

NELSON FARMS PARTNERSHIP

.....
FARM PLAN
.....

B & A NELSON
248 POTAKA ROAD
ARIA

.....
PLAN PREPARED BY:



IN PARTNERSHIP WITH:



.....
2017
.....

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FARM OVERVIEW

This Farm Plan is for Nelson Farms Partnership. It identifies farm-specific opportunities to manage your resources sustainably.

PROPERTY

The property is 1165.7 hectares running 10,233 stock units across an effective area of 1083.0 ha (9.4 su/ha).

Twelve different Land Use Capability (LUC) units and 9 dominant soil types were identified in the farm scale land resource survey. The LUC units range from versatile Class 2 flats to steep Class 7 hill country.

The hill country geology comprises of jointed and banded mudstone with patches of airfall tephra. The easier hill country and rolling slopes are formed from jointed mudstone mantled with airfall tephra, while the lower valleys and terraces are formed from alluvium and tephra.

The erosion present ranges from slight to moderately severe with soil slip, gully, sheet, earthflow, slump, deposition and streambank erosion present.

The property contour comprises approximately 17% flat to undulating land, 23% rolling to strongly rolling downlands and 60% moderately steep to steep hill country.

There were 10,233 stock units wintered to June 2017, with a stocking rate of 9.4 su/ha from an effective area of 1083.0 ha.

SHEEP JUNE 2016

Mixed age ewes	2900
Two tooth ewes	700
Ewe hoggets	1450
Breeding rams	45
Sheep stock units	4651

CATTLE

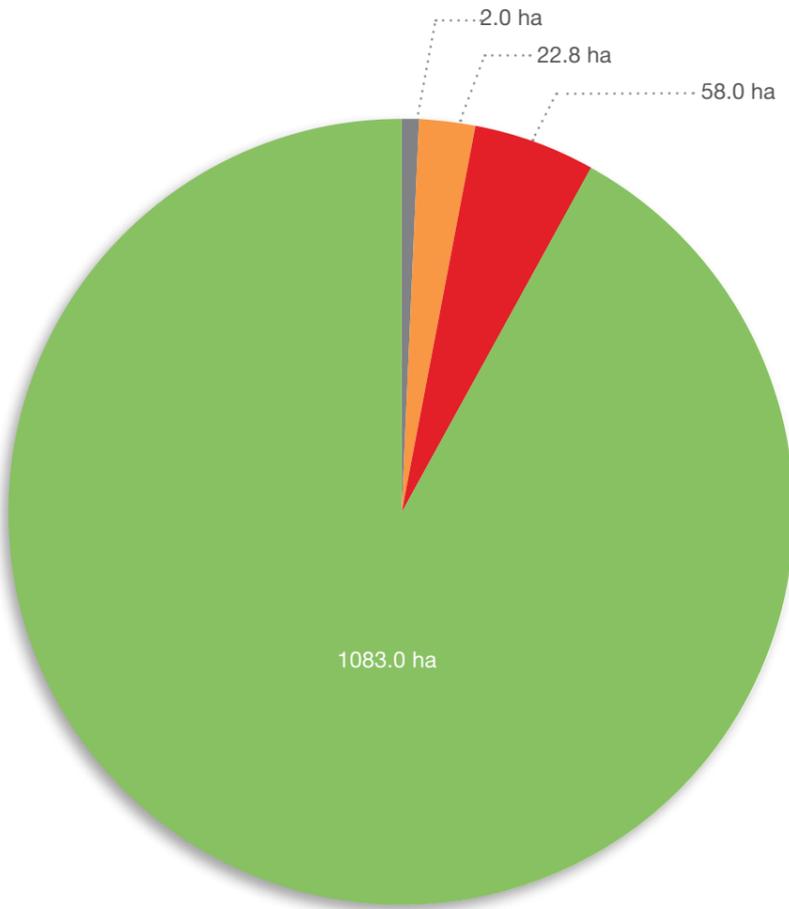
Mixed age cows	230
R2 heifers	75
R1 heifers	140
R2 Bulls	220
R1 Bulls	505
Breeding bulls	12
Cattle stock units	5582

