreation impacts, feral animal grazing
7	Cirque basins	Predominantly Palaeozoic sedimentary rocks of the Golden Bay and Haupiri Groups	1300–1800	Subalpine scrub, tussock land, alpine herb-fields	Conservation, recreation	Nil	Conservation	Recreation, feral animals

Steep glaciated valley walls in the upper Cobb Valley intersect the relatively flat bottomed valley floor (LT6), with minor moraine dumps.

The Cobb reservoir partially floods the formerly glaciated Cobb river valley (LT6).

7. Western Lowland Major River Valley Land Type

The Western Lowland Major River Valley Land Type consists of active and recently active riverbeds, floodplains, low terraces and associated backswamps, flights of intermediate and high terraces, and the dissected remnants of high terraces along the margins of the fault angle depressions of the Aorere and Takaka river valleys. This land type is formed from Recent predominantly fine grained river alluvium, and slightly to extensively weathered coarse aggradational and degradational terrace gravels. Elevation ranges from 0 to 120 m, and rainfall from 1500 to 2000 mm annually. The vegetation was originally podocarp-hardwood-beech forest, with tōtara, small stands of kahikatea, rimu, miro, and rātā; and on the high terraces, black and hard beech, pakihi and bracken vegetation.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Meander floodplain and floodbasins	Holocene alluvium, predominately sands and muds	0–20	Podocarp-hardwood-beech forest with tōtara, kahikatea, flax, rushes, sedges, scrubland	Intensive grazing, feed and cash cropping	High	Intensive grazing, feed and cash cropping, horticulture	Intensified land use, windbreaks, subdivision
2	River deltaic-estuarine fringe	Holocene alluvium, predominately muds and sands	0–2	Marshland vegetation, dune slack	Wildlife reserve, recreation	Very low	Wildlife reserve, recreation	Decrease in native species, increased exotic weeds, drainage
3	Low terraces	Holocene gravels	20–100	Podocarp-hardwood-beech forest with totara	Intensive grazing, cash and feed cropping, horticulture	High	Cash and feed cropping, horticulture, orchards, intensive grazing	Intensified land use, windbreaks, subdivision
4	Backswamps	Fine grained Holocene alluvium and organic deposits	20–100	Wetland, rushes, sedges, flax	Intensive grazing, feed cropping	High	Intensive grazing, feed cropping	Drainage, intensified land use, windbreaks, subdivision
5	Intermediate and high terraces	Slightly to extensively weathered Holocene gravels	40–120	Podocarp-hardwood-beech forest with tōtara and kahikatea	Intensive grazing, feed cropping, horticulture	High	Cash and feed cropping, horticulture, orchards, intensive grazing	Intensified land use, windbreaks, subdivision
6	Dissected high terrace remnants	Extensively weathered Holocene gravels	80–120	Pakihi and tall scrub, bracken	Extensive grazing, exotic forestry	Low	Exotic forestry, extensive grazing	Tracking, increased exotic weeds, decrease in native species

Dissected terrace remnants, foreground, above the intermediate terraces and floodplain on the true right of the lower Aorere Valley.

Intermediate and low terraces of the lower Takaka valley.

8. Golden Bay Coastal Fringe Land Type

The narrow Golden Bay Coastal Fringe Land Type incorporates the suites of narrow undulating to rolling beaches and sand dunes, sand flats, swamps, estuaries, alluvial terraces and raised coastal terraces from Abel Head in the north to Pohara in the east. The Land Type excludes those landforms such as the cliffed and rocky shorelines developed on weakly or strongly indurated rock types, e.g. Rangihaeata Head. Elevation ranges from 0 to 100 m and rainfall from 1200 to 1500 mm annually.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Beach sand dune complexes, undulating to rolling beaches and dune sands	Well sorted Holocene beach sand	0-100	Scrub, pingao, *Danthonia* grassland, dune slack, carex	Conservation, extensive grazing, recreation	Very low	Conservation, recreation, extensive grazing	Fire, recreation, buildings, erosion, increase in exotic weeds
2	Interdune and backswamp swamps	Swamp and estuarine deposits, poorly consolidated sand, mud and peat	0-5	Wetland vegetation, rush and sedges	Recreation, conservation, extensive grazing, wildlife reserve	Low	Conservation, recreation, extensive grazing, wildlife reserve	Drainage, loss of native vegetation, increase in exotic weeds
3	Sand flats, e.g. Triangle Flat	Well sorted sand	0-5	Scrub, pingao, *Danthonia* grassland, dune slack, carex	Semi-intensive grazing, recreation, conservation, wildlife reserve	Low-medium	Intensive grazing, exotic forestry, recreation, conservation, wildlife reserve	Intensified land use, subdivision, shelter belts, tracking, buildings
4	Raised coastal terraces	Weathered clay-bound gravels and minor fan deposits forming addgradational terraces	0-20	Coastal scrub, coastal and podocarp forest	Intensive grazing, feed cropping	High	Intensive grazing, feed and cash cropping, horticulture	Intensified land use, subdivision, shelter belts, tracking, buildings
5	Floodplains and low terraces	Holocene well sorted gravels and muds	0-20	Podocarp-hardwood forest, kahikatea	Intensive grazing, feed cropping	High	Intensive grazing, feed and cash cropping, horticulture	Intensified land use, subdivision, shelter belts, tracking, buildings
6	Estuaries and barrier spits, e.g. Pakawa and Ruataniwha Inlets	Well sorted sands, muds and shell beds	0-5	Pingao salt marsh, scrub, dune slack	Recreation, conservation land	Nil	Conservation, recreation	Loss of native vegetation, increase in exotic weeds, recreational impacts

Part of LT8—the Motupipi estuary and associated barrier spit.

9. Golden Bay 'Soft' Rock Tertiary Hills Land Type

The Golden Bay 'Soft' Rock Tertiary Hills Land Type comprises the rolling to steep hill and downland landscapes underlain by Mid-Tertiary aged calcareous mudstone, muddy sandstone, and hard crystalline and sandy limestone. The land type incorporates smooth rounded hill slopes developed on the weakly indurated strata; strongly textured, structurally controlled hills on the more indurated limestone strata,often with karst features such as rock pavements and caves; plateaux and gravel-capped surfaces; and associated terraces and minor floodplains. Elevation ranges from 40 to 800 m and rainfall from 2000 to 4000 mm annually. Originally podocarp-hardwood-beech forest with kahikatea, rimu, mataī, miro rātā, black and hard beech. Examples of areas include the western margin of the Aorere Valley east of the Wakamarama Fault; the downlands north east of the Golden Bay Fault; the gently rolling downlands on the lower eastern margin of the Takaka valley around Motupipi, west of the Pikikiruna Fault; and the eastern margins of the Takaka valley in the Upper Takaka, including the Barron Flat area.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	'Soft' rock erosional hill slopes	Mid Tertiary aged calcareous mudstones and muddy sandstone	20-700	Podocarp-hardwood-beech forest	Semi-intensive grazing, exotic forestry, scrubland	Medium	Semi-intensive grazing, exotic forestry	Fencing, tracking, exotic forest, decrease in native species
2	Spur crests and summits	Mid Tertiary aged calcareous mudstones and muddy sandstone	160–700	Podocarp-hardwood-beech forest	Semi-intensive grazing, exotic forestry, scrubland	Medium	Semi-intensive grazing, exotic forestry	Fencing, tracking, exotic forest, decrease in native species
3	'Soft' rock structural landforms with karst features	Mid Tertiary aged limestone, calcareous mudstone and sandstone	40–600	Podocarp-hardwood-beech forest, broadleaf scrub	Semi-intensive grazing, scrublands	Medium	Semi-intensive grazing, exotic forestry, recreation	Fencing, tracking, exotic forest, decrease in native scrub, recreation
4	Terraces and gravel-capped surfaces	Quaternary and Pleistocene gravels	0–300	Podocarp-hardwood-beech forest with tōtara and kahikatea	Intensive grazing, feed cropping	High	Intensive grazing, feed cropping	Fencing, cultivation, shelter trees, subdivision
5	Meander floodplain	Recent alluvium and swamp deposits	0–200	Podocarp-hardwood forest with kahikatea, wetlands, sedges and grasses	Intensive grazing and feed cropping	High	Intensive grazing, feed cropping	Drainage, cultivation, subdivision, shelter trees
6	Coastal cliffs and associated reefs	Mid Tertiary aged limestone, calcareous mudstone and sandstone	0–20	Coastal scrub and forest	Conservation, reserves, recreation	Nil	Conservation, reserves, recreation	Tracking, recreation, increase in exotic weeds
7	Mid elevation plateaux, e.g. Barron Flat	Mid Tertiary aged limestone and calcareous sandstone	600-900	Mixed beech-podocarp-hardwood forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Recreation, tracking, feral animals

Rolling soft rock hills above Rangihaeata Head (LT9).

