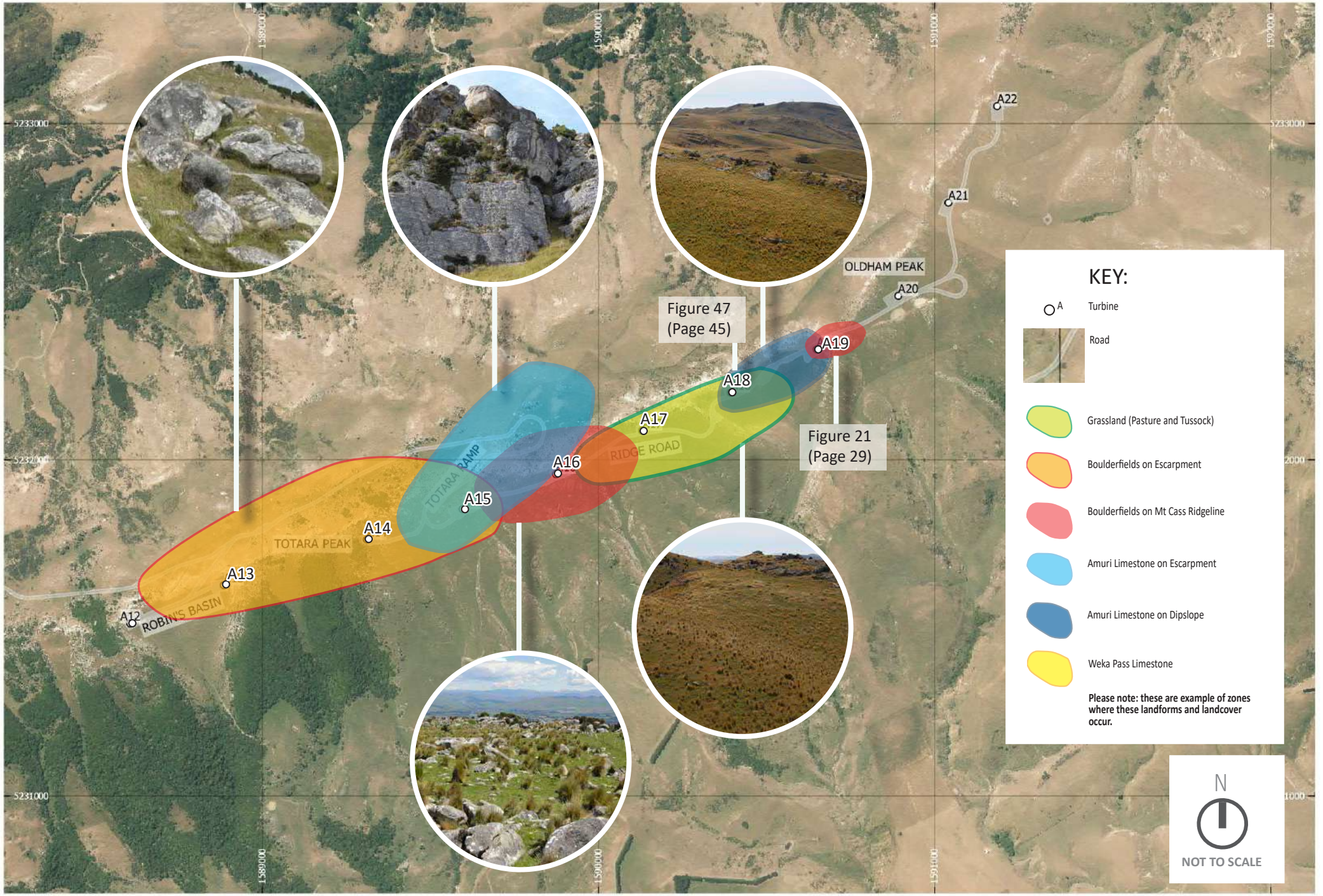

A22
A21
OLDHAM PEAK
A20
A19
A18
A17
A16
A15
A14
A13
A12
ROBIN'S BASIN
TOTARA PEAK
TOTARA RAMP
RIDGE ROAD
Figure 47
(Page 45)
Figure 21
(Page 29)
KEY:
A
Turbine
Road
Grassland (Pasture and Tussock)
Boulderfields on Escarpment
Boulderfields on Mt Cass Ridgeline
Amuri Limestone on Escarpment
Amuri Limestone on Dipslope
Weka Pass Limestone
Please note: these are example of zones where these landforms and landcover occur.
N
NOT TO SCALE

1.4 Viewpoints

The aim is to reduce the visual impact, reducing ecological effects and to protect and enhance the landscape. The following elements are visible from the main public viewpoints of SH1, SH7, Mt Cass Road, Amberley and the Tiromoana walkway.

1.4.1 Table of Viewpoints

Viewpoint	Element	Distance	Degree Visibility
SH7 (at Maungatahi farm gate)	Ramp Roads off Northern Terrace Roads	10.9km	Very low in am Low in pm
SH1 (at Mt Cass Road junction	None	7.8km	-
Mt Cass Road	Southern Access Road	2.6km	Low in am Very low in pm
Stockgrove Road	None	9.6km	-
SH1 at Omihi	Ramp Roads for A12 and A15	5.0km	Very low in am Low in pm
South end of Amberley township	Southern access Road and West extension road at west end	14.35km	negligible
Tiromoana Walkway	Can view part of Southern Access Road through to viewing no elements	2.6km+	Low in am Very low in pm