SUMMARY

Total stock units	10233
Sheep:cattle ratio	45:55
Stock units per ha	9.4



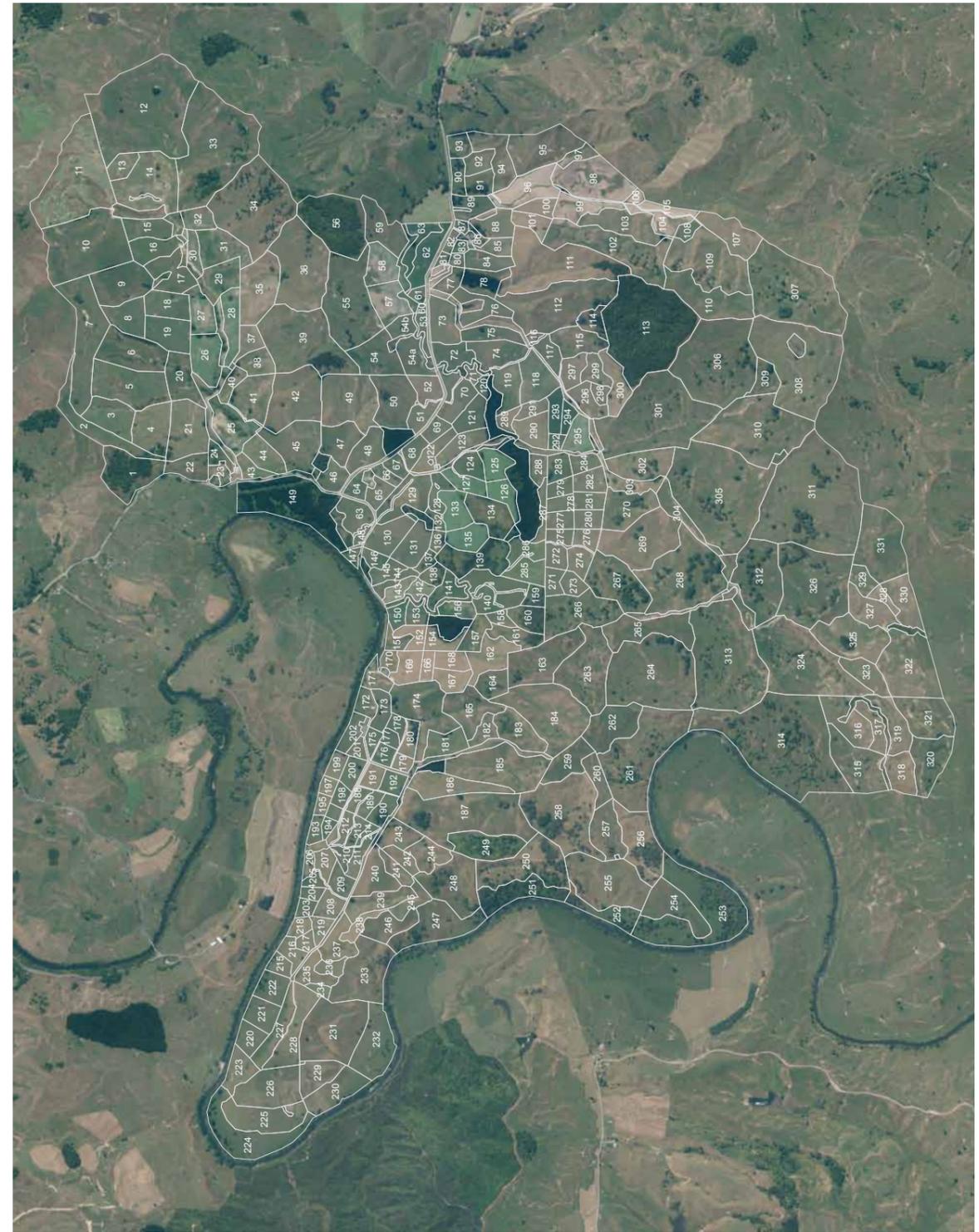
VEGETATION



Total Area: 1165.8 ha

LEGEND:

- Improved pasture, semi-improved pasture
- Exotic conifer forest
- Indigenous bush and manuka
- House grounds / yards / dams



PADDOCK MAP

B & A NELSON
248 Patoka Road
Aria

Drawn: Groundstock Limited
Date: December 2017

0 250 500 1,000 Meters



- LEGEND**
1. Barbery bush (5.05)
 2. Lame wares (3.78)
 3. Peppercorn (1.72)
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LAND USE ASSESSMENT

This section analyses your land resource data gathered during our farm visit.

LAND RESOURCES

A land and soils survey has been undertaken at farm scale using the Land Use Capability (LUC) classification system. Current soil and LUC maps for this area have been mapped at regional scale (1:63,000) and are not relevant for farm scale LRI and LUC surveys (1:15,000).

The Land Resource Inventory (LRI) is a systematic assessment system that divides the land into separate units based on the soil, geology, slope, vegetation and erosion potential. Once land units have been assessed using LRI, the LUC system is used to classify the units based on their potentials and limitations.

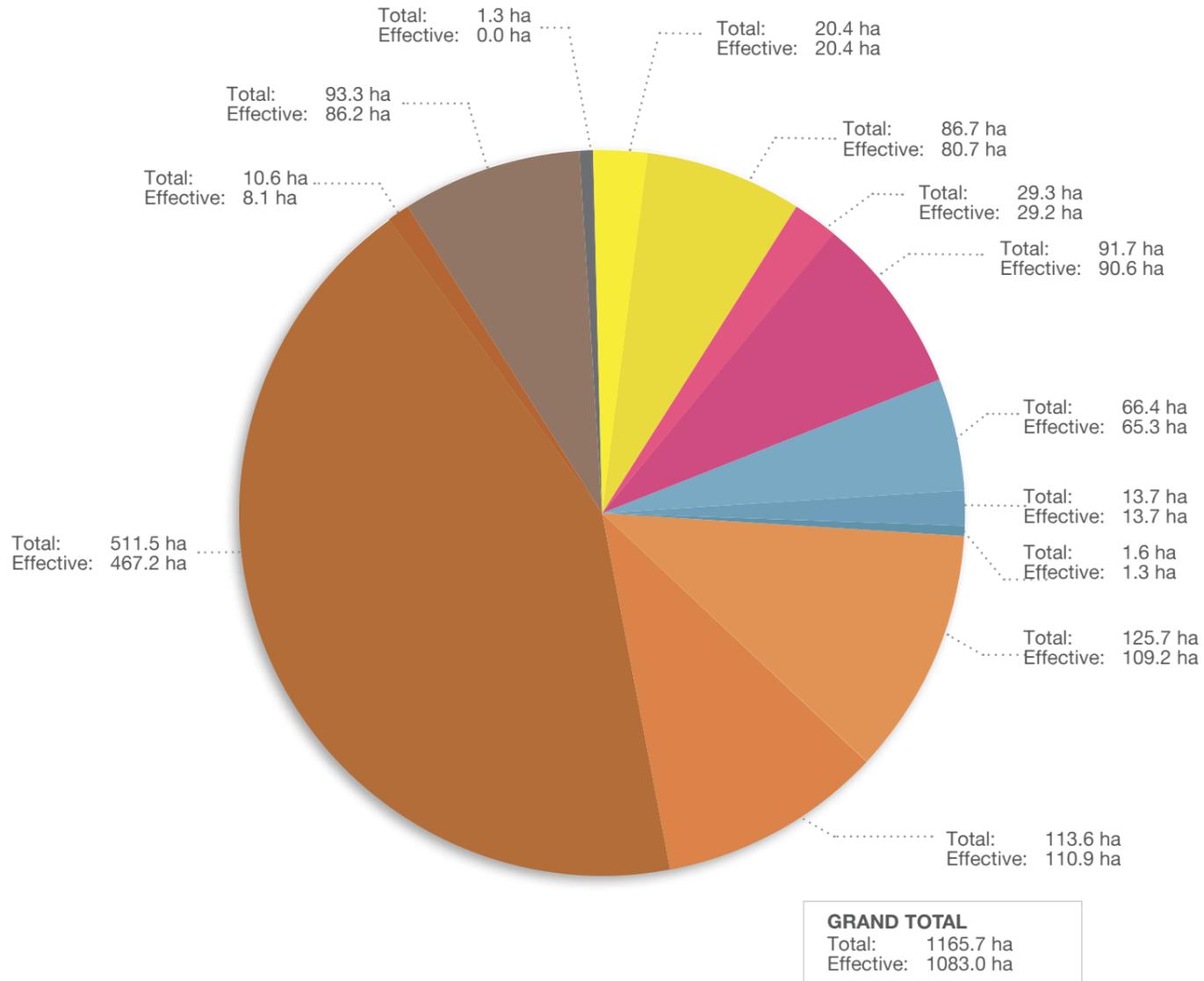
The LUC system uses 3 components when classifying land. To illustrate this we can use LUC unit **4w2** as an example. The first numeral **4** is the land class (from 1-8: flat productive to steep non-productive); the second letter **w** indicates the land unit's major limitation from a subclass of four limitations: wetness (w), erosion (e), soil (s) and climate (c); and the final numeral **2** provides a regional land unit classification.