Coastal cliffs (LT9) cut into soft Tarakohe formation mudstones, Onekaka Beach.

10. Coastal Separation Point Land Type

The Coastal Separation Point Land Type comprises the strongly rolling to steep dissected hill country underlain by extensively weathered, early Cretaceous-aged, predominantly biotite granites of the Separation Point Suite, and the associated minor undulating to rolling terraces, floodplains, beaches and sand dunes, swamp, and localised estuarine deposits. Elevation ranges from 0 to 1330 m, and rainfall from 1500 to 2200 mm per year. Strongly leached low fertility hill and steepland soils from granite predominate. Originally forested with podocarp-hardwood forest dominated by rimu and northern rātā with mataī, hīnau, Hall's tōtara with occasional pōkākā, miro and tōtara, and mixed beeches at higher elevations. The land type is now largely in secondary forest and scrub (mānuka, kānuka, gorse) after extensive European clearance. The land type extends from the Golden and Tasman Bay coastlines, including the valley floor landforms of Ligar Bay, Wainui Inlet, Totaranui, Awaroa and Sandy Bays, and continues upslope to bound the contrasting Northern Mt Arthur Marble Land Type around Moa Park. It also extends inland on the western bank of the Motueka River to the confluence of the Whangapeka River.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Steep upper hill slopes	Separation Point Suite granite	600–1330	Podocarp-hardwood forest, southern rātā	Conservation, protected native forest, exotic forestry, recreation	Low	Conservation, exotic forestry, protected native forest, recreation	Tracking, exotic forestry, recreation, buildings etc.
2	Moderately steep lower hill slopes	Separation Point Suite granite	0–600	Podocarp-hardwood forest, red, silver and black beech	Exotic forestry, conservation, protected native forest	Low	Exotic forestry, conservation, protected native forest, recreation	Exotic forestry, tracking, increase in exotic weeds
3	Spur crests and summits	Separation Point Suite granite	200–1330	Podocarp-hardwood forest, some red tussock and subalpine scrub	Conservation, protected native forest, exotic forestry, recreation	Low	Conservation, exotic forestry, protected native forest, recreation	Recreation, exotic forestry, tracking, buildings etc.
4	Meander floodplains	Recent alluvium and swamp deposits	0–40	Podocarp-hardwood forest, kahikatea, wetlands, sedges and grasses	Semi-intensive grazing, scrublands, conservation, protected native forest	Medium	intensive grazing, fodder cropping, exotic forestry, recreation	Fencing, tracking, shelter belts, exotic forest, increase in exotic weeds
5	Beaches, beach ridges, sand dunes, sand spits swamps, and estuarine mudflats	Recent sands and muds	0–10	Spinifex, dune slack rushes, sedges, low scrub	Extensive grazing, conservation, recreation	Low	Conservation, extensive grazing, recreation	Recreation, tracking, increase in exotic weeds, buildings etc.

Coastal hill slopes developed on Separation Point Suite granite surround the estuary and sand spit at Bark Bay (LT10) on the western shoreline of Tasman Bay.

11. Inland Intrusives Land Type

The Inland Intrusives Land Type comprises steep to very steep dissected hill country and mountain lands underlain by coarse grained intrusive rocks, including the Jurassic aged basic gabbro and diorites of the Rotoroa Complex outcropping between Howard Junction and the Matakitaki River north west of the Alpine Fault. It also includes the early Cretaceous aged, predominantly biotite granites of the Separation Point Suite on the true left of the Glenroy River, and forming the Hope Range, where they are extensively weathered, especially in the lower Dart River catchment. Along with these areas are the associated minor valley terraces and floodplains. The younger Separation Point rocks extensively intrude the Rotoroa Complex west of Lake Rotoroa, and remnants of older undifferentiated till are present in southern areas. Elevation ranges from 200 adjacent to the Whangapeka River to 1693 m (Mt Cann), and rainfall ranges from 1600 to 4000 mm per year. The native vegetation comprises largely indigenous forest, particularly red beech-silver beech, with silver beech-mountain beech at higher elevations.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Steep upper mountain slopes	Rotoroa Complex gabbro and diorites, and Separation Point Suite granites	600–1330	Silver and mountain beech forest	Conservation, protected native forest, exotic forestry, recreation	Low	Conservation, exotic forestry, protected native forest, recreation	Recreation, tracking, exotic forestry, buildings etc.
2	Moderately steep lower mountain slopes	Rotoroa Complex gabbro and diorites, and Separation Point Suite granites	200–600	Red and silver beech forest	Protected native forest, exotic forestry, conservation	Low	Exotic forestry, protected native forest, conservation land, recreation	Exotic forestry, tracking, increase in exotic weeds
3	Summits and spur crests above the bush line	Rotoroa Complex gabbro and diorites, and Separation Point Suite granites	1150–1693	Snow- and alpine-tussock grassland and herbfield, subalpine and alpine scrub, fellfield and scree vegetation	Conservation, recreation, feral animal grazing	Nil	Conservation, recreation	Recreation, feral animals
4	Moderately steep hill slopes	Rotoroa Complex gabbro and diorites, and Separation Point Suite granites	200-800	Red, silver and hard beech forest, some podocarp forest	Exotic forestry, extensive grazing, conservation, protected native forest	Low	Exotic forestry, extensive grazing, conservation, protected native forest, recreation	Exotic forestry, tracking, increase in exotic weeds
5	Minor valley terraces, floodplains and fans	Holocene post-glacial river gravels, sand and fan deposits	200–400	Red, silver and hard beech forest, some podocarp forest	Semi-intensive grazing, conservation, protected native forest	Medium	Semi-intensive grazing, fodder cropping, exotic forestry, recreation	Fencing, tracking, exotic forest, shelter belts, increase in exotic weeds

View from Porika Road across the mouth of Lake Rotoroa onto the Braeburn Range (LT11) and the Braeburn Track Valley. [GG Hunter image]

12. Northern Mt Arthur Marble Land Type

The Northern Mt Arthur Marble Land Type consists of very steep to moderately steep mountain and hill landscapes developed on Mount Arthur Group marble and limestone and associated rocks (including the Riwaka Complex basic intrusive pyroxenite, gabbro and diorite rocks and adjacent Onekaka schist). These areas are found predominately east of the Pikikiruna fault from the Motupipi to the Graham rivers, including Hoary Head and the outliers of Jones Ridge and Devils Thumb in the lower Whangapeka. The land type also includes the marble terrain on the true left of the lower Takaka Valley. The landscape is characterised by the very steep Pikikiruna fault scarp, the strongly rolling, dissected Tablelands with extensive karst landforms, rock outcrop, fluted weathering, caves, sink holes and disappearing streams etc. It dips gently to the north-east from the vicinity of Hales Knob to the Gold Creek area of the Cannan Downs. Characteristic features also include the steep dissected slopes of the marginal steeplands and hill country that drain eastwards into the Motueka River. Elevation ranges from 40 to 1500 m and rainfalls from 1800 to 2500 mm annually. The vegetation comprises podocarp and mixed podocarp-beech forest on lower slopes and valleys; red beech and silver with black beech on lower alluvial terraces, extensive beech forest at higher elevations to 1300 and 1400 m; with minimal subalpine scrub, red tussock and alpine herbfield above the treeline (Hoary Head).

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Upper mountain slopes (>1000 m)	Mt Arthur Group marble, limestone and associated rocks	1360–1500	Alpine tussock grassland and herbfield, subalpine scrub	Conservation, recreation, 'wild' animal grazing	Very low to nil	Conservation, extensive grazing, recreation, feral animal grazing	Tracking, feral animals, increased scrub with reduced grazing, recreation
2	Lower mountain slopes (<1200 m)	Mt Arthur Group marble, limestone and associated rocks	900–1300	Podocarp and podocarp/beech forest	Extensive grazing, conservation	Low	Extensive grazing, exotic forestry on moist aspects, conservation, recreation	Tracking, fencing, exotic trees and weeds, recreation
3	Very steep fault scarp	Mt Arthur Group marble, limestone and associated rocks	100-1200	Podocarp and podocarp/beech forest	Extensive grazing exotic forestry, conservation	Low	Extensive grazing, exotic forestry, conservation, recreation	Tracking, fencing, exotic trees and weeds, recreation
4	Strongly rolling tablelands	Mt Arthur Group marble, limestone and associated rocks	750-1000	Podocarp and podocarp/beech forest	Semi intensive grazing, exotic forestry, conservation	Medium	Semi intensive grazing, exotic forestry, conservation, recreation	Tracking, fencing, exotic trees and weeds, recreation
5	Marginal dissected hill and mountain slopes	Basic intrusive rocks of the Riwaka complex, Onekaka schist	60-1100	Podocarp and podocarp/beech forest	Conservation, exotic forestry, extensive grazing	Medium	Exotic forestry, semi intensive grazing, conservation, recreation	Tracking, fencing, exotic trees and weeds, recreation
6	Alluvial terraces and minor floodplains	Holocene clay-bound gravels and fan deposits	40-150	Red beech and silver with black beech	Semi intensive grazing, scrub, horticulture	High	Semi intensive grazing, horticulture	Subdivision, shelter belts, buildings, flooding

View across the rolling tablelands of LT12 to Tasman Bay, from the Takaka Hill.