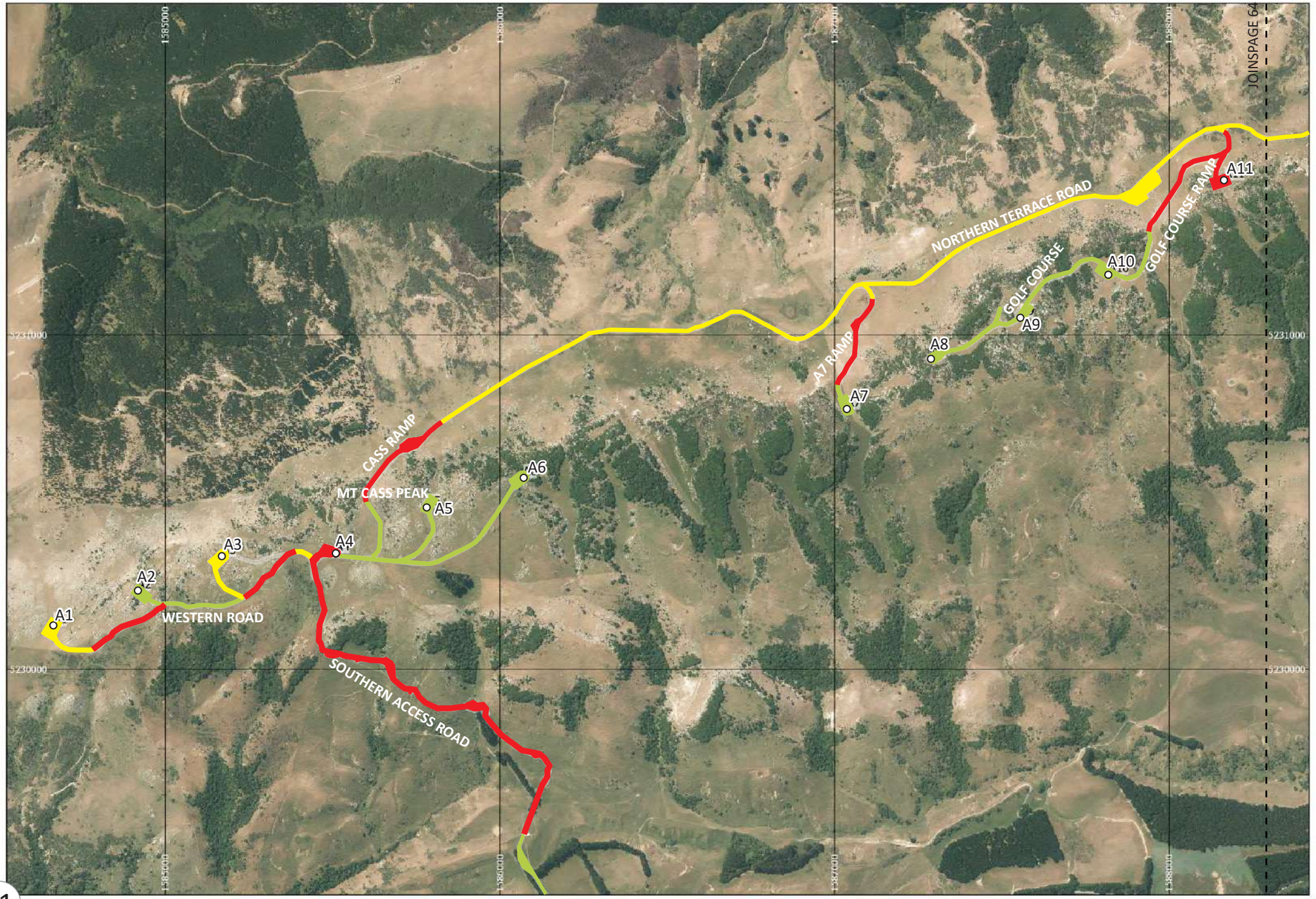
Table 1: Viewpoints

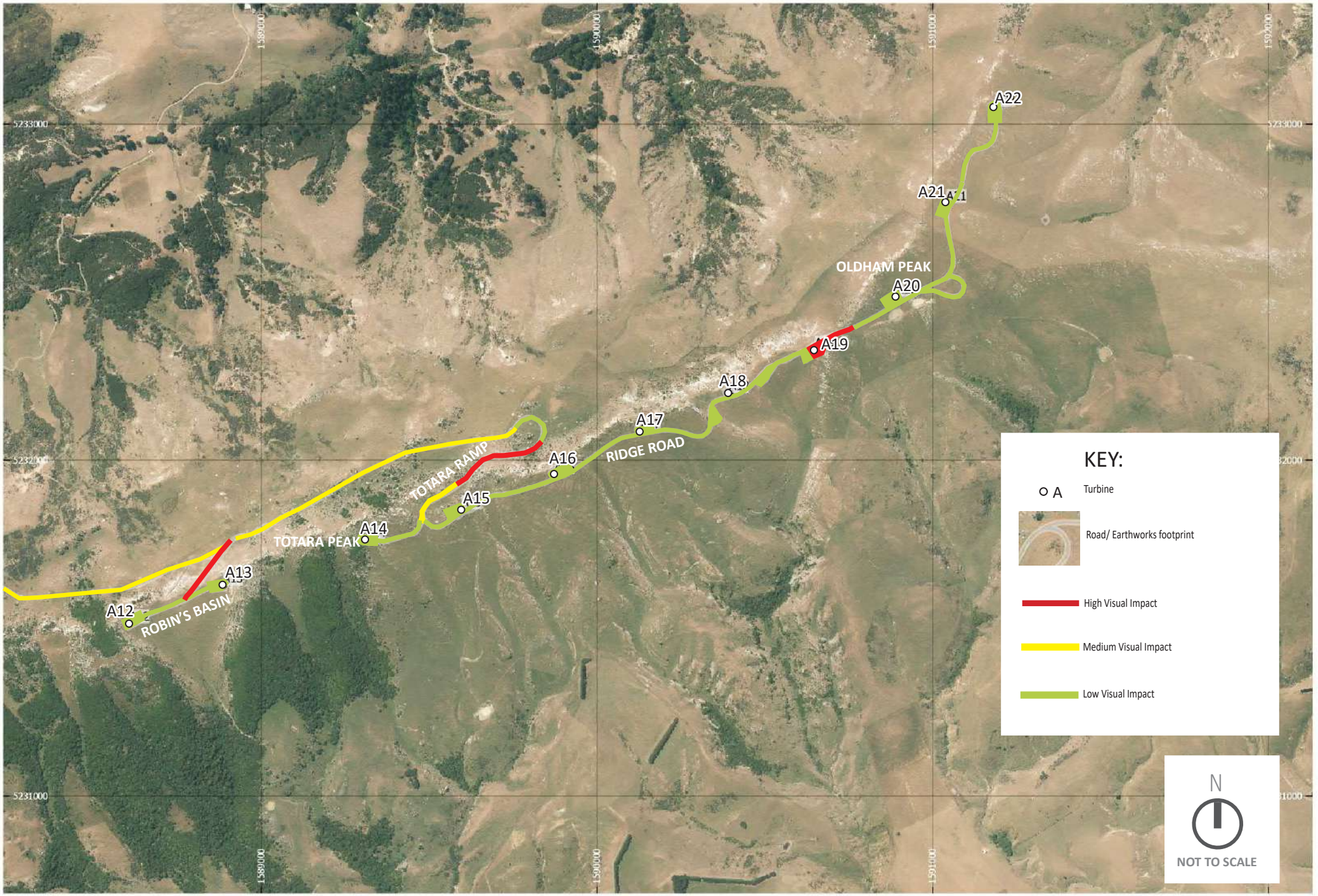
1.4.2 Viewpoints Map

KEY:

1. SH7 (at Maungatahi farm gate
2. SH1 (at Mt Cass Road junction)
3. Mt Cass Road
4. Stockgrove Road
5. SH1 at Omihi
6. South end of Amberley township
7. Tiromoana Walkway

1.5 Visibility Map




A22
A21
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OLDHAM PEAK
A19
A18
A17
A16
RIDGE ROAD
A15
TOTARA RAMP
A14
TOTARA PEAK
A13
A12
ROBIN'S BASIN
5233000
5232000
5231000
1589000
1590000
1591000
1592000
KEY:
A
Turbine
Road/ Earthworks footprint
High Visual Impact
Medium Visual Impact
Low Visual Impact
N
NOT TO SCALE

Landforms and Landcover

2.1 Grassland (Pasture and Tussock)

2.1.1 Context

Figure 1: Pasture grassland.

Fig. 2 Road through grassland approaching turbine A6.

Fig. 3 Tussock grassland.

2.1.2 Description of the landscape

Pasture grassland areas are generally located on the north facing slopes and along the broad ridgeline of Mt Cass where some of the areas are surrounded by broadleaf forest. There are also areas on the dip slope adjacent to the SAR.

The tussock land is more common at the east end, from turbine A12 to A19, and also between turbines A2 and A4.

Much of the NTR, ramp roads and many of the turbine platforms are to be located in existing pasture areas.

The large tussock areas have been avoided except for the eastern end between turbines A16 and A19.

2.1.3 Characteristics of the visual landscape

The characteristics of the visual landscape for both pasture and tussock land is one of a fine textured and open landscape. Any changes to this landscape could be visible from SH1, with a lack of vegetation and rocky outcrops to screen the NTR and ramp roads.

2.1.4 Relevant conditions of consent

‘

92. Where silver tussock is disturbed for pre-construction geotechnical investigations or construction purposes, but not necessary for the ongoing wind farm operation it shall be rehabilitated in accordance with condition [61] Rehabilitation of the area shall be to the standard identified in the pre-construction survey.

93. Where areas of silver tussock of a median greater than 10% density as identified on Golders Associates Plan CG241 dated 17 November 2010 are permanently removed as a result of wind farm development, an equivalent quantity of silver tussock shall be established and maintained on the wind farm site using direct vegetation transfer, planting, or other appropriate method.

’

2.1.5 Effects of activities in this landscape

The impact of the road alignment over open pasture and tussock grassland in an exposed landscape like Mt Cass is the result of its line expression, and also in colour changes where cuts and fills occur.

This line impact is to be lessened by taking care when aligning the road and side roads. The objective is that it is done so in uniformity with existing line expressions; e.g. a smoothly curved alignment in a landscape where smoothly curved lines dominate is to be achieved by following the contour. Colour impact is to be lessened by the regrading of side slopes and incorporating appropriate revegetation programmes or creating a textured rock surface. The aim is to integrate the new slopes into the existing slopes by rounding off hard edges.

2.1.6 Mitigation Measures

Mitigation measures are required to reduce the landscape and visual impacts of the road, such as the change of line and colour that will occur. This includes the following mitigation measures:

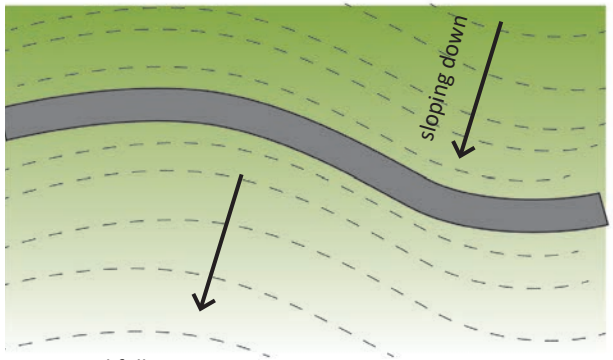


Fig. 4 Road following existing contours.

For straight line alignments the following measure is to be applied to reduce the visibility of the straight lines:

Fig. 5 Before: Straight line alignment of road.

Strip the grassland and soil off the road and place into a mounded area on the downhill side of the road, texture the cut surface so that organic matter will fill the crevices, mound the downhill side of the road to obscure part of the straight line alignment.

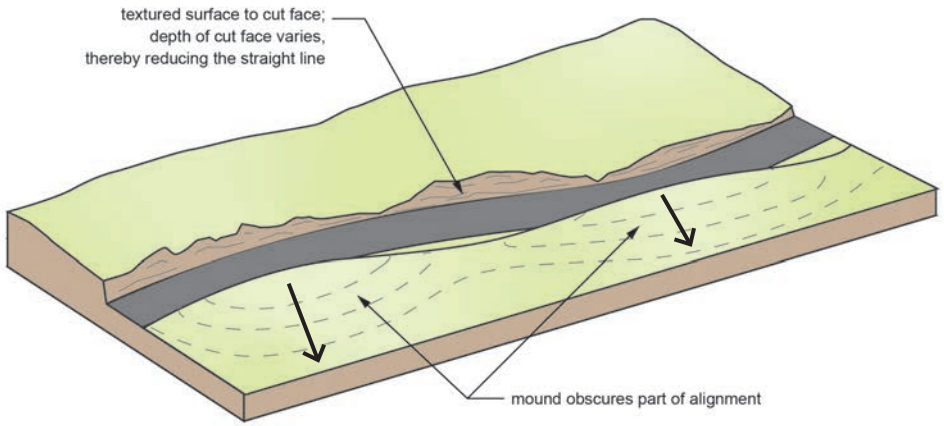


Fig. 2 Road through grassland approaching turbine A6.

Fig. 7 After: Add fill material to create mounds or vegetation to reduce impact of road.

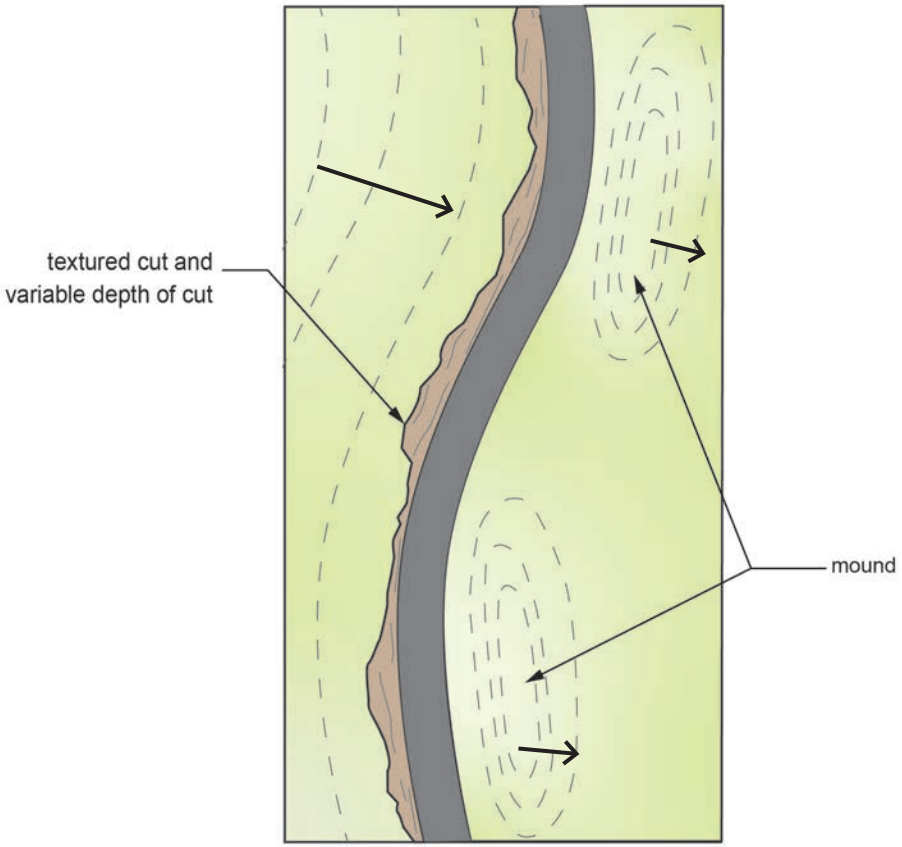
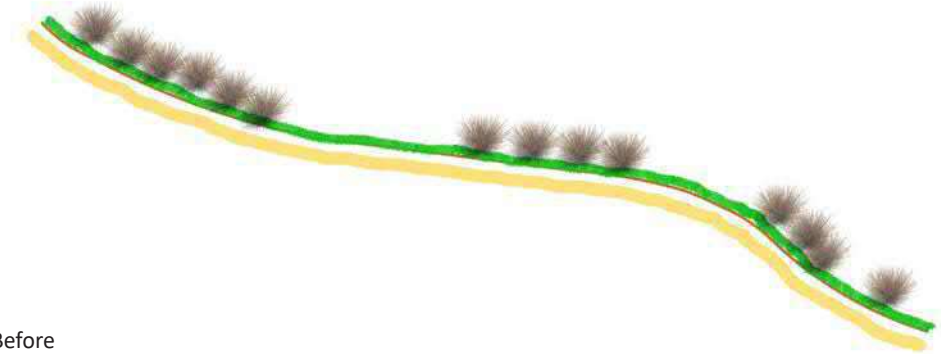
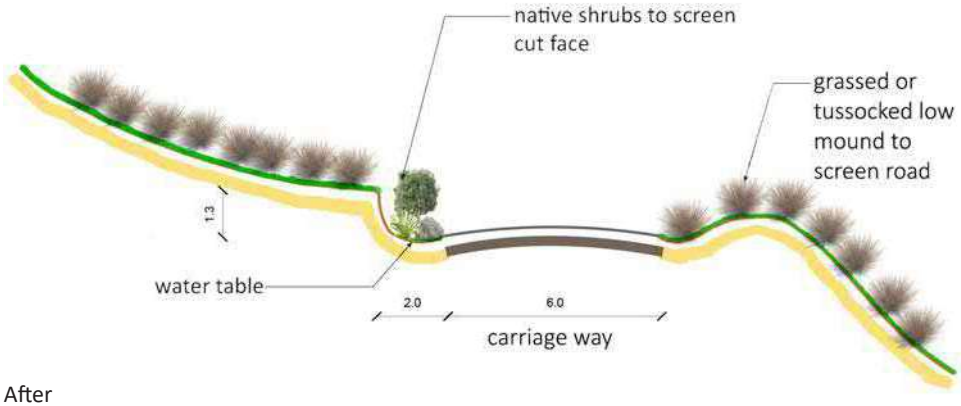


Fig. 8 Ramp Road scenario (plan).