This systematic approach highlights current potential and limitations of different land units

and can also be used to match to a scientifically appropriate environmental mitigation measure if required.

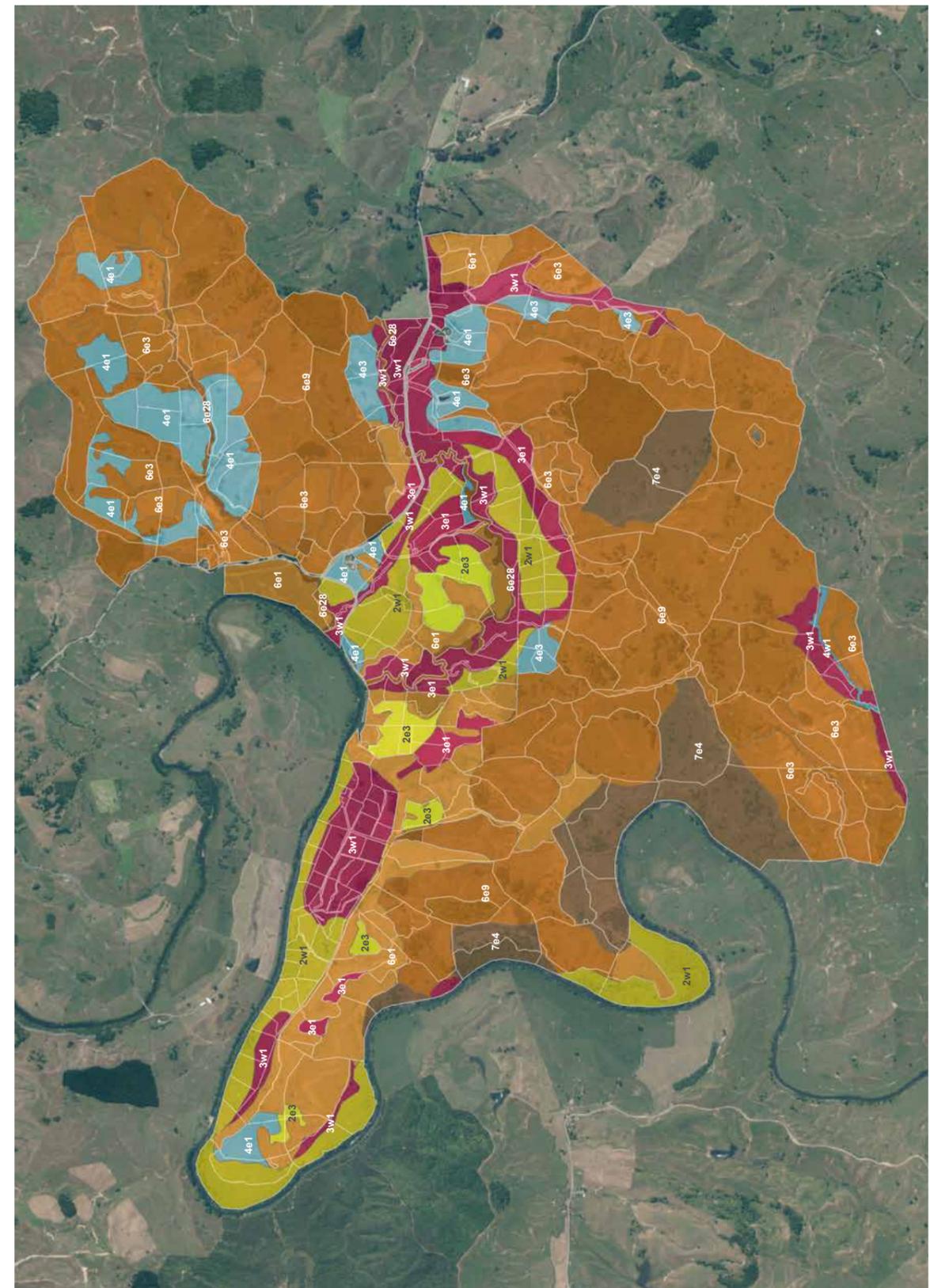
Based on this survey and working with the farmer the following general recommendations for the land and water have been formed and detailed in the Environmental Treatments section.