Lower Pikikiruna Range showing gently dissected summit ridge of LT12.

13. Southern Mt Arthur Marble Land Type (Mt Owen area)

The Southern Mt Arthur Marble Land Type consists of steep to very steep inland mountain landscapes developed on predominately Mount Arthur Group marble and limestone, and associated sedimentary rocks (e.g. Wangapeka and Baldy Formation siliceous siltstones and sandstones) and schist rocks (e.g. Onekaka Schist). The area is south of the Graham River, and also includes the subalpine basins of the Mount Owen massif. The landscape is characterised above the bush line by extensive karst landforms and rock pavement, with fluted weathering, caves, sink holes and disappearing streams etc. Elevation ranges from 360 to 1875 m (Mt Owen) and rainfalls from 1800 to 3000 mm per year. Native vegetation comprises podocarp and mixed podocarp - beech forest on lower slopes and valleys; red beech and silver with black beech on lower alluvial terraces, extensive beech forest at higher elevations to 1300 m; and above treeline subalpine scrub, red tussock and alpine herbfield.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Upper mountain slopes	Mt Arthur Group marble, limestone and associated rocks	800–1300	Beech forest, subalpine scrub	Protected native forest, conservation, recreation, feral animal grazing	Nil	Conservation, recreation	Recreation, tracking, feral animals, buildings
2	Lower mountain slopes	Mt Arthur Group marble, limestone and associated rocks	550–800	Podocarp and mixed podocarp - beech forest	Protected native forest, conservation, recreation	Low	Conservation recreation, exotic forestry	Tracking, exotic trees and weeds, recreation
3	Broad summits with extensive rock outcrop	Mt Arthur Group marble, limestone and associated rocks	1300–1875	Subalpine scrub, red tussock and alpine herbfield	Conservation, recreation, feral animal grazing	Nil	Conservation, recreation	Recreation, feral animals, tracking, buildings
4	Marginal foothill hill slopes	Mt Arthur Group marble, limestone and associated rocks	360–700	Podocarp and mixed podocarp - beech forest	Protected native forest, conservation, recreation	Low	Conservation, recreation, exotic forestry	Tracking, exotic trees and weeds, recreation
5	Sinuous narrow alluvial terraces and minor floodplains	Holocene gravels and fan deposits	360-500	Red beech and silver with black beech	Protected native forest, conservation, recreation	Low	Protected native forest, conservation, recreation	Recreation, tracking, buildings

Mount Patriarch, capped by Ordovician Summit Limestone (LT13). [GNS image]

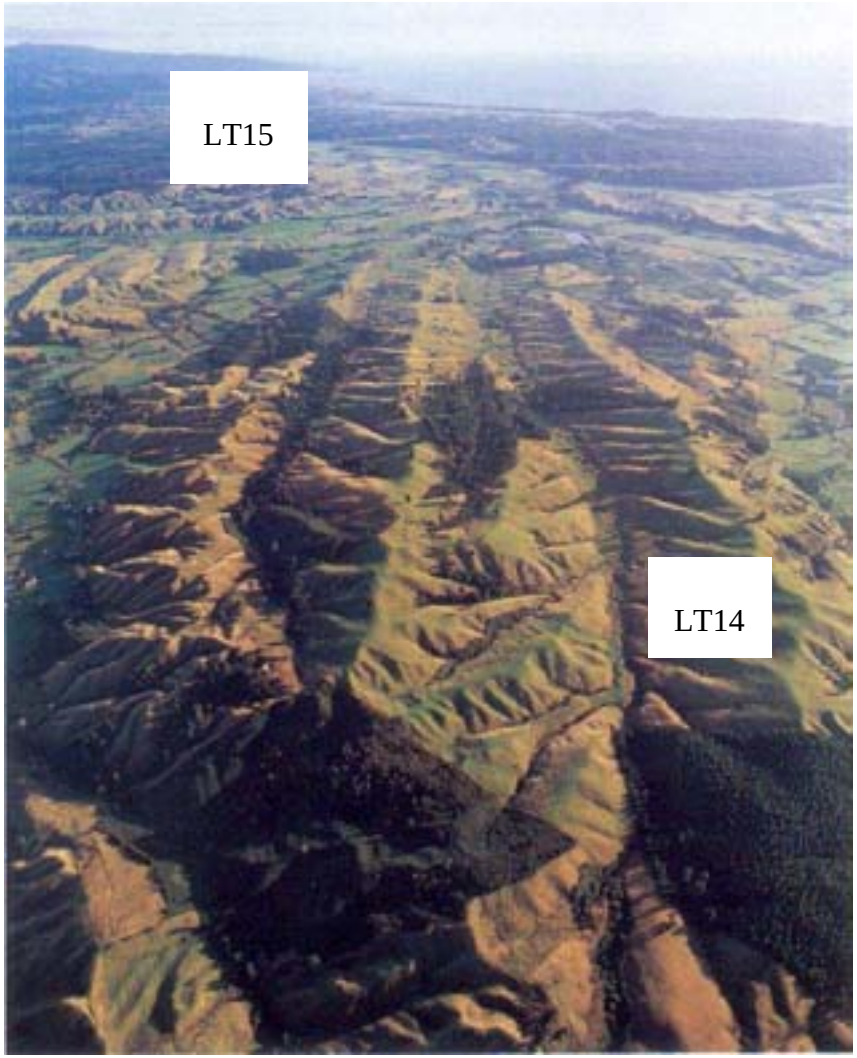
Subalpine basins and tops of the Mount Owen massif.

14. Moutere Gravels Land Type

The Moutere Gravels Land Type consists of strongly rolling, to moderately steep, to steep hill country. It is dissected in a distinctive herring bone dissection pattern, and is developed on weakly consolidated, poorly to moderately well sorted clay-bound gravels dominated by sandstone clasts. It has associated minor fans, terraces and floodplains in the 30 km wide Moutere Depression, and includes the marginal hills underlain by Mid Tertiary aged rocks in the east and in the Sherry and Tadmor catchments. The land type is fault-bounded to the east by north-east-trending Waimea-Flaxmere Fault System and to the west by the Coastal Separation Point and Inland Intrusives land types. The Moutere Gravels land type extends from the Buller River in the south to the coast at Ruby Bay and Kina. Shallow soil slip erosion is a feature on mid to lower slopes in pasture converted from scrub and forest. Elevation ranges from sea level to 850 m, and rainfall from 1000 to 1600 mm per year. Originally beech forested, it now has mainly black beech along the coast, with hard beech becoming more prominent inland especially on ridges; and red beech dominant over silver beech further inland, with mountain and silver beech to the south. Podocarp forest (tōtara, mataī, rimu, miro, kahikatea) originally dominated the valley floors; with some lowland tall hardwood forests with podocarps near the coast.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	'Soft' rock erosional hill slopes on Moutere gravels	Plio-Pliestocene aged clay bound Moutere Gravels	0–850	Beech forest, small remnants of podocarp and hardwood forests	Exotic forestry, semi-intensive grazing, feed cropping, conservation, recreation	Low to medium	Exotic forestry, semi-intensive grazing, feed cropping, conservation, recreation	Tracking, roading, fencing, buildings, cultivation, exotic weeds
2	Spur crests and summits on Moutere gravels	Plio-Pliestocene aged clay bound Moutere Gravels	20–850	Beech forest, small remnants of podocarp and hardwood forests	Exotic forestry, semi-intensive grazing, feed cropping, conservation, recreation	Low to medium	Exotic forestry, semi-intensive grazing, feed cropping, conservation, recreation	Tracking, roading, fencing, buildings, cultivation, exotic weeds

3	'Soft' rock erosional hill slopes on mid Tertiary rocks	Port Hills Gravels and mid Tertiary aged Jenkins Group sandstone, siltstone, limestone and minor conglomerate.	20–200	Podocarp and hardwood forests, scrub	Intensive grazing, exotic forestry, conservation, recreation	Low to medium	Exotic forestry, semi-intensive grazing, conservation, recreation	Tracking, roading, fencing, buildings, cultivation, exotic weeds
4	Fans	Quaternary and Holocene aged fan deposits	10–450	Podocarp and hardwood forests	Intensive grazing, feed and cash cropping	Medium to high	Intensive grazing, feed and cash cropping, exotic forestry, horticulture	Intensive land use, windbreaks, subdivision
5	Terraces	Quaternary and Holocene aged river gravels sands with minor and silt	20–450	Podocarp and hardwood forests	Intensive grazing, feed and cash cropping, horticulture (hops and berries)	Medium to high	Horticulture, intensive grazing, feed and cash cropping, exotic forestry	Intensive land use, windbreaks, subdivision
6	Minor meander floodplains	Recent alluvium and swamp deposits	0–300	Wetlands, sedges, grasses	Intensive grazing, feed and cash cropping, horticulture (hops and berries)	High	Horticulture, intensive grazing, feed and cash cropping, exotic forestry	Intensive land use, drainage, windbreaks, subdivision
7	Sea cliffs	Plio-Pliestocene aged clay bound gravels	0–60	Coastal forest, scrub, ngaio	Conservation	Very low	Conservation	Tracking, building platforms



The Moutere valley draining north to Motueka (LT15). Note that the linear valleys and ridges with regularly spaced tributaries are a typical geomorphic expression of the Moutere Gravel Land Type (LT14). [GNS image]

Moutere Gravel landscape (LT14) looking north east across the Motupiko River.