Before



After

Fig. 9 Ramp Road scenario (section).

In open pasture areas it is unlikely that anything other than over-sowing of grass seed will occur in terms of revegetation. This intention is that this shall consist of a mix of short rye, fescue and NZ browntop.

Where there has been tussock damage, then planting of *Poa cita* is required at centres of less than 1.0m.

Fig. 10 An example of high-impact cuts and poor mitigation.

2.2 Boulderfields on Escarpment

2.2.1 Context

Fig. 11 & 12 Existing boulderfield above road will be relocated to below the road.

2.2.2 Description

Weka limestone boulders are found on the north facing escarpment and ridge of Mt Cass. They are found partly submerged surrounded by pasture, tussock or broadleaf vegetation. On the upper slopes of the escarpment there is a greater predominance of dense vegetation occurring due to the protection from stock by the boulders, and therefore revegetation is successfully occurring.

The ramp roads and the top part of the SAR will be affected by the boulderfields, but the NTR alignment has generally avoided boulderfields where possible e.g. between turbines A5- A11. Most of this area is of a pasture land cover. Between A13 to A18 there are boulder fields through which the NTR runs.

Fig. 13 Road crosses scarp face boulderfield on ramp to turbine A7.

Fig. 14 NTR across boulderfield with broadleaf vegetation.

2.2.3 Characteristics of the visual landscape

The characteristics of the visual landscape for the boulderfields is one of a fine textured and open landscape and in part a vegetated landscape. Changes to this landscape could be visible from SH1, especially the ramp roads, due to the visibility of the alignment.

2.2.4 Relevant conditions of consent

101. Limestone boulders within boulderfields derived from Weka limestone that will be displaced through the construction of the Northern Terrace Road and ramp roads or displaced through stabilisation measures, shall be relocated locally in naturalistic patterns on the downhill side of the roads. To the extent practicable, boulders shall be located in ground to a similar depth and orientation as they were in their natural state.

102. The finish of cut limestone faces and fill surfaces, the establishment of replicated boulderfields, the design of spoil disposal areas and the establishment of plants for mitigation and remediation shall be guided by the preparation (by the Consent Holder in consultation with the Hurunui District Council) of a site 'landscape pattern book' of graphic examples drawn from the locality. The pattern book will provide a source book of examples that should be used to guide the visual appearance of landscape mitigation and remediation works.

2.2.5 Effects of the activities in this landscape

The impact of the road through boulderfields is the result of colour changes due to the displacement of the boulders themselves, and the line expression of the roads.

The line impact is lessened due to the presence of boulders and vegetation which reduces the visual appearance of the road.

The aim is that the colour impact, due to a whiter appearance of the displaced limestone boulders, shall be lessened by placing them in depressions and orienting them in their original position, with the grey lichen and surface treatment being exposed. The objective is that they shall be located below the road, with planting added, for screening purposes.

2.2.6 Mitigation Measures

To manage the changes of line and colour and to reduce the landscape and visual impacts of the road, the following mitigation measures are required:

(i) Alignment

- Avoid boulderfields where possible,
- Strip the pasture and soil stockpile and use this material for mounding on the downhill side of the road to “break” the line of the road. the pasture and soil, and stockpile,
- Remove the boulders and place below the road, bury up to 1/3 and arrange in a naturalistic style (ie: in informal groups of 5 to 7 boulders),
- Use the stockpiled soil to place around the boulders and shape this material,
- The boulder shall be placed using a webbing sling so as not to mark them, in a depression and in their original orientation.

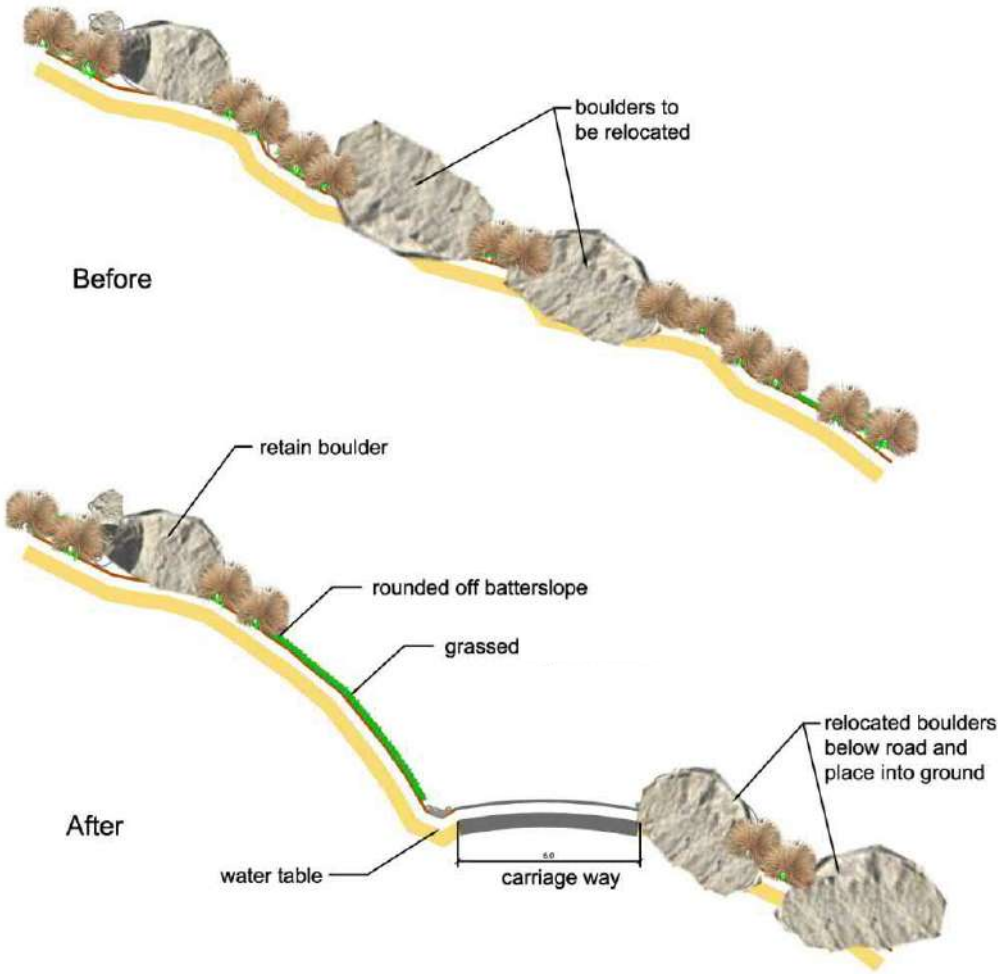


Fig. 15 Weka boulderfields and placement of boulders below the road.

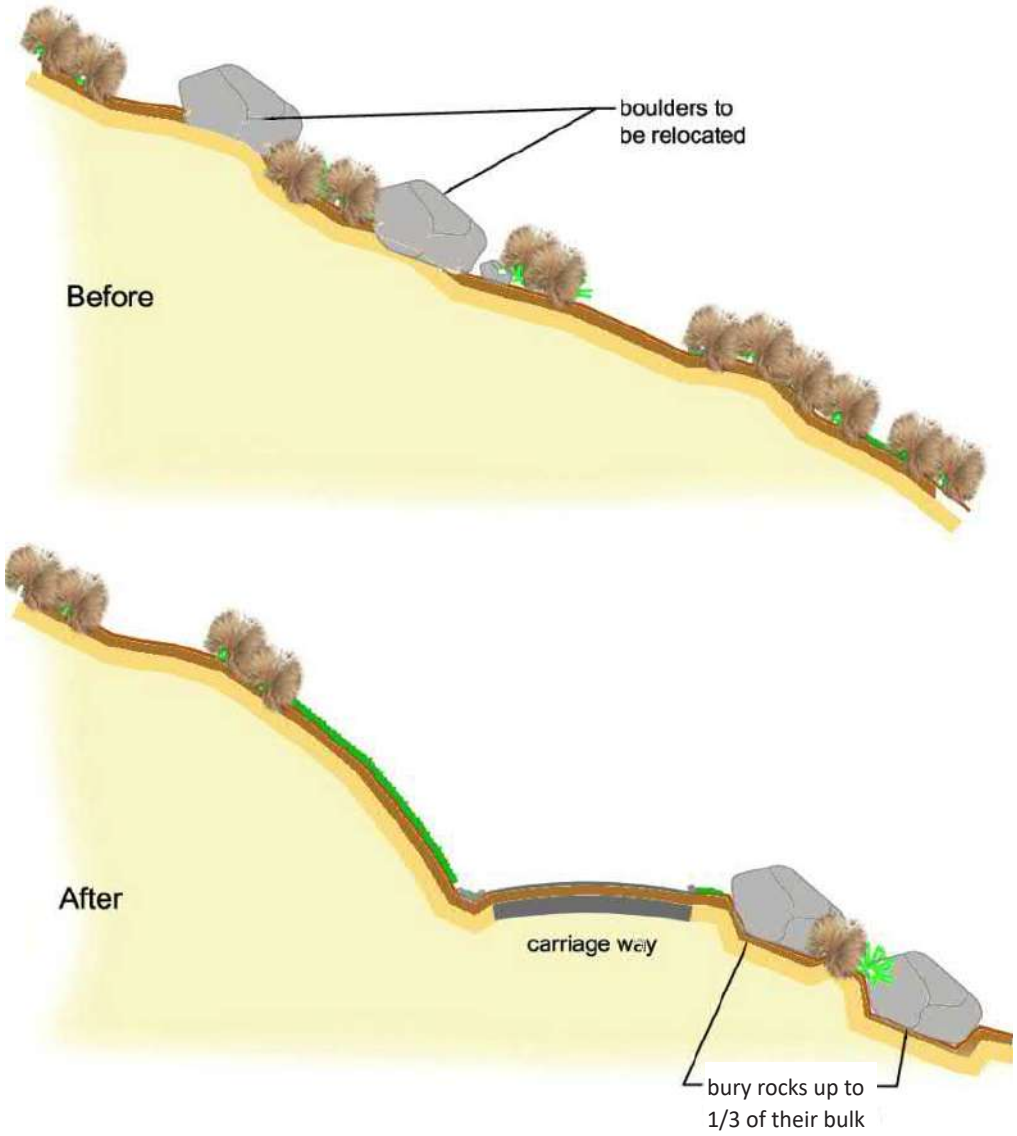


Fig. 16 Transfer boulders from uphill of the newly formed access road to below the road.