LAND USE CAPABILITY (LUC) UNITS



LEGEND:

CLASS 2	CLASS 3	CLASS 4	CLASS 6	CLASS 7
2e3	3e1	4e1	6e1	7e4
2w1	3w1	4e3	6e3	House / yards / dams
		4w1	6e9	
			6e28	

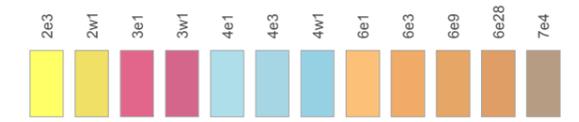


Drawn: Groundstock Limited
Date: December 2017

LAND USE CAPABILITY MAP

B & A NELSON
248 Patoka Road
Aria

LEGEND



LUC UNIT DESCRIPTIONS

CLASS 2:

2e3



Description

Undulating to rolling slopes on moderately fertile yellow-brown loams with a slight erosion hazard when cultivated.

Erosion

Actual: Nil.

Potential: Slight sheet and rill erosion when cultivated.

Strengths

- > Productive hill country unit.
- > Good soil physical properties.
- > Good drainage with soils more resilient to pugging and treading damage.
- > Good access

Limitations

- > Prone to sheet and rill erosion if cultivated.
- > High phosphate retention soils.

Appropriate Land Use

- > Intensive pastoral production.
- > Cereal cropping.
- > Root and green fodder cropping

2w1



Description

Low river terraces with a continuing slight wetness limitation.

Erosion

Actual: Nil.

Potential: Nil.

Strengths

- > Very productive finishing unit.
- > Flat to undulating.
- > Potential for horticultural and cereal crops.

Limitations

- > Finishing stock exposed to high winds and rain.
- > Weaker soil structure which is prone to treading damage by heavy cattle during prolonged wet periods.

Appropriate Land Use

- > Intensive pastoral production.

CLASS 3:

3e1 ■



Description

Rolling slopes on yellow-brown loams with a slight to moderate erosion hazard when cultivated.

Erosion

Actual: Nil.

Potential: Moderate to severe sheet and rill erosion when cultivated.

Strengths

- > Productive hill country unit.
- > Good soil physical properties.
- > Good drainage with soils more resilient to pugging and treading damage.

Limitations

- > Prone to severe sheet and rill erosion if cultivated.
- > High phosphate retention soils.

Appropriate Land Use

- > Intensive pastoral production.
- > Cereal cropping.
- > Root and green fodder cropping.

3w1 ■



Description

Narrow terraces with a moderately high water table. Subject to runoff from adjacent hills.

Erosion

Actual: Nil.

Potential: Nil.

Strengths

- > Reasonable natural fertility.
- > Generally summer safe.
- > Flat to undulating.
- > Potential for intermittent cropping following drainage.

Limitations

- > Wetness limitation even after drainage.
- > Wetness can delay crop planting and harvesting.
- > Weaker soil structure which is prone to treading damage by heavy cattle during wet periods.

Appropriate Land Use

- > Intensive pastoral production with drainage.

CLASS 4:

4e1 ■



Description

Strongly rolling slopes on yellow-brown loams with a moderate to severe erosion hazard when cultivated.

Erosion

Actual: Nil.

Potential: Moderate to severe sheet and rill erosion when cultivated.

Strengths

- > Productive hill country unit.
- > Good soil physical properties.
- > Good drainage with soils more resilient to pugging and treading damage.

Limitations

- > Prone to severe sheet and rill erosion if cultivated.
- > High phosphate retention soils.

Appropriate Land Use

- > Intensive pastoral production.

4e3 ■



Description

Strongly rolling slopes on sedimentary lithologies with moderate to severe erosion hazard when cultivated.

Erosion

Actual: Nil.

Potential: Slight gully erosion. Moderate to severe erosion sheet and rill erosion when cultivated..

Strengths

- > Productive hill country unit.
- > Easy access and contour.
- > Wetter unit than 4e1.

Limitations

- > Prone to severe sheet and rill erosion if cultivated.
- > Take care with heavy cattle during extended wet periods.

Appropriate Land Use

- > Intensive pastoral production.

CLASS 6:

4w1



Description

Flat, narrow valley floors with gleyed and strongly gleyed soils. Subject to periodic flooding and/or runoff from adjacent slopes.

Erosion

Actual: Slight streambank erosion.

Potential: Moderate streambank erosion.

Strengths

- > Reasonable natural fertility.
- > Generally summer safe.
- > Flat to undulating.

Limitations

- > Some areas have a wetness limitation even after drainage.
 - > Weaker soil structure which is prone to treading damage by heavy cattle during wet periods.
- > Wetness can delay crop planting and harvesting.
- > The high water table and frequent surface flooding limit cropping.

Appropriate Land Use

- > Intensive pastoral production with drainage.

6e1



Description

Moderately steep to strongly rolling slopes on yellow-brown loams over various lithologies.

Erosion

Actual: Nil to slight sheet and soil slip erosion.

Potential: Slight sheet and soil slip erosion.

Strengths

- > Productive hill country unit.
- > Good soil physical properties.
- > Good drainage where tephra is located.

Limitations

- > Prone to slight sheet and soil slip erosion.
- > High phosphate retention soils where tephra soils are present.

Appropriate Land Use

- > Intensive pastoral production.

6e3



Description

Moderately steep to strongly rolling slopes on sedimentary lithologies with patchy airfall tephra.

Erosion

Actual: Nil to slight gully, sheet and soil slip erosion.

Potential: Slight gully, sheet and soil slip erosion.

Strengths

- > Productive hill country unit.
- > Easy access and contour.
- > Wetter unit than 6e1.

Limitations

- > Prone to slight sheet, gully and soil slip erosion.
- > Patches of high phosphate retention soils where tephra is present.

Appropriate Land Use

- > Intensive pastoral production.

6e9



Description

Strongly rolling to moderately steep slopes on tertiary lithologies with a moderate potential for earthflow and gully erosion.

Erosion

Actual: Slight to moderate earthflow erosion. Nil to slight gully, soil slip and sheet erosion.