Characteristic ‘herringbone’ spurs on the Moutere Gravels with forest cover in the foreground (LT14). Also visible are young moraine and outwash terraces of the high country valley floor land type (LT22) extending downstream from Lake Rotoiti; with the peaks and ranges of the Greywacke Mountains east of the Alpine Fault land type (LT18) in the background. [GNS image]

15. Eastern Lowland Major River Valley Land Type

The Eastern Lowland Major River Valley Land Type consists of the recent floodplains and riverbeds, low terraces and associated backswamp wetlands, flights of intermediate and high terraces, and minor fans in the upper tributaries; and the deltaic fringe complexes of barrier islands, spits, beach ridges, sand dunes and estuaries of the lower Motueka, Moutere, and Waimea Rivers. The land type is formed from Holocene-aged, predominantly fine grained, river alluvium, and slightly to extensively weathered coarse aggradtional and degradational terrace gravels. Elevation ranges from 0 to 420 m, and rainfall from 1000 to 1600 mm per year. The areas were originally forest (tall podocarp-hardwood-beech), grassland, scrub, and bracken fern, with flax and raupo in the swamps.

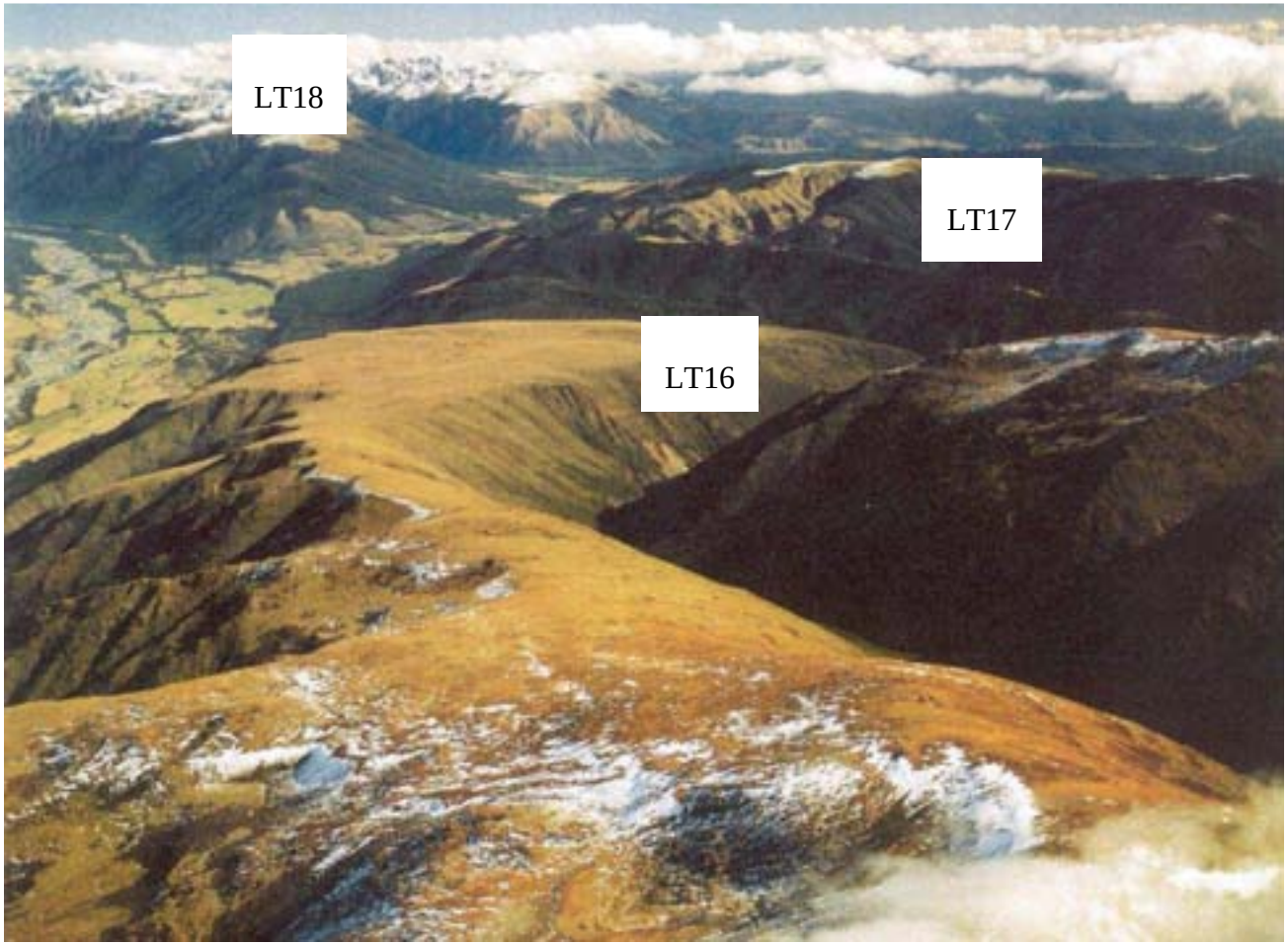
	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Modern floodplain and active riverbeds	Well sorted Holocene alluvial gravels	0–200	Scrubland, flax, raupo swamps	Intensive grazing, feed and cash cropping, horticulture	Moderate	Intensive grazing, feed and cash cropping, horticulture	Intensified land use, windbreaks, subdivision
2	Low terraces	Well sorted Holocene alluvial gravels	5–60	Danthonia grassland, kōwhai, kānuka, matagouri, scrub, cabbage trees, bracken	Intensive grazing, cash and feed cropping, viticulture, orchards	High	Horticulture, viticulture, orchards, cash and feed cropping intensive grazing	Intensified land use, windbreaks, irrigation, subdivision
3	Backswamps	Fine grained Holocene alluvium and organic deposits	5–60	Flax, raupo swamps	Intensive grazing, cash and feed cropping	High	Cash and feed cropping, horticulture, intensive grazing	Intensified land use, drainage, windbreaks, subdivision
4	Intermediate and high terraces	Late Quaternary clay bound and slightly weathered gravel with minor fan deposits	10-420	Podocarp-hardwood-beech forest, kānuka, matagouri, scrub, cabbage trees, bracken	Intensive grazing, cash and feed cropping, viticulture, orchards	High	Horticulture, viticulture, orchards, cash and feed cropping intensive grazing	Intensified land use, windbreaks, irrigation, subdivision
5	Deltaic fringe complexes of barrier islands, spits, beaches, and sand dunes	Holocene sand and mud forming beach ridges and sand dunes	0–5	Pingao, scrub, dune slack, carex, *Danthonia* grassland	Exotic forestry, recreation, utilities	Low	Exotic forestry, recreation, utilities	Loss of native vegetation, tracking, erosion, increase in exotics, recreational impacts
6	Estuaries	Holocene sand and mud	0–2	Salt marsh, scrub	Extensive grazing, wasteland	Low	Stabilisation, recreation	Loss of native vegetation, increase in exotics, recreational impacts

Recent floodplain and low terraces of the Waimea River with forest-covered Rabbit Island in the background (LT15). [GNS image]

16. Ultramafics Land Type

This land type includes the western slopes of the Red Hills ultramafic block draining into the Motueka catchment, and parts of the crest and upper western side slopes of the Bryant Range extending to and including Dun Mountain. Landform components include steep upper mountain slopes, summit ridges, and an extensive erosional plateau developed on ultrabasic and basic rocks of the Dun Mountain Ultramafics Group with extensive vegetated scree deposits and juxtaposed sedimentary rocks in inland situations. Elevations range from 400 to 1790 m and rainfall ranges from 2000 to 4800 mm per year. Soils are of very low fertility, with high levels of exchangeable magnesium. Toxic levels of chromium and nickel are often exceeded. Red and silver beech forest predominates, with open mixed scrub and shrubland, mānuka, flax, cassinia, and snow tussock grassland on Dun Mountain and the Red Hills. The land type is largely in Mt Richmond Conservation Park.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Steep to very steep upper mountain slopes and summit ridges on ultrabasic rocks	Dun Mountain Ultramafics Group	900–1790	Open mixed scrub and shrubland, mānuka, flax, cassinia, snow tussock grassland, red and silver beech forest at lower elevations	Conservation, protected native forest, recreation, feral animal grazing	Nil	Conservation, recreation	Recreation, tracking, feral animal grazing, buildings etc.
2	Moderately steep to steep hill slopes	Dun Mountain Ultramafics Group rocks dispersed through Maitai Group	400–900	Red and silver beech forest, open mixed scrub and shrubland and mānuka	Conservation, exotic forestry, protected native forest, recreation	Low	Exotic forestry, conservation, recreation	Recreation, tracking, buildings etc.
3	Erosional summit plateau	Dun Mountain Ultramafics Group	1000–1160	Open mixed scrub and shrubland, mānuka, flax, cassinia, snow tussock grassland	Conservation, recreation, feral animal grazing	Nil	Conservation, recreation	Recreation, tracking, feral animal grazing, buildings etc.