(ii) While not all the displaced boulderfields will be placed to the same depth and orientation, if not treated, the pale cream colour of the newly exposed rock will colour to a grey colour approximately 5 years after being displaced.

(iii) Where the slopes may be too steep to replace the boulders ie: in slopes over 1v:2.5h (ie: 1 vertical in 2.5 horizontal), the boulders are to be removed and then buried within a re-contoured landform to ensure stability, using ledges to hold them in place. This is subject to confirmation by the civil design team.

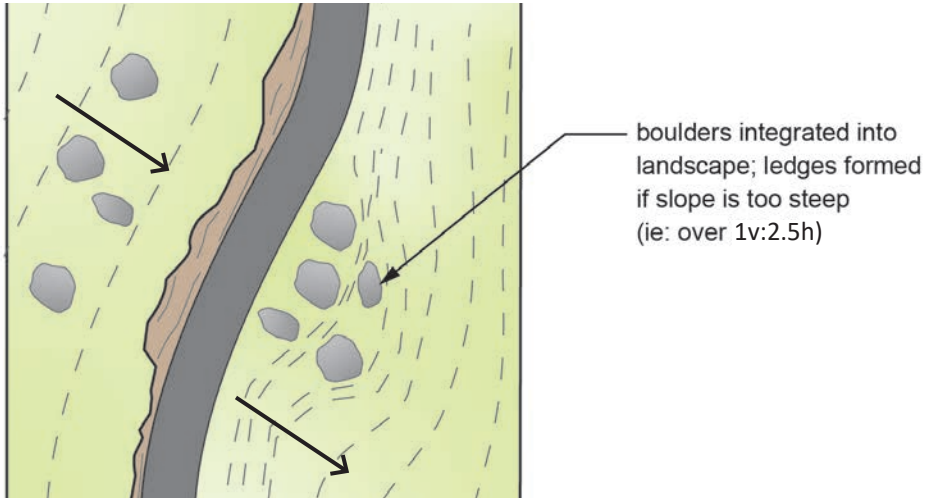


Fig. 17 Integration of boulders into landscape.

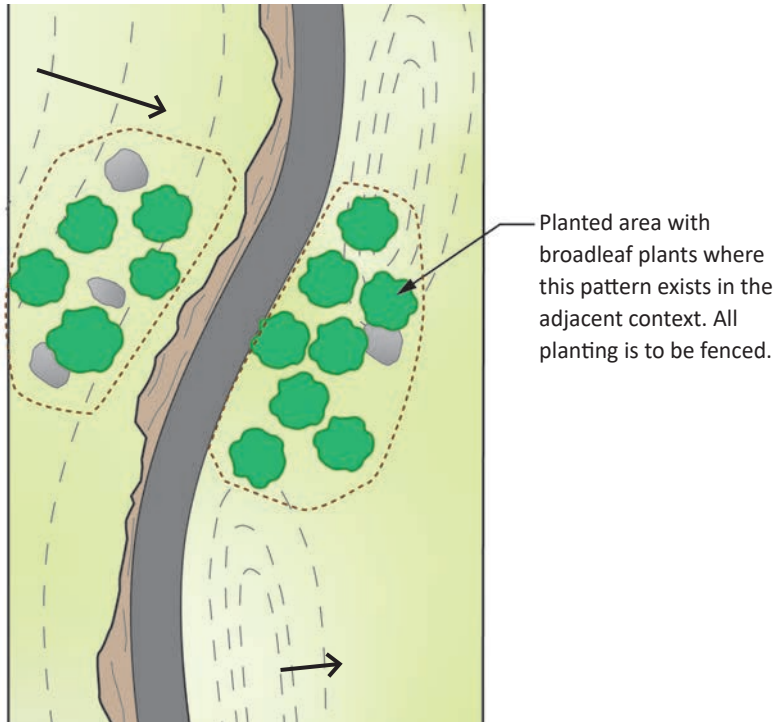


Fig. 18 Planted area with broadleaf plants where this pattern exists in the adjacent context.

2.3 Boulderfields on the Mt Cass Ridgeline

2.3.1 Context

Fig. 19 & 20 Boulderfields on the ridgeline.

2.3.2 Description of the Landscape

The ridgeline of Mt Cass is relatively flat within the boulderfield, and broadleaf vegetation is common e.g. between turbines A8-A11; while between turbines A14-A22 the ridge is less flat with little broadleaf vegetation existing amongst the boulderfields.

A road between turbines A15-A19 traverses the ridgeline where there are boulderfields, broadleaf vegetation and open grassland. Because it is generally flat the boulders can be easily moved to the edge of the road.

2.3.3 Characteristics of the visual landscape

The visual characteristics of the boulderfields on the ridgeline is one of coarse texture with boulders and vegetation. While the ridgeline is a relatively exposed landscape, its topography and coarse texture can generally accommodate access roads without large or noticeable areas of cut and fill. Changes to this landscape would therefore not be as readily visible from any public viewpoint.

2.3.4 Relevant conditions of consent

These relate to CoC 101-102 for limestone boulders, but also to the limestone pavement, which is discussed in the section on “Weka Pass Limestone”.

> *101. Limestone boulders within boulderfields derived from Weka limestone that will be displaced through the construction of the Northern Terrace Road and spur roads or displaced through stabilisation measures, shall be relocated locally in naturalistic patterns on the downhill side of the roads. To the extent practicable, boulders shall be located in ground to a similar depth and orientation as they were in their natural state.*
>
> *102. The finish of cut limestone faces and fill surfaces, the establishment of replicated boulderfields, the design of spoil disposal areas and the establishment of plants for mitigation and remediation shall be guided by the preparation (by the Consent Holder in consultation with the Hurunui District Council) of a site ‘landscape pattern book’ of graphic examples drawn from the locality. The pattern book will provide a source book of examples that should be used to guide the visual appearance of landscape mitigation and remediation works.*

2.3.5 Effects of the activities in this landscape

The road through the ridgeline boulderfields in an exposed landscape will have an impact, as could occur adjacent to turbine A19 (Figure 21). This will be the result of its line expression, and the colour changes where cuts and fill occur.

The objective is to lessen the impact of the NTR and ramp roads by aligning the roads along the contours as smoothly curved lines. Colour impact is to be lessened by regrading the batter slopes, creating a textured rock surface, placing the weathered rocks in the original position and establish revegetation patterns.

Fig. 21 Ridge Rd crosses boulderfield on ridge just past turbine A19.

2.3.6 Mitigation Measures

Mitigation measures to reduce the landscape and visual impacts of the road traversing the ridgeline boulderfields are to include the following:

(i) Alignment

- Avoid boulderfields where possible
- Strip the pasture and soil, and stockpile
- Remove the boulders and place below the road in a depression and in a naturalistic style (ie: in informal groups of 5 and 7 boulders)
- Use the stockpiled soil to place around the boulders and shape this material
- It is intended that the boulders be placed using a webbing sling so as not to mark them, in a depression and in their original orientation.

(ii) While not all the displaced boulderfields will be placed back to the same depth and orientation, if not treated, the pale cream colour of the newly exposed rock will colour to a grey colour in approximately 5 years after being displaced.

(iii) Where the slopes may be too steep to replace the boulders ie: in slopes over 1v:2.5h the boulders shall be removed and then placed in a safe and stable manner, using ledges to hold them in place, subject to confirmation by civil design team .

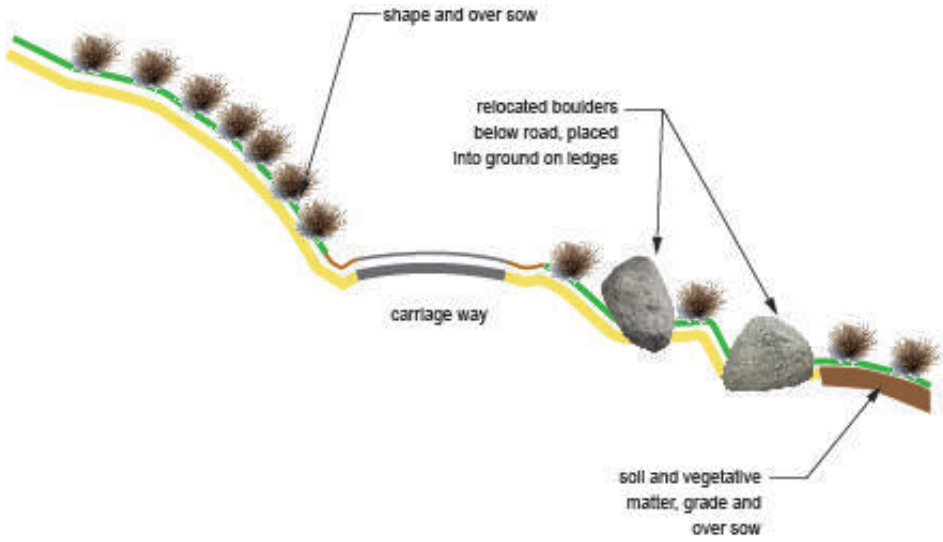


Fig. 22 Boulders placed on ledges where the slope may otherwise be too steep ie: in slopes over 1v:2.5h.

Mitigation Measures (continued)

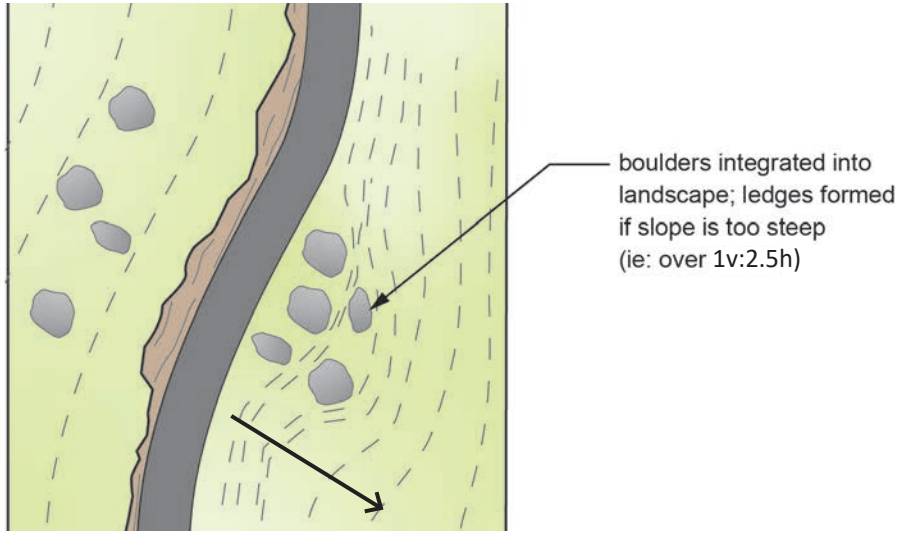


Fig. 23 Boulders placed on ledges where slope may otherwise be too steep, ie: in slopes over 1v:2.5h.

(iv) Grade the fill material and over-sow with grass seed.

(v) Develop a planting programme and fence off planted area.