Potential: Moderate earthflow and gully erosion. Slight soil slip and sheet erosion.

Strengths

- > Productive hill country unit, north facing.
- > Higher natural fertility.

Limitations

- > Potential for moderate earthflow and gully erosion. Slight soil slip and sheet erosion.
- > Soils are prone to pugging and treading damage when wet.

Appropriate Land Use

- > Pastoral production with conservation measures, plantings.

CLASS 7:

6e28



Description

Strongly rolling to steep banks found adjacent to streams and rivers.

Erosion

Actual: Nil to moderate streambank and deposition erosion.

Potential: Severe streambank erosion.

Strengths

> Good unit for increasing property biodiversity.

Limitations

- > Prone to severe streambank erosion.
- > Weakly developed soils, prone to treading damage from cattle.

Appropriate Land Use

> Exclude cattle.

7e4



Description

Strongly rolling to steep, very broken slopes on sedimentary lithologies with a severe earthflow and slump potential.

Erosion

Actual: Slight to severe earthflow and slump erosion. Slight to moderate gully erosion. Negligible to slight soil slip and sheet erosion.

Potential: Severe earthflow and slump erosion. Moderate gully erosion, soil slip and sheet erosion.

Strengths

- > Productive hill country unit.
- > Higher natural fertility.

Limitations

- > Potential for severe earthflow and slump erosion. Moderate gully, soil slip and sheet erosion.
- > Soils are prone to pugging and treading damage when wet.

Appropriate Land Use

- > Pastoral production with intensive conservation measures, intensive poplar plantings and dewatering.
- > Protection forestry.

ENVIRONMENTAL TREATMENTS

This section details the environmental issues identified on the property and the recommended treatments for best practice management.

ENVIRONMENTAL ISSUES

SLOPE STABILITY ON STEEP HILL COUNTRY

Soil slip and earthflow erosion

Soil slip erosion results from over-saturated soil slipping off steep slopes.



Earthflow erosion is where flows move across the surface. The surface breaks into hundreds of hummocks and ridges transverse to the direction of flow.



The moderate to steep hill country on the property with slight to moderate earthflow and soil slip erosion can be controlled with space planted trees at 12 to 15 metre spacing over the erosion prone parts of the slope (see the 'space planting' icons on the Treatments map).

Start by planting up from the bottom of the slope and working up the wetter ephemeral waterways, stabilising the toe of the slope first to control erosion on this hill country.

On the steeper Class 7 units, pole plantings should be restricted to the lower colluvial slopes and gullies or where there is adequate soil depth for trees to establish.

Gully erosion



Gully erosion is the removal of soil or soft rock material by water, forming distinct narrow channels, which usually carry water during and immediately after rains. Where there is adequate soil depth, the gully erosion can be controlled by pair planting poplar and willow poles at 10-12 metre intervals in the gully system in order to slow the flow of the water.

It is estimated that a further 650 poles (see the space planting icons on the Treatments map) are required for space planting on the property over unstable hill country and gullies (excluding poles required for the treatment areas following).