Red Hills Ridge with the erosional plateau surface capped by Pleistocene Plateau Gravel (LT16). The hills and steeplands of LT17 occupy the centre right, north of the Tophouse Valley, with the mountain slopes of the St Arnaud Range (LT18) to the south. [GNS image].

17. Eastern Hill and Mountain Land Type

The Eastern Hill and Mountain Land Type encompasses the steep to very steep hill and mountain slopes south of the Waimea-Flaxmere Fault System to the summit of the Bryant Range, including the Gordon Range and the Rodding, Wairoa and Lee River catchments.This land type is developed on indurated predominantly late Permian and Triassic Maitai Group sedimentary rocks (sandstones, siltstones, mudstones and limestones), and volcanoclastic rocks and basalts of the Livingstone Volcanics Group; as well as isolated pods of Dun Mountain Ultramafic Group rocks. Elevation ranges from 60 to1685 m, and rainfall from 1200 to 2080 mm per year, with common high intensity rains. Native vegetation consisted of mixed beech-podocarp forest dominated by red beech, silver beech, black beech-mountain beech complexes, and occasional hard beech with rimu, miro and mataī with some tōtara. Mountain beech forest dominates at higher elevations with snow tussock above the tree line. There is some mixed mānuka dominated scrub at lower elevations.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Steep upper mountain slopes	Maitai Group sandstones, siltstones, mudstones and limestones; Livingstone Volcanic Group rocks	600–1330	Mountain and silver beech forest	Exotic forestry, conservation, protected native forest, recreation	Low	Exotic forestry, conservation, protected native forest, recreation	Tracking, exotic forestry, recreation, buildings
2	Moderately steep lower mountain slopes	Maitai Group sandstones, siltstones, mudstones and limestones	200–600	Mixed beech-podocarp forest dominated by red beech, silver beech, black beech-mountain beech complexes	Exotic forestry, protected native forest, recreation	Low to moderate	Exotic forestry, protected native forest, recreation	Tracking, exotic forestry, increase in exotic weeds
3	Summits and spur crests above the bush line	Maitai Group sandstones, siltstones, mudstones and limestones; Livingstone Volcanic Group rocks	1150–1693	Snow and alpine tussock grassland and herbfield, subalpine and alpine scrub	Conservation, recreation	Very low-nil	Conservation, recreation	Recreation, feral animals
4	Moderately steep hill slopes	Maitai Group sandstones, siltstones, mudstones and limestones	60-800	Mixed beech-podocarp forest dominated by red beech, silver beech, black beech-mountain beech complexes	Exotic forestry, protected native forest, recreation	Low to moderate	Exotic forestry, protected native forest, recreation	Exotic forestry, tracking, increase in exotic weeds
5	Moderately steep to steep hill slopes	Dun Mountain Ultramafics Group rocks dispersed through Maitai Group	400–900	Red and silver beech forest, open mixed scrub and shrubland and mānuka	Conservation, exotic forestry, protected native forest, recreation	Low	Exotic forestry, conservation, recreation	Recreation, tracking, buildings etc.
6	Minor valley terraces, floodplains and fans	Clay-bound gravels and minor fan deposits	200–400	Mixed beech-podocarp forest	Exotic forestry, semi-intensive grazing	Moderate	Exotic forestry, semi-intensive grazing	Fencing, tracking, shelter belts, increase in exotic weeds

The western slopes of the Bryant Range (LT17), extending from Hacket Peaks to Mt Stewart. [GNS image]

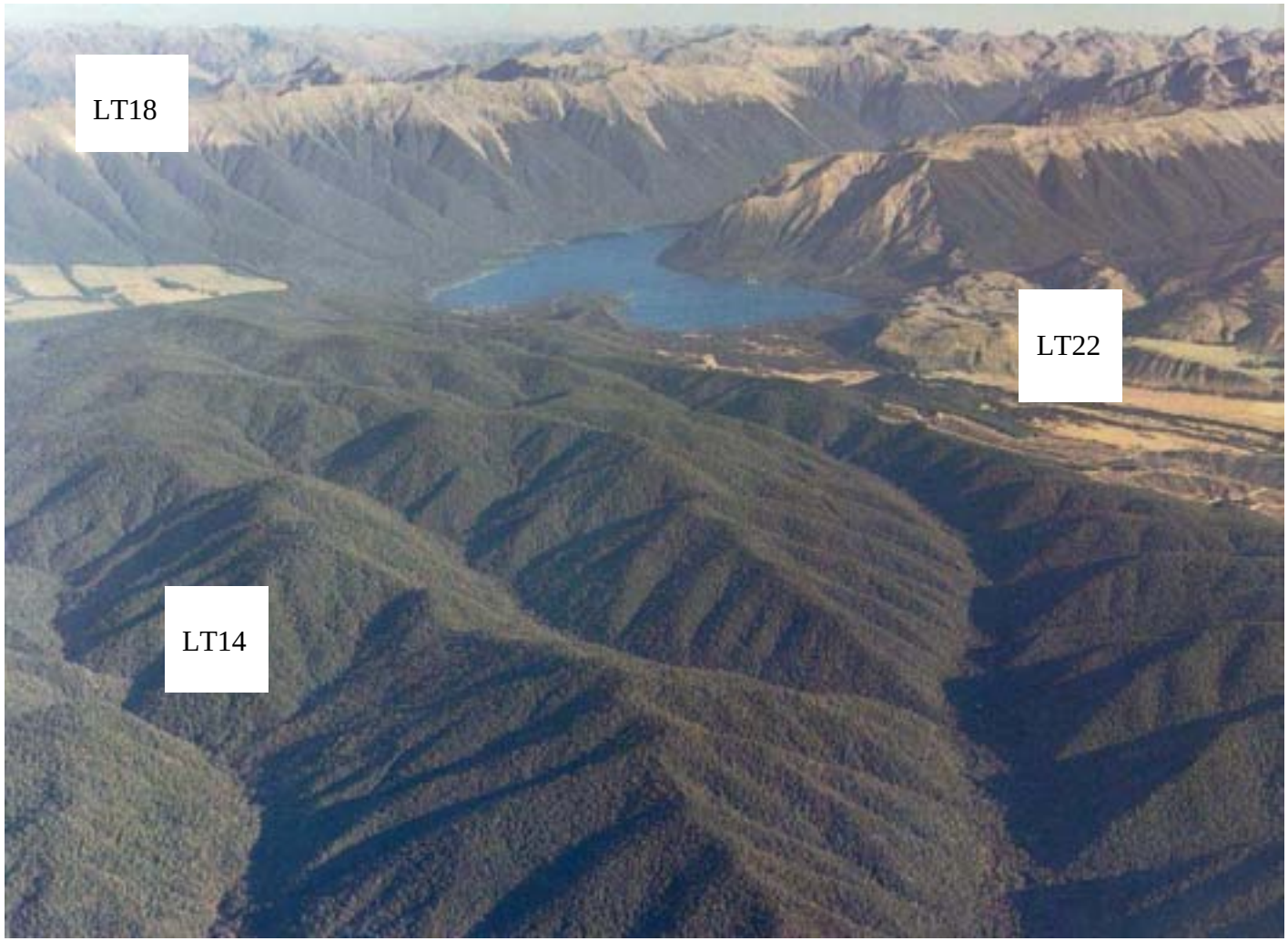
Dun Mountain Ultramafics Groups rocks outcropping on the Bryant Range looking northeast to Dun Mountain (centre distance), a component of the Eastern Hill and Mountains Land Type (LT17). [GNS image]