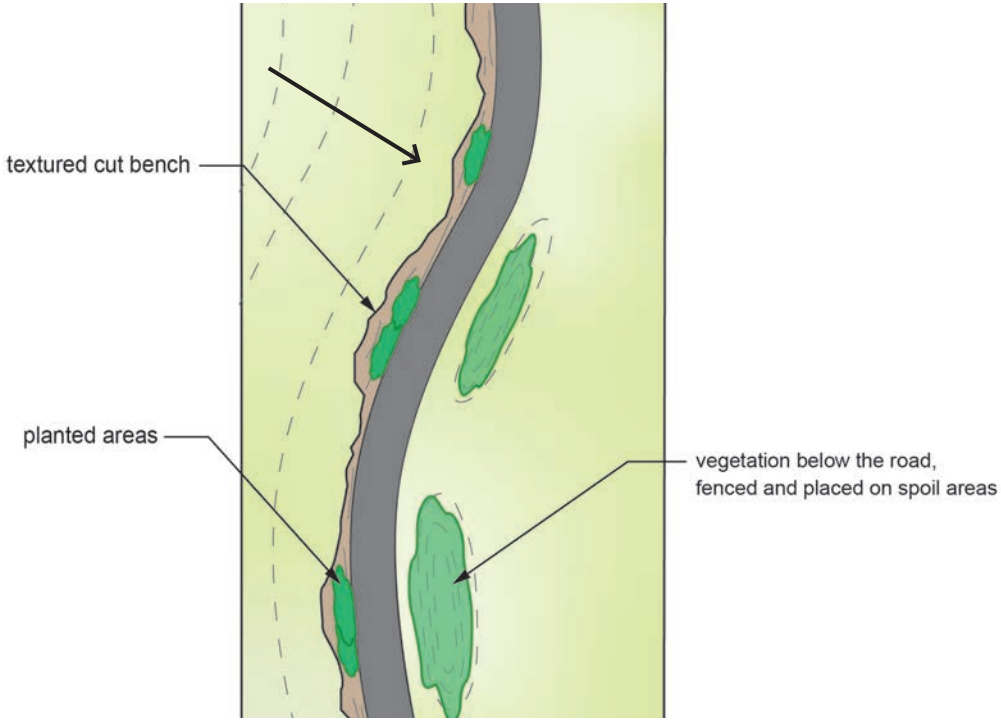


Fig. 24 Planting can reduce the impact of the road alignment.

(vi) Use plants suitable for north facing slopes. (see Appendix 1.0)

2.4 Amuri Limestone on the Escarpment

2.4.1 Context

Fig. 25 Amuri limestone outcrop.

Fig. 26 Exposed Amuri limestone.

2.4.2 Description

Amuri limestone is a layered material with a textured surface and appears as very large outcrops embedded into the escarpment.

It is a landscape of coarse texture with outcrops and scattered vegetation on the north facing slopes of the escarpment. A large percentage of the NTR is aligned through this type of landscape, for example the ramp to turbine A15. The limestone outcrops appear intermittently amongst the grassland landscape.

2.4.3 Characteristics of the visual landscape

Characteristics of the visual landscape for the Amuri limestone are of a coarse textured landscape with scattered rocky outcrops and some isolated clumps of vegetation.

Any changes to this landscape with road alignments may be visible from SH1, only where there is a lack of vegetation and rocky outcrops. These would be long distance views.

2.4.4 Relevant conditions of consent

96. Uphill edges of cut faces for roads built through Amuri limestone shall be finished in an irregular pattern.

97. Straight line interfaces between cut faces and original surfaces shall be avoided.

98. Cut faces in Amuri limestone shall be finished so as to emulate naturally occurring limestone faces. Techniques for this purpose shall reference naturally occurring patterns in local limestone faces and may include:

a. Cut faces shall be scarified to achieve a surface texture commensurate with naturally occurring surface textures in weathered Amuri limestone. Scarification shall be done with a tyned tool in the direction of the bedding plane or 'grain' in the limestone.

b. Continuous, sheer limestone cut faces shall be avoided through the creation of surface variations that emulate naturally occurring patterns. Shallow vertical and diagonal fissures, narrow rills and shallow pockets shall be cut into limestone faces in an irregular pattern at 3—5 m intervals.

c. In cuts over 2 m in height, shallow benches approximately 200-400mm deep shall be cut into the face at approximately 2 m (but irregular) intervals, parallel to the bedding plane or 'grain' of the rock. These benches will provide locations for the accumulation of sediments and the products of natural erosion, which will in turn form a substrate for the establishment of plants.

Road Edges:

"99. During the construction of Northern Terrace Road and associated ramp roads to the main ridgeline, cut material shall not be sidecast down-slope of the road, but shall be removed from the work areas and disposed of at disposal sites indicated on the Golder Associates Plans CG151.4-153.4.

100. Mitigation techniques on the outside edges of roads referred to in Condition [99] shall include, but not be limited to, the following:

a. Where these roads are cut through Amuri limestone, at irregular intervals along the outer edges of roads, topsoil shall be removed from the edge of the road to expose patches of underlying limestone.

b. Indigenous tussock and grey scrub species shall be established sufficiently close to the outer edge of the road to grow above the level of the roads formation.

2.4.5 Effects of the activities in this landscape

The impact of the road through the Amuri limestone on the escarpment, as occurs on the ramp road to turbine A15 in an exposed landscape, will be the result of its line expression, and the colour changes. This will be where the cuts occur, and will be highlighted by a light cream colour of the rock material.

It is intended that the line impact be lessened due to care taken when aligning the NTR and ramp roads and keeping a uniformity with the existing landforms, and reducing harsh and incongruous alignments.

Colour impact is to be lessened by regrading batter slopes to fit in with the surrounding landforms, mounding and scarifying the rock type and establishing revegetation which replicates existing vegetation patterns.

2.4.6 Mitigation Measures

Mitigation measures required to reduce the landscape and visual impacts of the road and platforms are to include:

(i) **Alignments**

Avoid the limestone outcrops if and where possible, but in most cases, this is generally impossible due to gradient and horizontal alignment.

(ii) Strip the pasture cover and vegetative matter and place in stockpiles.

(ii) Conditions 100a and 100b:

Mitigation techniques on the outside edges of roads referred to in Condition [99] shall include, but not be limited to the following:

a. Where these roads are cut through Amuri limestone, at irregular intervals along the outer edges of roads, topsoil shall be removed from the edge of the road to expose patches of underlying limestone.

b. Indigenous tussock and grey scrub species shall be established sufficiently close to the outer edge of the road to grow above the level of the roads formation.

(iv) Soils and Vegetative Matter

All soil and vegetative matter is to be placed and shaped as a mound below the road.

(iv) Soils and Vegetative Matter

The Amuri limestone surface is to be textured in order to reduce the dominant cream colour characteristic. It is intended that organic matter from the site shall collect in the cracks, crevices and gaps and this will grow vegetative matter, thereby reducing the visibility of the cut material.

Fig. 27 Striated texture of Amuri Limestone. Organic matter collects in the crevices and ledges.

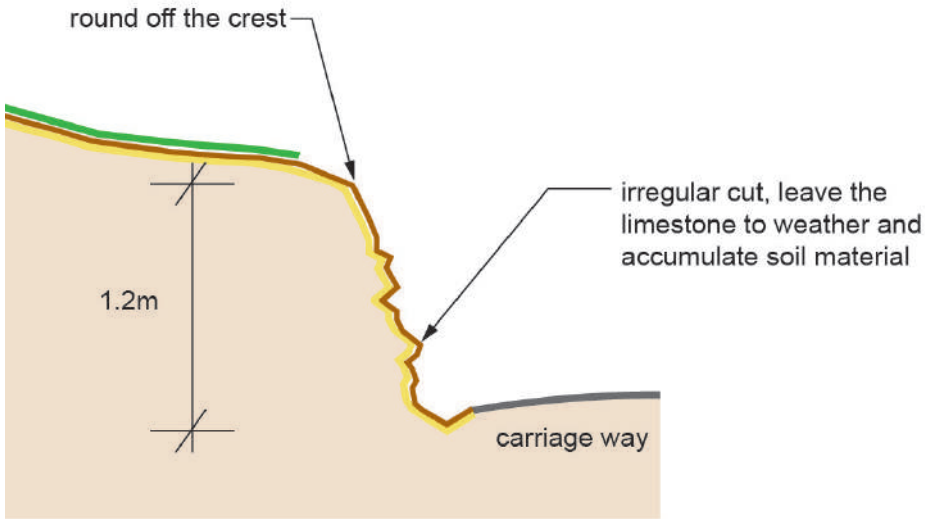


Fig. 28 & 29 A 1.2 m high cut into Amuri Limestone.

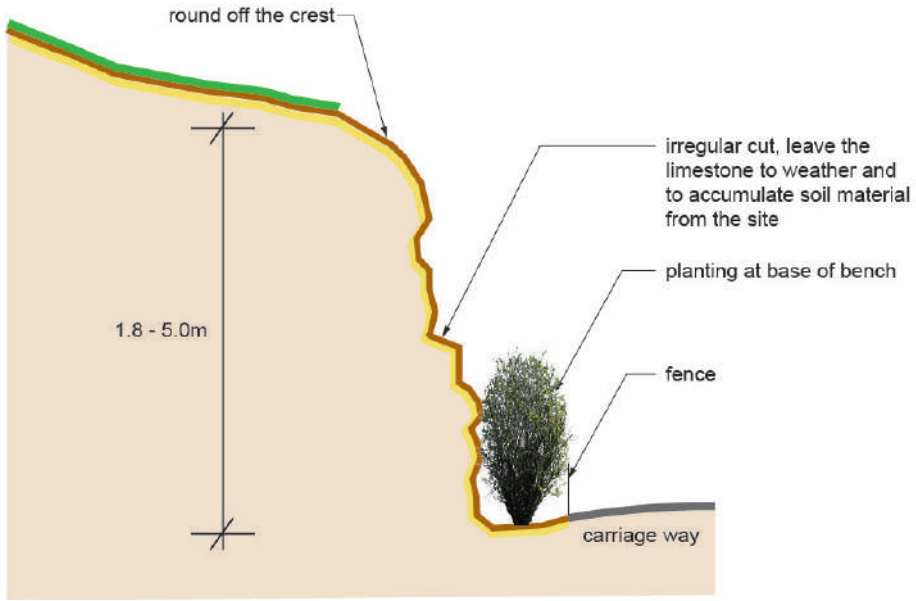


Fig. 30 & 31 A 1.8 – 5.0 m high cut batter constructed in an irregular fashion so that organic matter will accumulate. The organic matter shall be material which is sourced on site, with a seed mix added. The crest needs to be rounded off it is intended that planting shall take place at the base of the batter.

Fig. 32 Organic matter in crevices.

Topsoil will be removed, and the limestone face is cut to the batter slope above the road. The cut is to be irregular, as per condition 96, so that ledges and crevices are created to enable organic matter from the site to be placed on, within, or accumulate.