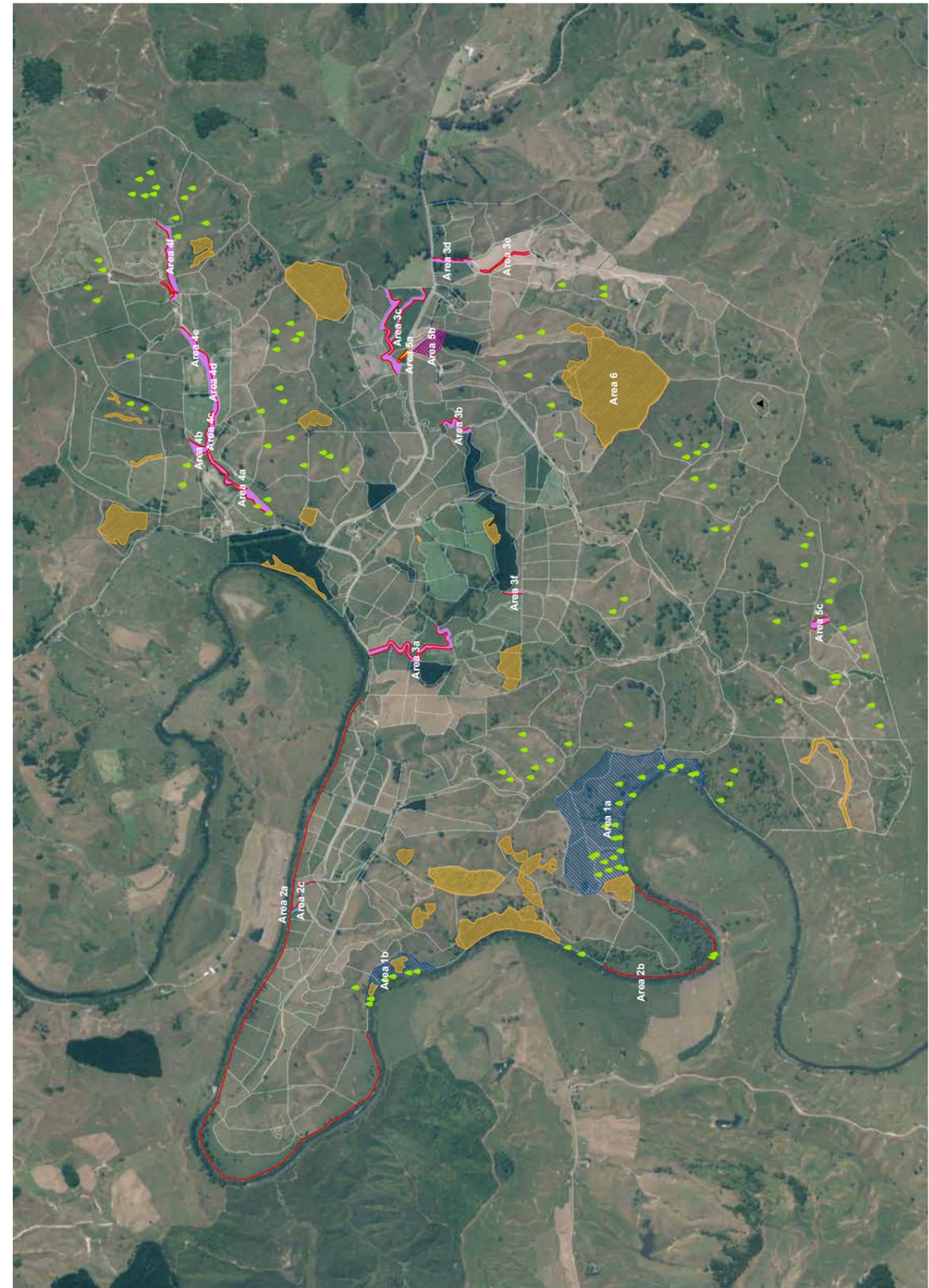
Soil health



The soils of LUC units 3w1 and 4w1 (some 2w1, Soil 1) units are predominantly formed from fine textured alluvium.

Where possible, separate these units from other land units as these soils are younger, weakly developed and have poorer drainage making them prone to pugging and treading damage from heavy cattle when wet.

Although very productive units, if they are not managed well a significant pugging event can reduce pasture productivity by up to 50%.



- LEGEND**
- ▲ Dam removal
 - Space planting
 - Riparian fencing
 - Regeneration
 - Cattle exclusion
 - Riparian fencing
 - Riparian management
 - Slope stabilisation
 - Yard filter strip



TREATMENTS MAP

RECOMMENDED TREATMENTS

AREA 1A & B

SLOPE STABILISATION



Area 1 is part of a mudstone earthflow slump complex located adjacent to the Mokau River. The river is undermining slope stability which is contributing to the current slope malformation and headscarp erosion.

To stabilise these areas start by stagger-planting hybrid willows along the riparian zone (8 m spacings), then plant hybrid willows or poplars up the wetter ephemeral drainage channels (10-12 m spacings).

Any natural or man-made dams located above these areas should also be drained to prevent water pooling and lubricating the slip planes.

Treatment Area	Poles
Area1a	200 +75 riparian plantings
Area 1b	35 + 30 riparian plantings
TOTAL	340

AREA 2A-C

RIPARIAN FENCING (MOKAU RIVER)



Areas 2a-c are unfenced intensive pastoral areas located adjacent to the Mokau River.

For future management, streambank and water quality issues it is recommended that stock are excluded from these areas with only periodic sheep grazing to control weeds.

It is recommended that fences adjacent to the Mokau River should be 2-wire electric as soil profiles show frequent flooding of this terrace.

See table below for areas and fencing requirements (refer to Treatments map for locations).

Treatment Area	Fencing required (km)
Area 2a	3.90
Area 2b	1.19
Area 2c	0.25
TOTAL	5.34

AREA 3A-F
RIPARIAN FENCING (WAIROROMA STREAM)



Areas 3a-f (3.9 ha) are unfenced sections of the Wairoroma Stream riparian zone located adjacent to intensively farmed LUC Class 2 and 3 land.

For future management, streambank and water quality issues it is recommended that stock are excluded from these areas.

It is recommended that lower sections of the Wairoroma Stream (e.g Near Appletree paddock) should be fenced with 2-wire electric fences as soil profiles show frequent flooding due to backup from high flow periods in the Mokau River.

See table below for areas and fencing requirements (refer to Treatments map for locations).

Treatment Area	Fencing required (km)
Area 3a	1.31
Area 3b	0.24
Area 3c	1.17
Area 3d	0.21
Area 3e	0.29
Area 3f	0.10
TOTAL	3.32

AREA 4A-F
RIPARIAN FENCING (WHAUHI STREAM)



Areas 4a-f (4.4 ha) are the Whauhi Stream riparian zones located adjacent to intensively farmed land that are currently unfenced.

For streambank, water quality and track runoff buffer purposes it is recommended that these areas are fenced off from stock with a minimum 2.48 km of riparian fencing.

See table below for fence lengths and areas.

Treatment Area	Fencing required (km)
Area 4a	0.83
Area 4b	0.21
Area 4c	0.19
Area 4d	0.33
Area 4e	0.25
Area 4f	0.67
TOTAL	2.48

AREA 5A-C
SOURCE AREA MANAGEMENT



Located above area 5a (0.1 ha) is the nutrient and sediment runoff source point from the adjacent stockyards. For water quality issues it is recommended to retire Area 5a and plant in sedges and indigenous plants to act as a filter strip to capture any excess runoff from the stockyards. This requires 170 m of conventional fencing.

Area 5b (1.1 ha) has two small ephemeral waterways located in the paddock adjacent to the stockyards. It is impractical to fence these off but it is recommended to exclude cattle from this area.



Area 5c (0.3 ha) is a small section of unfenced riparian zone located at the northern end of the Swamp paddock adjacent to Class 3w1 land. This area requires 85 m of riparian fencing to exclude stock. This will also providing a track runoff buffer zone from the dissecting track.

AREA 6
REGENERATION



Area 6 (50.3 ha in total) comprises small to larger areas of bush and scrub located on erosion prone slopes and in gullies. These areas are generally impractical to fence off from stock but provide effective soil conservation and biodiversity value on the associated LUC Class 6 & 7 land.

RECOMMENDED TREATMENTS SUMMARY

TREATMENT TYPE	QUANTITY
Slope stabilisation	340 hybrid willow or poplar poles.
Riparian management (Mokau River)	20 poles, 5.34 km riparian fencing.
Riparian fencing	8.3 ha, 5.8 km riparian fencing.
Source area management	1.5ha, 260 m riparian fencing.
Regeneration	50.3 ha.
Slope and gully plantings	650 poles.