18. Greywacke Mountains east of the Alpine Fault

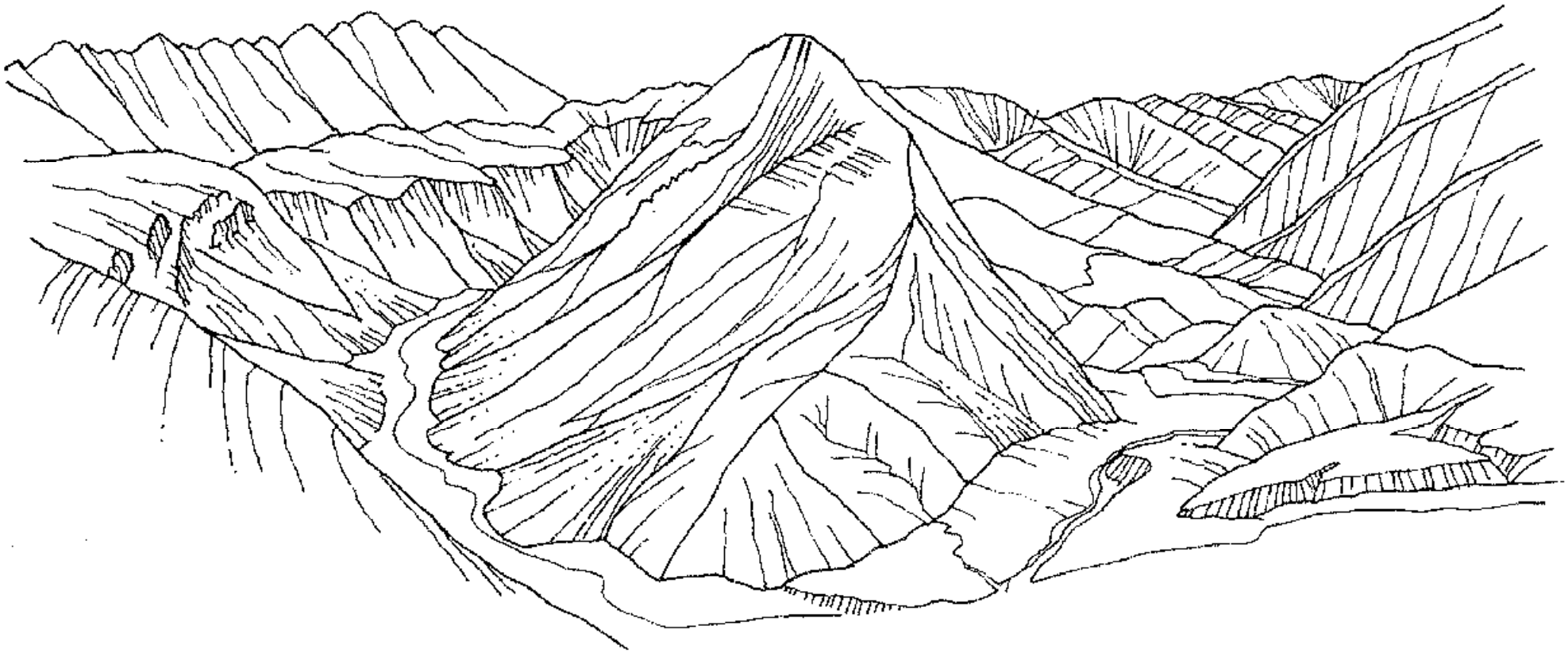
The land type comprises steep to very steep, high, glaciated mountains of the Main Divide and the St Arnard, Travers and Ella Ranges, and the Spenser Mountains. This land type is developed predominately on Torlesse Group sedimentary and semi schist rocks, and includes some Maitai and Caples Group rocks west of the Alpine Fault. Glacially eroded bedrock forms—cirque basins, U-shaped glacial troughs with extensive bare rock and scree—dominate above 1400 m. Extensive thin scree and talus mantles rectilinear slopes below 1500 m. Steep to very steep, dissected, lower mountain slopes with Holocene moraines, fluvioglacial benches and colluvial footslope fans fill valley heads and veneer valley walls. Elevation ranges from 550 to 2309 m (Mt McKay), and rainfall varies from 2400 to over 6400 mm per year through the montane to alpine–nival bioclimatic zones. Alpine vegetation, snow tussock and subalpine scrub, modified fescue-snow tussock grassland, mānuka and matagouri scrub, remnant and extensive beech forest clothe slopes below 1500 m. The land type incorporates the headwaters of the Buller River.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Upper mountain slopes, summits and cirques above vegetation limit	Torlesse Group sandstones and siltstones, semi schist, minor Maitai and Caples Group rocks	Upper limit of vascular plants to 2300 m	Bare rock, scree	Recreation, tourism, conservation	Nil	Conservation, recreation, tourism	Recreation impacts
2	Middle mountain slopes, summits and cirques (>1200 m)	Torlesse Group sandstones and siltstones, semi schist, minor Maitai and Caples Group rocks	1200 m to upper limit of vascular plants	Snow and alpine tussock grassland and herbfield, subalpine and alpine scrub, fellfield and scree vegetation	Recreation, tourism, conservation, feral animal grazing	Nil	Conservation, recreation, tourism, feral animal grazing	Recreation, tracking, buildings, tow lines, feral animals
3	Lower mountain slopes (<1200 m)	Torlesse Group sandstones and siltstones, colluvium, and moraine; minor Maitai and Caples Group rocks	550–1200	Mountain beech and Hall's tōtara forest, snow and short tussock grassland with matagouri, mānuka-kānuka, broadleaved and subalpine scrub and herbs	Conservation, protected native forest, recreation, extensive grazing	Very low	Conservation, recreation, extensive grazing, exotic forestry <1000 m	Tracking, exotic trees and forestry, recreation, feral animals
4	Minor valley floors, moraine and colluvial side slopes	Colluvium, moraine and alluvium from Torlesse Group sandstones and siltstones	550–1000	Beech forest , short tussock grassland with matagouri, mānuka-kānuka, broadleaved scrub, red tussock and wetlands	Conservation, native forest, recreation, extensive grazing	Low	Conservation, native forest, recreation, extensive grazing	Recreation, increase in exotic species, exotic forest

Lake Constance and Blue Lake at the head of the Sabine River resulting from landside dams in a deglaciated valley, and an unnamed tarn in the foreground filling a glacial cirque developed on the Torlesse Group sedimentary and semi schist rocks of the Greywacke Mountains east of the Alpine Fault Land Type (LT18). [GNS image]



The peaks and ranges of the Greywacke Mountains east of the Alpine Fault land type (LT18) forms the background and encloses Lake Rotoiti, from which the young moraine and outwash terraces of the high country valley fill land type extend downstream (LT22). The foreground comprises the characteristic 'herringbone' pattern of the Moutere Gravel land type (LT14). [GNS image]