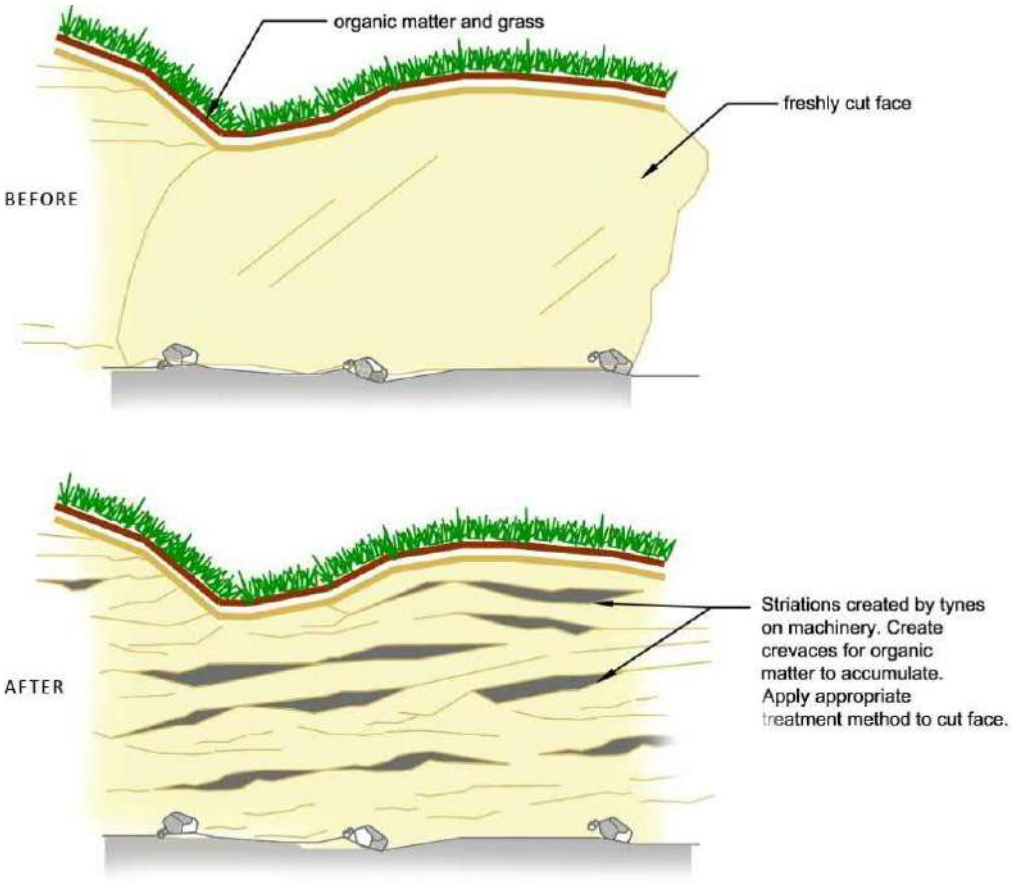


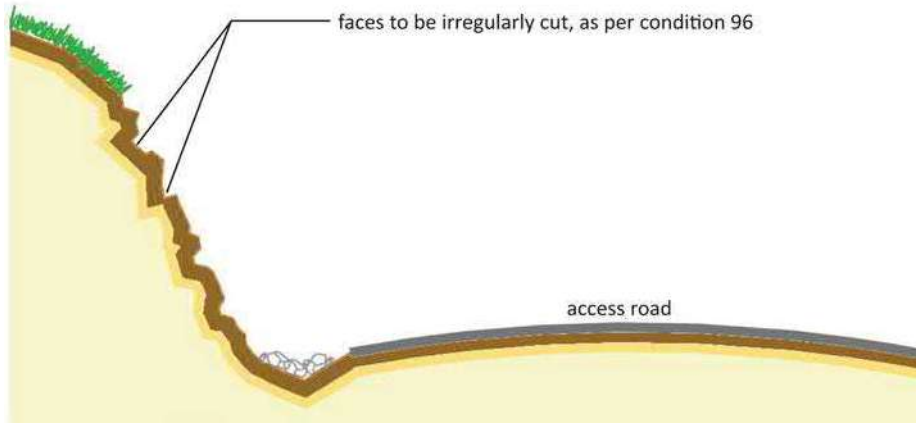
Fig. 33 Scarification of cut faces in direction of bedding plane/grain.

The aim is that the scarifying of these cut faces or exposed faces shall be in the direction of the bedding plane or grain. Shallow vertical and diagonal fissures, pockets and rills shall be cut into limestone faces in an irregular pattern as per condition 96 and depending on the direction of the limestone grain, at approximately 3m intervals.

Fig. 34 A textured Amuri limestone outcrop.

Texturing the surface assists, along with the weathering process, to reduce the visual impact of flat and reflective cut faces. The objective is that the textured surface is deep enough, e.g. 25-50mm, for organic matter (ie: material collected on site) to accumulate. This is a passive mitigation technique, creating a rough surface that allows soil to accumulate. The more fragmented cut surfaces weather faster and allow vegetation to establish and so reduce visual effects.

To further speed the process, some discrete cuts and pockets are to be hydroseeded on the south side. Refer to Figure 34. This is an active mitigation technique. However, for the northern facing slopes this is unlikely to be effective, due to the dry site conditions.



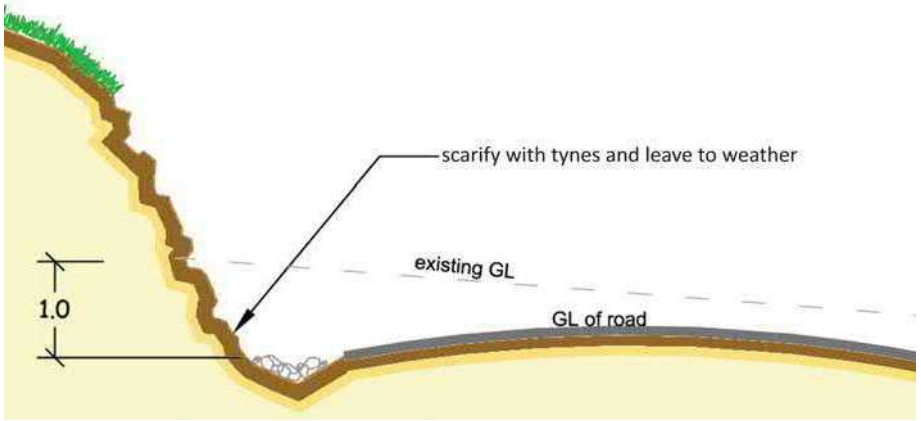


Fig. 35 Cut Faces of Amuri Formation (e.g. northern terrace road).

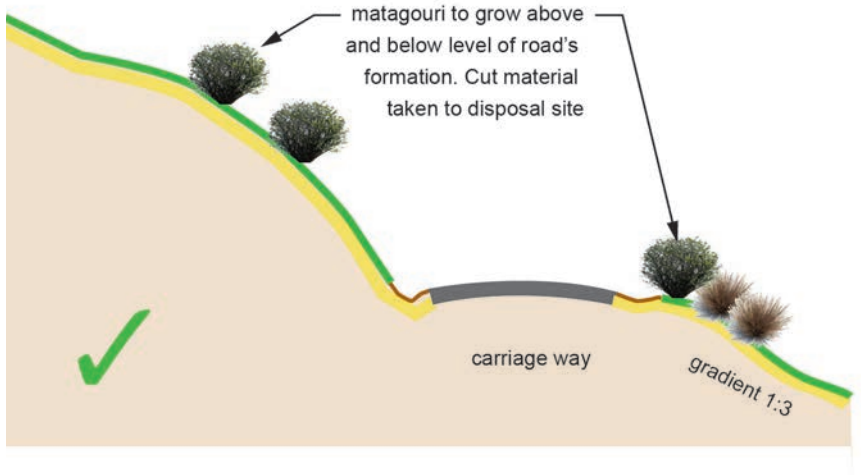


Fig. 36 Vegetation established on road edge.

(vii) Revegetation

For the cut faces of the Amuri limestone apart from texturing the surface, undertake mounding on the lower side, and relocate the excess cut materials. Slopes are to be flatter than 1v:2.5h. Another method to reduce the limestone visibility is to undertake the following forms:

- Hydroseeding the cut faces on the south side with grass seed or native plant seeds
- Over-sowing of any damaged grassland areas
- Stockpile the vegetation and soil matter and form up naturally appearing formations to integrate with the landform
- Planting of tussocks and or broadleaf plants (see list in appendix)

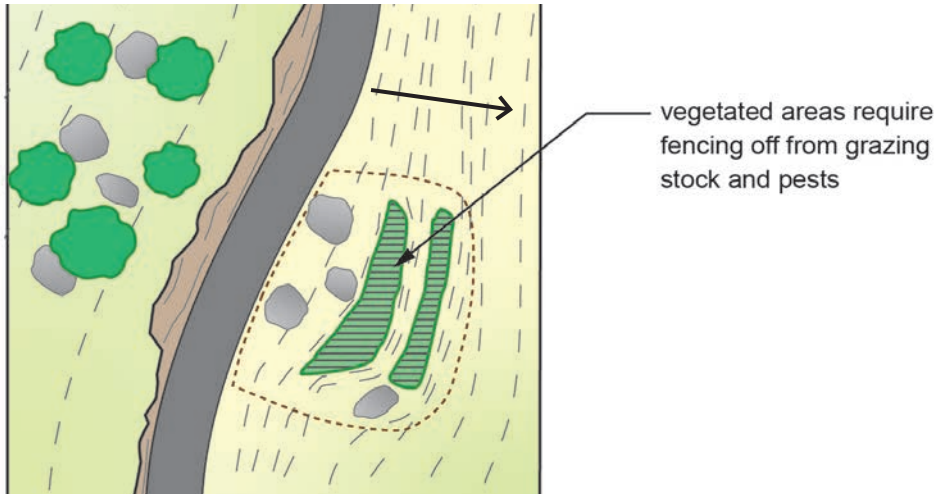


Fig. 37 Vegetated areas fenced off from grazing stock and pests.

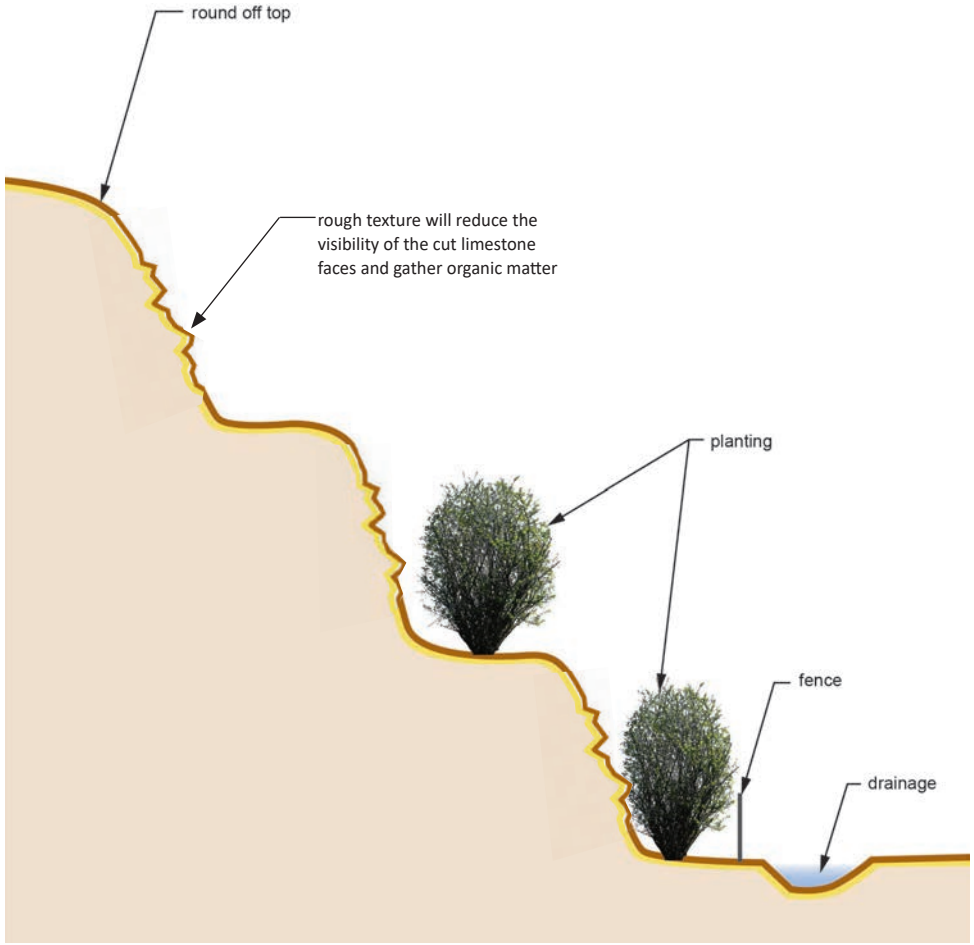


Fig. 38 Vegetated areas fenced off from grazing stock and pests.