ENVIRONMENTAL BEST PRACTICE

This section provides farmers with practical descriptions of techniques, measures or actions that they can implement to mitigate environmental issues.

SOIL MANAGEMENT

EROSION

- SOIL SLIP EROSION: SLIGHT TO MODERATE**
 - > Space plant poplar and willows at 12-15 metre intervals.
 - > Allow regeneration on the steep slopes where soil depth is too shallow for pole planting.
- SOIL SLIP EROSION: MODERATE TO SEVERE**
 - > Intensive space planting, managed retirement or afforestation depending on soil depth and access.
- GULLY EROSION:**
 - > Space plant willows or poplars up the gully systems. Where soil depth is too shallow for pole survival allow regeneration.
- EARTHFLOW & SLUMP EROSION: SLIGHT TO MODERATE**
 - > Space plant poplar and willows at 12-15 metre intervals starting from the bottom of the slope and working up the ephemeral and drainage waterways.
- EARTHFLOW & SLUMP EROSION: MODERATE TO SEVERE**
 - > Mechanical smoothing of tension cracks and draining of wetter areas especially below head scarps.
 - > Intensive space planting of willows or poplars starting from the bottom of the slope and working up the ephemeral and drainage waterways.
- STREAMBANK EROSION:**
 - > Plant willow poles on stream pressure points.
- SHEET EROSION:**
 - > Ensure effective vegetative ground cover over the soil for as long as possible. Improve soil fertility.

HEALTH

- SOIL HEALTH:**
 - > Monitor stock during wet periods on high risks soils to avoid pugging and compaction.
 - > Monitor soil health using the Visual Soil Assessment tool.
 - > Heavy machinery kept on tracks.
 - > Direct drilling or minimum tillage used in preference to conventional cultivation in high erosion risk situations.

FERTILITY

- SOIL FERTILITY:**
 - > Consistent soil testing from the same sites over time establish fertility trends.
 - > Combine test results with nutrient budgets.

WATER MANAGEMENT

QUALITY

POINT SOURCE CONTAMINANTS:

- > Fence and exclude cattle from streams and waterways where practical.
- > Ensure runoff from yards is not directed into waterways.
- > Ensure refuse tips and offal pits are sited away from streams and above water tables where there is no risk of contamination to groundwater.
- > Use specific dosage as preference over dipping stations.
- > Avoid fertiliser near waterways.
- > Culvert or bridge main farm tracks.

NON POINT SOURCE CONTAMINANTS:

- > Develop riparian strips on permanent waterways.
- > Maintain good pasture cover.
- > Grazing management - breakfeed toward waterways with crops.
- > Utilise farm nutrient budgets.
- > Ensure correct timing of fertiliser applications.

- > Minimum or no-till cultivation techniques used when high risk of run-off from cultivated blocks.
- > Leave a minimum 3 m wide uncultivated margin along streams in winter feed paddocks. If stream is unfenced, use a single hotwire to prevent cattle access and maintain the vegetated strip.

BIODIVERSITY

MANAGEMENT

NATIVE BUSH:

- > Exclude stock from grazing where possible.
- > Shoot deer and goats.
- > Shoot and poison possums.

POPLAR AND WILLOW POLES:

- > Form prune trees for future management.

TRACKS

MANAGEMENT

STORM WATER:

- > Maintain track water tables.
- > Ensure track water discharged onto stable ground.
- > Maintain culverts and track crossings.
- > As track angle increases, culvert spacing should decrease.



APPENDIX

SOIL LEGEND

SOILS OF THE LOWLANDS



Soil 1
LUC map symbol: 1
Parent material: Alluvium.
Drainage status: Moderately well to imperfectly drained.
Texture: Loam - silt loam.

Located on the lower terraces, young accumulating alluvial soil.

Management considerations: This soil has a relatively weak soil structure compared to soils 1c and 3 making it prone to tread damage by heavier stock classes during wet periods.



Soil 1a
LUC map symbol: 1a
Parent material: Alluvium.
Drainage status: Imperfectly drained.
Texture: Silt loam over silt loam.

The soil has a moderately high water table and can be subject to runoff from adjacent hills. An alluvial soil with a weaker topsoil structure that is prone to treading damage from cattle when wet.

Management considerations: Susceptible to pugging and tread damage from cattle. Avoid grazing with heavy cattle during wet periods.



Soil 1b
LUC map symbol: 1b
Parent material: Alluvium.
Drainage status: Poorly drained.
Texture: Silt loam over clay loam.

This alluvial soil has slow permeability and a high water table. It has a weak topsoil structure and is very prone to treading damage from cattle when wet.

Management considerations: High susceptibility for pugging. Avoid grazing with heavy cattle during wet periods.



Soil 1c
LUC map symbol: 1
Parent material: Alluvium and volcanic tephra.
Drainage status: Moderately well drained.
Texture: Loam over loam.

This soil located on the mid terraces (e.g. track end of Grapeflat paddock.)

Management considerations: This soil has a moderately developed soil structure and moderate permeability which makes this soil less prone to tread damage by heavy stock classes during wet periods, but care still needs to be taken due to the moderate permeability of the soil.



Soil 2
LUC map symbol: 2
Parent material: Alluvium.
Drainage status: Very poorly drained.
Texture: Clay loam over clay.

This soil has very poor drainage and is not suited to pastoral farming.

Management considerations: This soil is very weakly developed and very poorly drained. Exclude stock from these areas.



Soil 3
LUC map symbol: 3
Parent material: Volcanic tephra.
Drainage status: Moderately to well drained.
Texture: Fine sandy loam over loam.

Located on the easy rolling downlands, this soil has a deep topsoil profile and a higher P retention than the alluvial soil. A better soil than 1 and 2 for wintering cattle on.

Management considerations: Care with cultivation to avoid sheet and rill erosion. This soil has a low vulnerability to water logging and tread damage from cattle when wet.