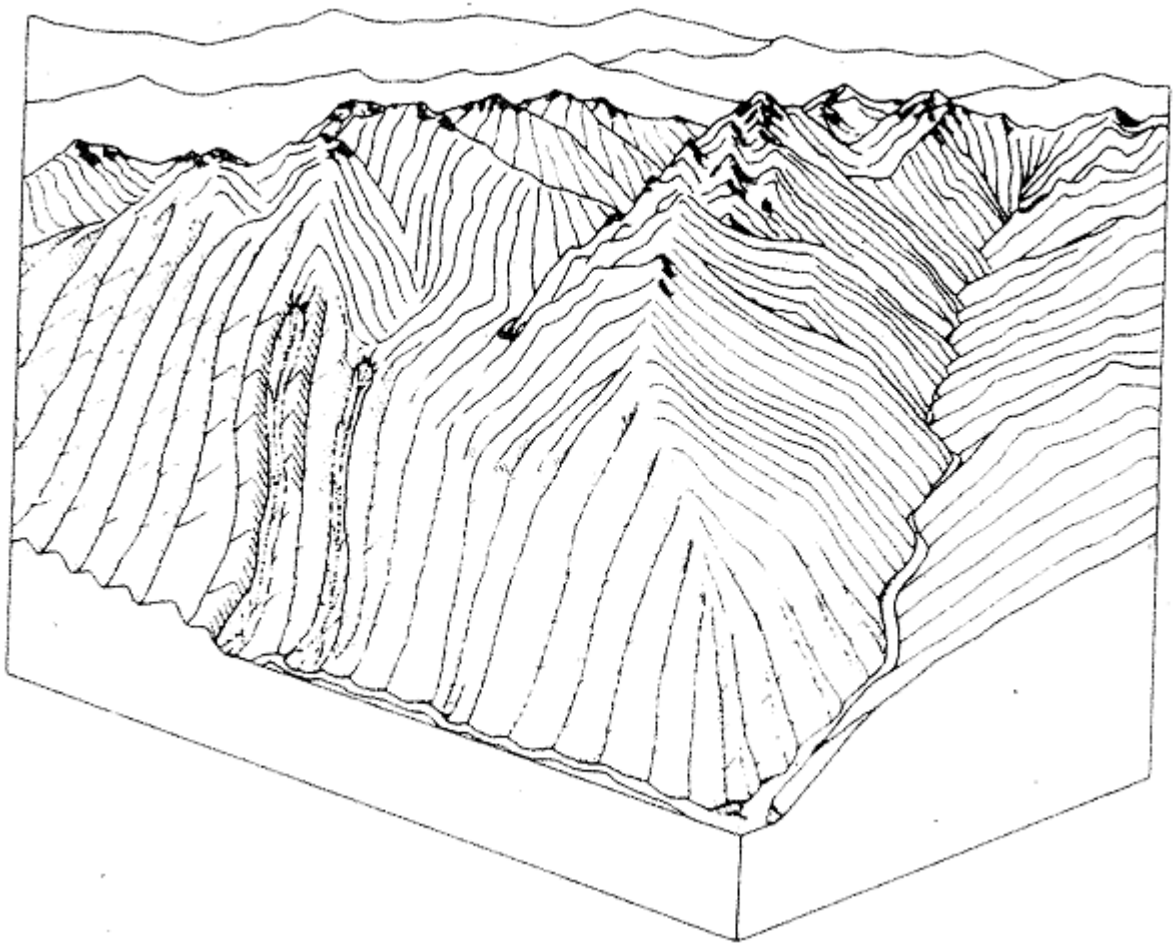


Land Type 18 – Greywacke Mountains east of the Alpine Fault

19. South-western Granite Land Type

The South-western Granite Land Type encompasses the moderately steep to steep mountain and hill slopes of the Victoria and Brunner Ranges, the summits of which have been glaciated, and the Lyell Range. The land type is developed on Devonian aged Karamea suite and Cretaceous aged biotite-muscovite granites of the Rahu suite. It also occurs on associated remnant high terraces and moraine, valley fill fans, terraces and floodplains. Elevation ranges from 150 to 1639 m (Mt Victoria), and rainfall from 1700 to 4000 mm annually. Podocarp-beech and beech forest cover dominates, with subalpine scrub, tussock land and alpine herb-fields above the bushline.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Steep upper mountain slopes	Karamea and Rahu Suite granites	600–1640	Silver and mountain beech forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Recreation, feral animal grazing, tracking
2	Moderately steep lower mountain slopes	Karamea and Rahu Suite granites	150–600	Podocarp-beech and beech forest	Conservation, protected native forest, recreation	Low	Conservation, protected native forest, recreation	Tracking, feral animal grazing, recreation, buildings
3	Mountain spur crests and summits	Karamea and Rahu Suite granites	200–1630	Podocarp-beech and beech forest	Conservation, recreation	Low	Conservation, protected native forest, recreation	Recreation, feral animal grazing, buildings
4	High glaciated mountain summits	Karamea and Rahu Suite granites	1200–1640	Subalpine scrub, tussock land, alpine herb-fields	Conservation, recreation, feral animal grazing	Nil	Conservation, feral animal grazing	Recreation, feral animal grazing, buildings
5	Moderately steep to steep hill slopes	Karamea and Rahu Suite granites	150–600	Podocarp-beech and beech forest	Conservation, protected native forest, exotic forestry, recreation	Low	Conservation, exotic forestry, protected native forest, recreation	Land clearance, loss of native species, tracking, recreation, buildings
6	Remnant high terraces and moraine	Moderately to extensively weathered Pleistocene gravels and till	150–400	Podocarp-hardwood-beech forest with tōtara and kahikatea	Conservation, protected native forest, exotic forestry, recreation	Low	Conservation, exotic forestry, protected native forest, recreation	Land clearance, loss of native species, tracking, recreation, buildings
7	Valley floor fans, terraces and floodplains	Holocene post-glacial river gravels, sand and fan deposits	100–400	Podocarp-beech and beech forest	Semi intensive grazing, fodder cropping, protected native forest, recreation	Medium	Semi intensive grazing, fodder cropping, protected native forest, recreation	Subdivision fencing, shelter belts, loss of native species



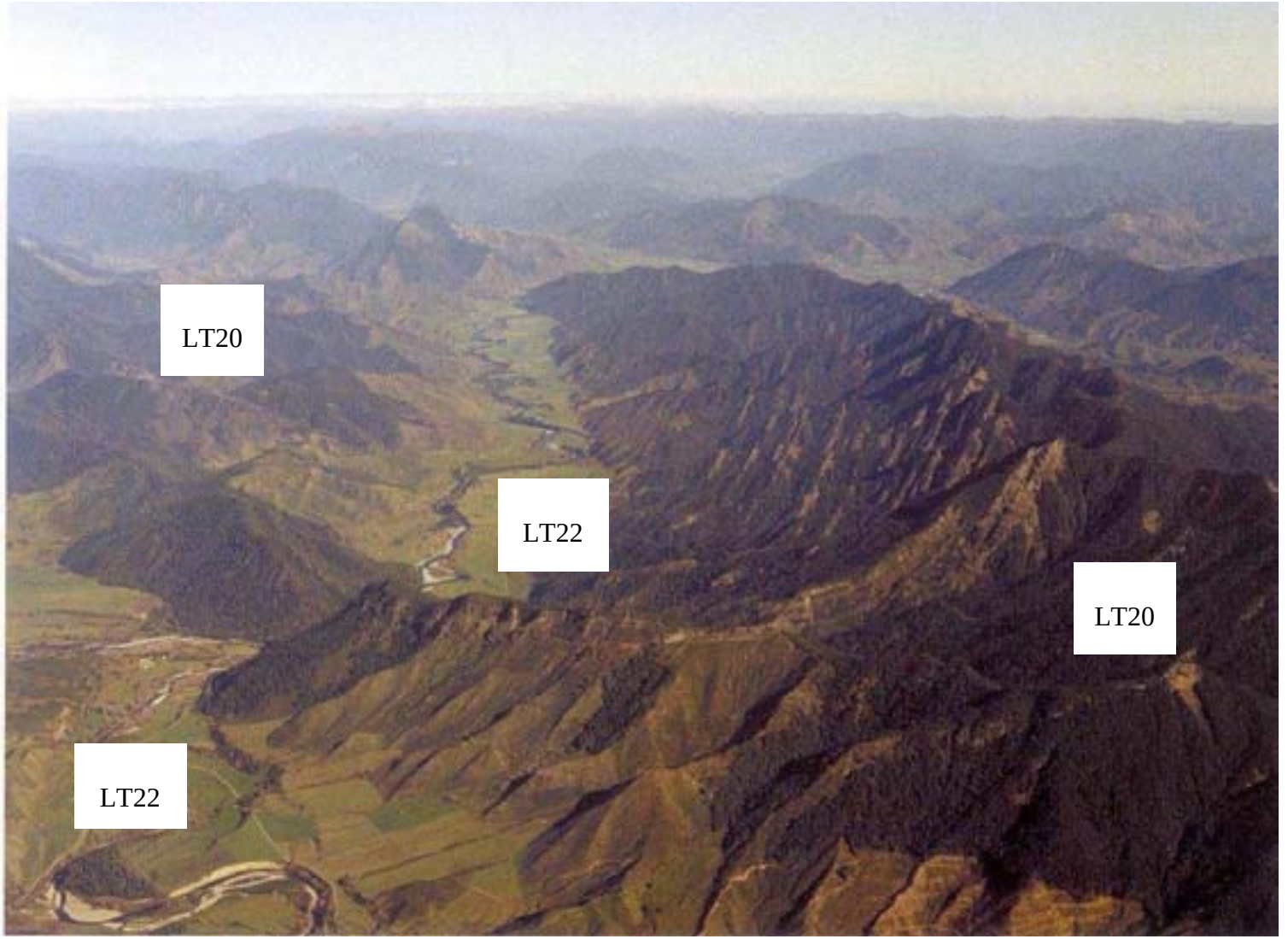
Land Type 19 – South-western Granite (from Whitehouse and Pearce 1992).

View across the Maruia River to the Victoria Range (LT19).