Fig. 39 Avoid benching in even steps.

(viii) Removing topsoil to expose limestone

For the cut faces of the Amuri limestone where the slopes are greater than 1v:2.5h, with the terrain too steep to revegetate, the method outlined in 100a Conditions of Consent is to be used. By creating cuts at irregular intervals, the road will not be read as a line in the landscape, so reducing the landscape and visual impacts of the road.

> *Mitigation techniques on the outside edges of roads referred to in Condition [99] shall include, but not be limited to the following:*
>
> *a. Where these roads are cut through Amuri limestone, at irregular intervals along the outer edges of roads, topsoil shall be removed from the edge of the road to expose patches of underlying limestone.*
>
> *b. Indigenous tussock and grey scrub species shall be established sufficiently close to the outer edge of the road to grow above the level of the roads formation.*

Fig. 42 Road ramp to turbine 15 through boulders and vegetation. (see 2.5.4)

(viii) Limestone Treatment

Another possiblilty to mitigate the visual effects of the limestone cuts, is a method already used on limestone rock work at Broken River, Canterbury. This is using the application of a 5% solution of black oxide, washed over the limestone areas.

it is important that the percentage of oxide is to be no higher than 5%, as if there is a much higher concentration of black oxide in the solution, then the resultant colour will appear unnatural.

2.5 Amuri Limestone on Dip Slope

2.5.1 Context

Fig. 41 & 42 Amuri limestone on dip slope.

2.5.2 Description

The dip slope is on the south side of the escarpment. This slopes south and has less sun with moister slopes. Amuri limestone is overlaid with a competent Weka Rock formation in places . Turbine A18 is located on a dip slope, with Amuri Limestone at the surface, as are Turbines A12 and A13, along with the Southern Access Road (SAR).

The south facing slopes exhibit a better quality tussock and broadleaf forest, although pasture does exist as well. The turbines and road are mainly located in grassland (pasture and tussock land). See 2.0.

2.5.3 Characteristics of the visual landscape

The characteristics of the visual landscape for this location is one of a fine textured and open landscape which is not visible from any public viewpoint on land, but visible from the sea at a considerable distance.

While not visible on the surface, there is an underlying rock formation which will be exposed, particularly at A18 where there will be 8 m vertical cuts into the Amuri Limestone.

2.5.5 Effects of the activities in this landscape

Between turbines A15 to A22, the road is located on the dip slope of an Amuri limestone landscape, with the turbines located consecutively along this route.

It is an exposed landscape of pasture and tussock grassland and the resulting expression of the road will be its line and colour. The colour will result from where the cuts will occur for the road and turbine platforms, especially where the cuts occur in the limestone.

The objective is to lessen the line expression by reducing the height of the cuts and with the alignment in keeping with the uniformity of the existing landform.

Scarifying the limestone cuts, reducing any harsh edges and developing a revegetation programme is to be used also to assist in reducing the visual impact of the road and platforms.

2.5.6 Mitigation Measures

Mitigation measures required to reduce the landscape and visual impacts of the roads and platforms are to include the following approaches, subject to confirmation by a civil design team:

(i) **Alignments**

- Avoid large cuts and fills
- Avoid forested areas

(ii) Stripping of landcover including all vegetative matter and soil. This is to be stockpiled in readiness for shaping and mounding.

(ii) Cutting of benches adjacent to the road and platforms. All limestone material is to be crushed and used for fill in designated fill and disposal areas, where it will be placed on the adjacent landform, shaped and covered with topsoil. Cut benches are to be formed at, for example turbine A18, where the vertical height is approximately 8.0m. (see Figure 47)

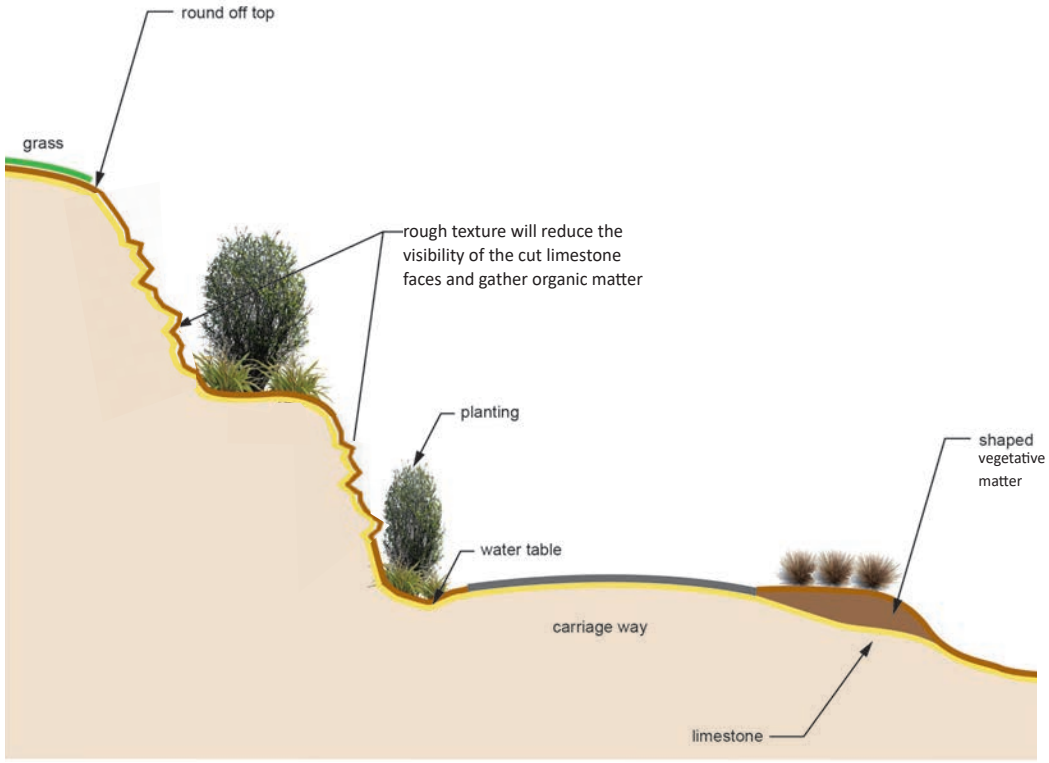


Fig. 43 Shaped vegetative matter and cut benches.

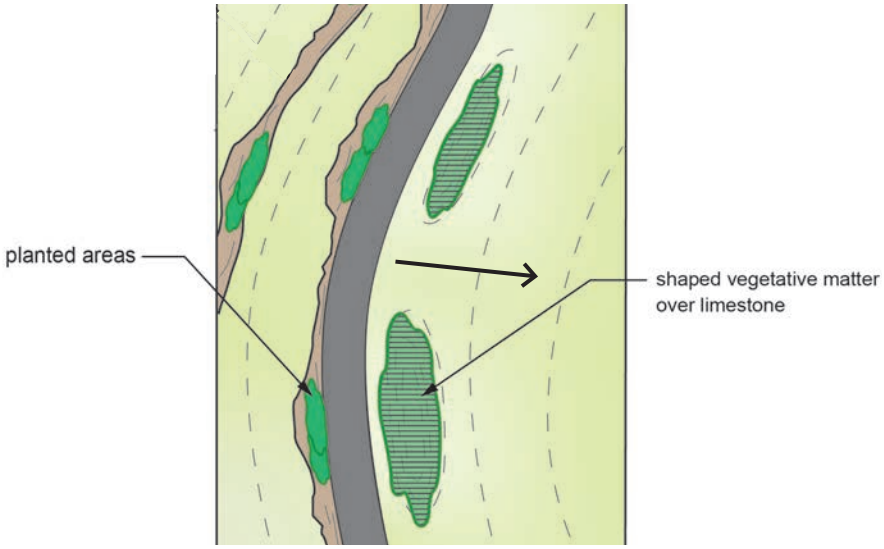


Fig. 44 Shaped vegetative matter and cut benches.

The cut surface will be striated and planted in places. The objective is to undertake pocket planting with shrubs that grow in this location like Coprosma and NZ Broadleaf.

Mitigation Measures (continued)

Fig. 45 Avoid benching in even steps.

Fig. 46 An example of high-impact cuts and poor mitigation.

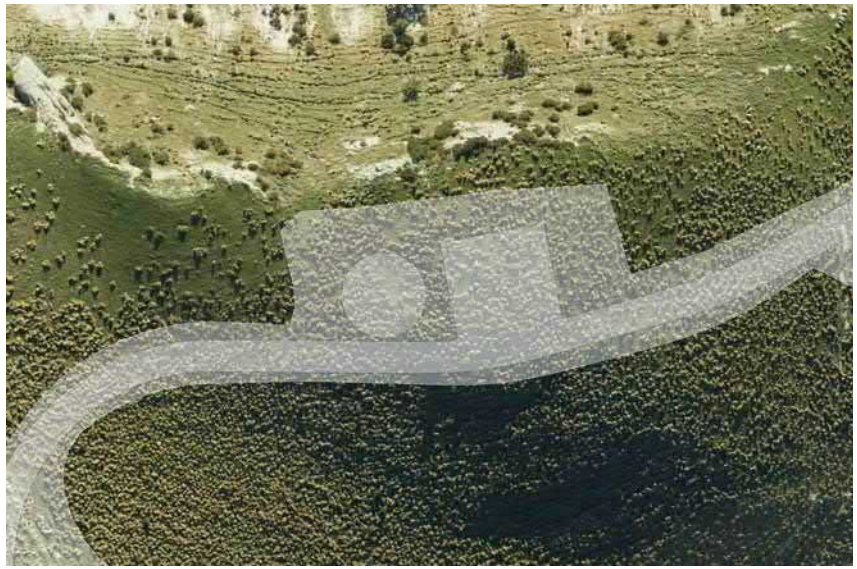


Fig. 47 Tussock grassland with 8m cuts into Amuri dip slope at turbine A18.

2.6 Weka Pass Limestone

2.6.1 Context

Fig. 48 & 49 Exposed Weka Pass limestone.

2.6.2 Description

The Weka Pass limestone is identified as limestone pavement in the “golf course” area between turbines A8 and A10, at A2, and on the dip slope at turbine A16. The pavement areas are found on the flat ridgeline amongst broadleaf vegetation and grassland, and are manifested either on the surface or partially buried as slabs of rock. Water erosion has taken place to create interesting patterns on the rock surface.