SOILS OF THE EASY TO STEEP HILL COUNTRY



Soil 4
LUC map symbol: 4
Parent material: Volcanic tephra.
Drainage status: Well drained.
Texture: Fine sandy loam over loam.

This volcanic tephra soil is found throughout the moderately steep to steep hill country overlying limestone, mudstone and greywacke lithologies.

This soil has similar physical qualities to soil 3 but with a shallower topsoil due to increased slope factors. This soil has high P retention due to iron oxides present in the tephra and a lower natural fertility.

Management considerations: Good soil for wintering cattle on due to topsoil development and drainage.



Soil 5

LUC map symbol: 5

Parent material: Jointed mudstone.

Drainage status: Imperfectly drained.

Texture: Silt loam over clay loam to clay.

Located throughout the property this soil is does not have a thick mantle of volcanic tephra and is particularly prone to pugging and treading damage from cattle during wet periods. Topsoil depth decreases with increased slope.

Management considerations: Care with heavy stock during wet periods. Prone to soil slip erosion. Space plant poplars or willows up ephemeral waterways and on erosion prone parts of slope.



Soil 6

LUC map symbol: 6

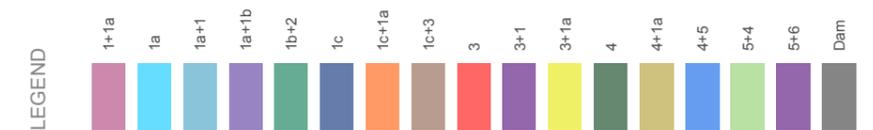
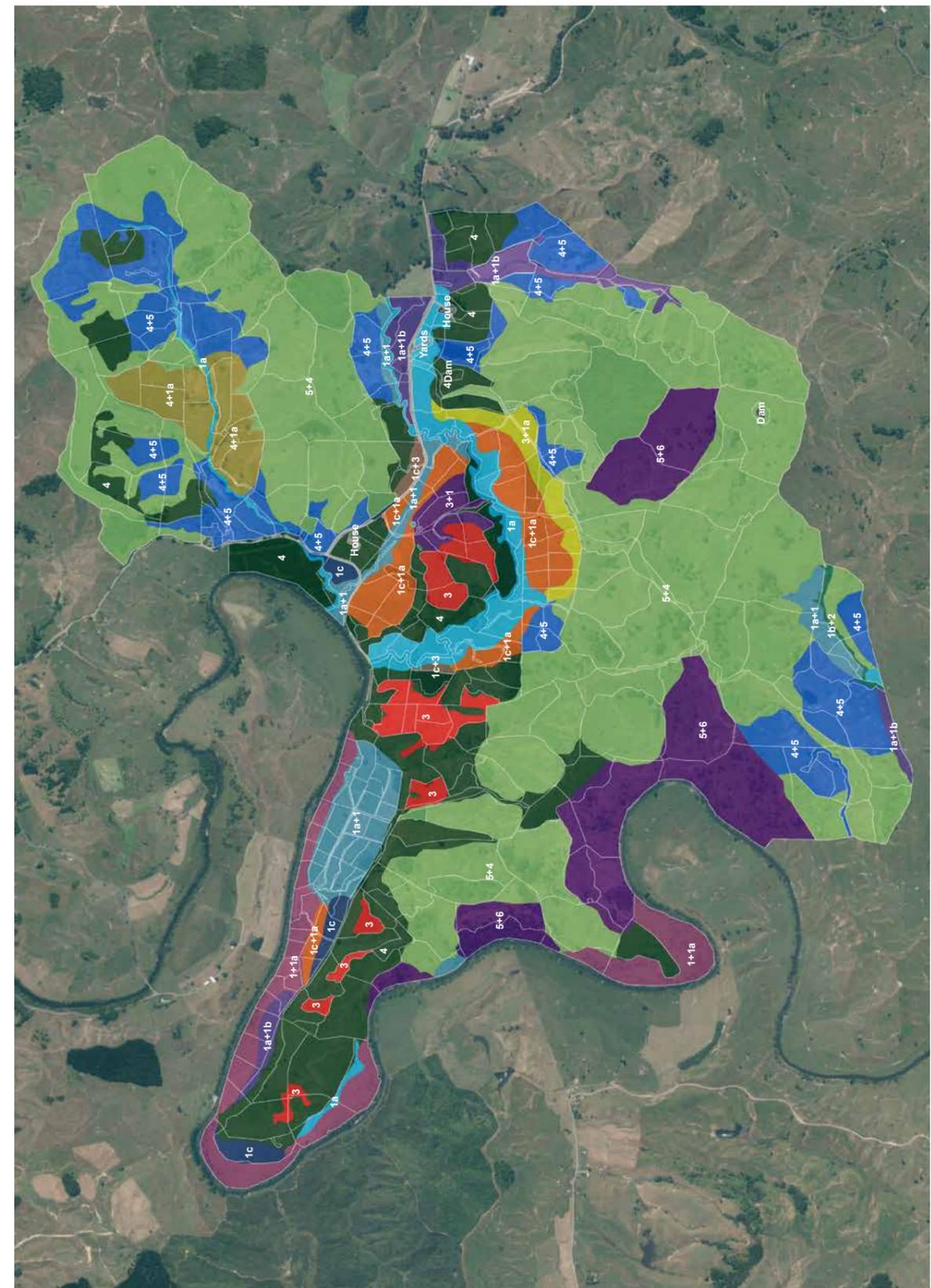
Parent material: Banded mudstone

Drainage status: Imperfect to moderately well drained.

Texture: Silt loam over clay loam.

This soil is located throughout the steeper hill country at the back of the property. It is prone to soil slip erosion and unlike Soil 5 the topsoil depth is more skeletal.

Management considerations: Prone to soil slip erosion. Space plant poplars or willows up ephemeral waterways and lower parts of the slope.



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