20. South-western Tertiary Rock Land Type

The South-western Tertiary Rock Land Type encompasses moderately steep to very steep hill slopes and associated valley fill fans, terraces and floodplains. It is developed on Oligocene and Miocene ‘soft’ sedimentary rocks of the Maruia, Matiri, Mangles and Longford Formations, comprising massive and bedded sandstones, calcareous and carbonaceous mudstones, and siltstones. These are interbedded with thick conglomerate and pebbly sandstone bands which often form bluffs and benches in the landscape, such as in the Murchison basin north and south of the Buller river from Husband Creek to Owen Junction, including the Blue Cliffs Ridge. Structurally controlled hillscapes are common. Elevation ranges from 150 to 1100 m, and rainfall from 1600 to 2500 mm annually. Red beech-silver beech forest predominates with silver beech-mountain beech forest at higher elevations, podocarps on the warmer aspects, and hard beech on the midslopes.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	'Soft' rock erosional hill slopes	Mid-Tertiary aged massive and bedded sandstones, mudstones and siltstones with thick conglomerate and pebbly sandstone bands	150–1000	Beech forest, small remnants of podocarp and hardwood forests	Native forest, conservation, extensive grazing, exotic forestry	Low to medium	Conservation, exotic forestry, extensive grazing	Tracking, roading, fencing, exotic weeds
2	Spur crests and summits	Mid-Tertiary aged massive and bedded sandstones, mudstones and siltstones with thick conglomerate and pebbly sandstone bands	200–1100	Beech forest, small remnants of podocarp and hardwood forests	Native forest, conservation, extensive grazing, exotic forestry	Low to medium	Conservation, exotic forestry, extensive grazing	Tracking, roading, fencing, exotic weeds
3	'Soft' rock structural landforms, e.g. cuestas	Mid-Tertiary aged massive and bedded sandstones, mudstones and siltstones with thick conglomerate and pebbly sandstone bands	150-1100	Beech forest, small remnants of podocarp and hardwood forests	Native forest, conservation, extensive grazing, exotic forestry	Low to medium	Conservation, exotic forestry, extensive grazing	Tracking, roading, fencing, exotic weeds
4	Fans	Quaternary and Holocene aged gravelly fan deposits	150–450	Beech forest, small remnants of podocarp and hardwood forests	Semi-intensive grazing, feed and cash cropping	Medium to high	Intensive grazing, feed and cash cropping, exotic forestry	Intensive land use, shelterbelts, subdivision
5	Terraces	Quaternary and Holocene aged river gravels sands with minor and silt	150–450	Podocarp and hardwood forests	Intensive grazing, feed and cash cropping	Medium to high	Intensive grazing, feed and cash cropping, exotic forestry	Intensive land use, shelterbelts, subdivision
6	Floodplains	Recent gravelly alluvium and swamp deposits	150–300	Wetlands, sedges	Intensive grazing, feed cropping	High	Intensive grazing, feed and cash cropping, exotic forestry,	Intensive land use, drainage, windbreaks, subdivision



The Buller River flowing south to Murchison (centre distance) along a narrow valley floor (LT22) through thick Eocene to Miocene sedimentary strata of the Murchison sedimentary basin (Land Type 20). [GNS image]

21. Matiri Land Type

The Matiri Land Type consists of the ‘flat’ topped mountain plateaux and steep to very steep sided valleys of the Matiri Range and associated steeplands, including the Thousand Acres Plateau and The Haystack. It is developed on Oligocene and Miocene sedimentary rocks of the Maruia and Matiri Formations, comprising well bedded and massive calcareous mudstones, sandstone, limestone, and carbonaceous siltstones, with thick conglomerate and pebbly sandstone bands that crop out in the Matiri catchment. Landslide erosion is a feature on the steep valley side slopes (many resulting from the 1929 Murchison Earthquake), and on the valley floors, landslide-dammed lakes and associated valley fill wetlands are common. Elevation ranges from 300 to 1500 m, and rainfall from 4000 to 5000 mm per year. Indigenous forest dominates with mixed age silver beech-dominant forests on younger surfaces. Silver beech forest forms the treeline at 1280 m; silver beech-mountain beech complexes occur on wetter and colder sites; and dracophyllum scrub, mountain flax, celmisia, red tussock grassland and snow tussock occur on the plateaux.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Summit plateau	Mid-Tertiary aged limestone and massive and bedded sandstones, mudstones and siltstones with thick conglomerate and pebbly sandstone bands	1100–1500	Dracophyllum scrub, mountain flax, celmisia, red and snow tussock grassland	Conservation, recreation, feral animal grazing	Nil	Conservation, recreation, feral animal grazing	Recreation impacts, tracking, exotic weeds
2	Very steep upper side slopes	Mid-Tertiary aged limestone and massive and bedded sandstones, mudstones and siltstones with thick conglomerate and pebbly sandstone bands	900–1280	Beech forest, silver beech and mountain beech forests with diverse canopy species	Native forest, conservation, recreation, feral animal grazing	Low	Conservation, recreation, feral animal grazing	Recreation impacts, tracking, exotic weeds
3	Very steep lower side slopes	Mid-Tertiary aged limestone and massive and bedded sandstones, mudstones, and siltstones with thick conglomerate and pebbly sandstone bands	300-900	Mixed red beech-silver beech forests with diverse canopy species	Native forest, conservation, recreation, feral animal grazing	Low	Conservation, recreation, feral animal grazing	Recreation impacts, tracking, exotic weeds
4	Floodplain, swamps, fans and terraces	Recent poorly sorted gravel and fan deposits	300-450	Mixed red beech-silver beech forests with diverse canopy species, rushes, sedges	Native forest, conservation, recreation	Low	Conservation recreation	Recreation impacts, tracking, exotic weeds
5	Landslide dams and lakes	Landslide deposits	300-400	Scrub, rushes, sedges, silver beech	Scrubland, native forest, conservation land, feral animal grazing	Low	Conservation, recreation, feral animal grazing	Recreation impacts, tracking, exotic weeds

Well bedded calcareous mudstone and sandstone of the Matiri Formation, viewed looking south along the Matiri Range (LT21). [GNS image]

Karst topography of the Matiri Range (LT21), looking southeast to Thousand Acres Plateau (middle right). [GNS image]

22. Major Southern High Country Valley Fill Land Type

The Major Southern High Country Valley Fill Land Type incorporates the alluvial valley fill, active and recently active riverbeds, recent floodplain terraces, flights of intermediate and high terraces, and coalescing valley-fill fans of rivers draining the Spenser Mountains and the St Arnaud Range, and the tributaries of the Buller River. Elevation ranges from 200 to 1100 m with rainfall from 1800 to 4000 mm per year. Formerly the vegetative cover was predominately red beech, silver beech, and mountain beech forest. The land type includes the high country segments of the Travers, Sabine, D'Urville, Matakitaki and Glenroy rivers as well as the lower elevation tributaries of the Buller.

	Landform component	Geological formation	Elevation (m)	Remnant native vegetation	Present land use	Agronomic potential	Potential land use	Potential impacts
1	Alluvial valley fill	Pleistocene/Holocene fluvial deposits	200–1000	Silver beech, mountain beech, matagouri scrub, short tussock	Conservation, semi intensive grazing, feed cropping, recreation, feral animal grazing	Medium	Semi intensive grazing, feed cropping, conservation, recreation	Fencing, tracking, loss of native vegetation, increased exotic weeds, recreation
2	Coalescing valley side fans	Pleistocene/Holocene fluvial deposits	200–900	Silver beech, mountain beech, matagouri scrub, short tussock, gravel fields	Conservation, semi intensive grazing, recreation, feral animal grazing	Low	Conservation, semi intensive grazing, recreation	Tracking, loss of native vegetation, increased exotic weeds, recreation
3	Floodplain terraces	Pleistocene/Holocene fluvial deposits	200–900	Silver beech, mountain beech, matagouri scrub, short tussock	Conservation, semi intensive grazing, feed cropping, recreation, feral animal grazing	Medium	Semi intensive grazing, feed cropping, conservation, recreation	Fencing, tracking, loss of native vegetation, increased exotic weeds, recreation

4	Intermediate and high terraces	Slightly to extensively weathered Pleistocene and Holocene gravels	200–400	Podocarp-hardwood-beech forest with tōtara and kahikatea	Semi intensive grazing, feed cropping, conservation, recreation, feral animal grazing	High	Intensive grazing, feed cropping, conservation, recreation	Intensified land use, fencing, tracking, windbreaks, subdivision
5	Valley floor swamps	Pleistocene/Holocene fluvial and swamp deposits	200–900	Sedge, turf, reed and rushlands, red tussock and raupō	Conservation, recreation, feral animal grazing	Low	Conservation, recreation	Drainage, tracking, recreation, loss of native species
6	Minor valley head and terminal moraine (often lake damming) and associated outwash	Late Pleistocene outwash gravels and moraine	380–1000	Short tussock and matagouri scrub, some red tussock	Conservation, recreation, feral animal grazing	Very low	Conservation, recreation	Recreation, tracking, exotic weeds
7	Large lakes and lake shorelines	Holocene fluvial deposits	400–500	Raoulia cushion fields, moss tussock gravel fields	Recreation	Nil	Conservation, recreation	Recreation, tracking, buildings, exotic weeds

Terraces, fans and floodplain of the Matakitaki valley floor which joins the Buller River valley at Murchison (LT22). The easterly dipping Tertiary rocks of the Mangles Formation of land type 20 were the source of the large landslide triggered by the1929 Murchison earthquake onto the floor of the Matakitaki Valley. [GNS image]

6 Conclusions

The 22 land types established at a scale of 1:250 000 and mapped at 1:250 000 and 1:50 000 scales for the Tasman District provide a geomorphologically based assessment and grouping of the district's landscape. Although the land types have been designed primarily to assist in assessment of landscape appreciation and planning, they also provide an objective, physically based, subdivision of the Tasman District landscape suitable for resource monitoring, strategy planning, and land resource assessment and evaluation.

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Appendix 1 – Maps