On the dip slope there is pavement above and below ground level. Where it is below ground level often it is covered by tussock and pasture.

A ridge link road between turbines 8 and 10 passes through the pavement area, while the Ridge Road connects turbines A16-A22 in the dip slope area.

Fig. 50 “Golf course”. Pavement between A9 and A10 to be buried.

Fig. 51 Road crosses pavement at turbine A2.

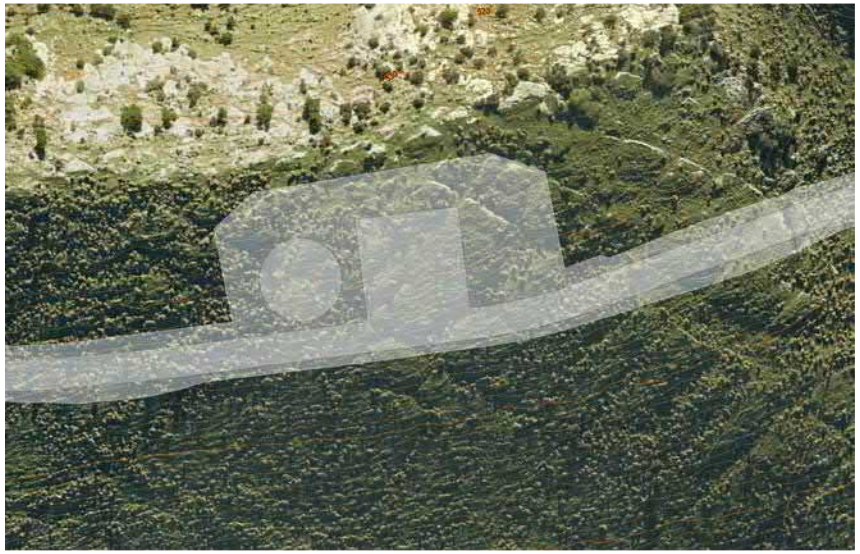


Fig. 52 Turbine A16 Weka Pass dip slope, likely to result in cuts up to 9m in height.

2.6.3 Characteristics of the landscape

The characteristics of the landscape, which contribute to the ONFL values for the pasture and tussock area, is one of a fine textured and open landscape, dominated by an ochre colour in summer and a green colour in winter. Any changes to this landscape would not be visible from any public viewpoint.

The characteristics relating to the crest or ridge area of pavement is one of an enclosed landscape of dense broadleaf vegetation and pasture.

Any changes to this landscape would not be visible from any public viewpoint.

2.6.4 Relevant conditions of consent

Treatment of Identified Limestone Pavement Areas

45. Limestone pavement within the areas marked on Golder Associates plan CG161.3 and CG163.3 shall be covered to a sufficient depth with crushed limestone or other appropriate material as necessary so as to avoid cuts to limestone pavement.

46. Limestone pavement in the areas identified in condition [45] shall be partially rehabilitated to a width for the running surface of the road of 3.5 metres in accordance with the Chris Glasson Plan, dated 15 November 2010, and the plan titled 'Indicative Cross Section of the Completed Road Formation and Mitigation Measures', dated 24 July 2011, attached as Appendix 3. The Consent Holder may at any time for maintenance or decommissioning reasons reinstate full access in these areas for so long as that access is required. Once full access is no longer required the Consent Holder is to partially rehabilitate the area to the standard required by the Chris Glasson Plan dated 15 November 2010.

2.6.5 Effects of Activities in this Landscape

The impact of the road and turbine platforms within the enclosed "golf course" area will result in a change to the pattern and colour of the location. This is due to the road alignment and materials, loss of pavement and vegetation. The road will generally traverse a pasture landscape.

In the dip slope location, the roading and platforms will result in a line expression and colour change.

2.6.6 Mitigation Measures

Mitigation measures to reduce the landscape and visual impacts of the road and turbine platforms include:

(i) Alignment

- Within the 'golf course' area, align the road through the pasture 'fairways' as much as possible.
- Where the road crosses over pavement, this shall be covered with crushed limestone (CoC 45) to avoid cuts to the limestone pavement.
- In other locations, the road design is to follow the grain of the pavement and the earthworks perimeter is to follow the natural joint patterns wherever possible (see Appendix 2: Rehabilitation of Limestone Pavement). That is to say, where possible, a section of a limestone pavement separated from adjacent sections by a fracture, or a "clint", is to be removed as a whole block of pavement, rather than be cut through. The removed pavement is then to be crushed and used for fill.

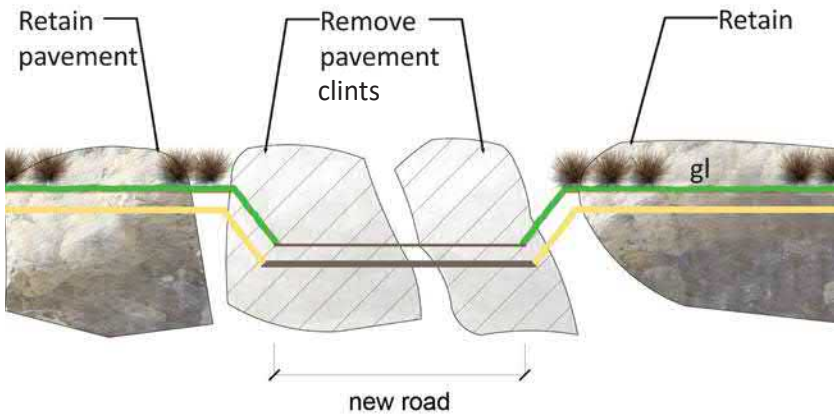


Fig. 53 Limestone pavement, showing clints, section.

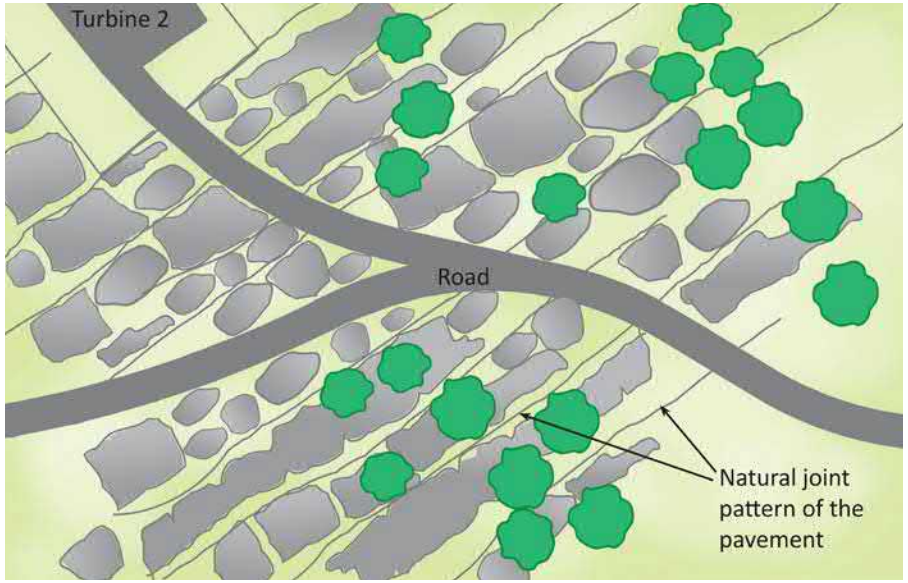


Fig. 54 Turbine 2. Limestone pavement solutions, plan view.

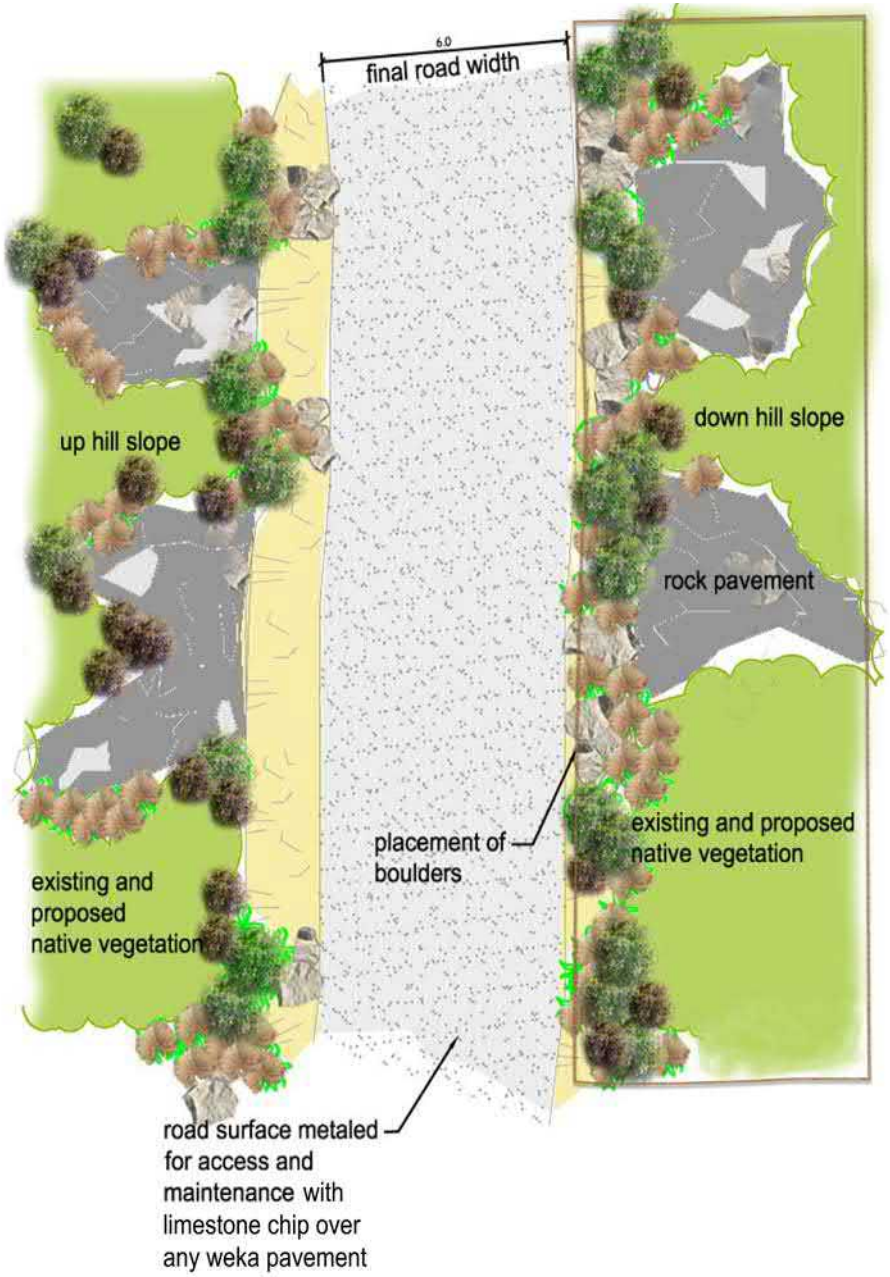


Fig. 55 Limestone pavement.

(ii) **Strip the grassland** and cut the vegetation and stockpile until the road alignment is constructed.

(iii) **Shape the organic matter** into low mounds that relate to the existing landform.

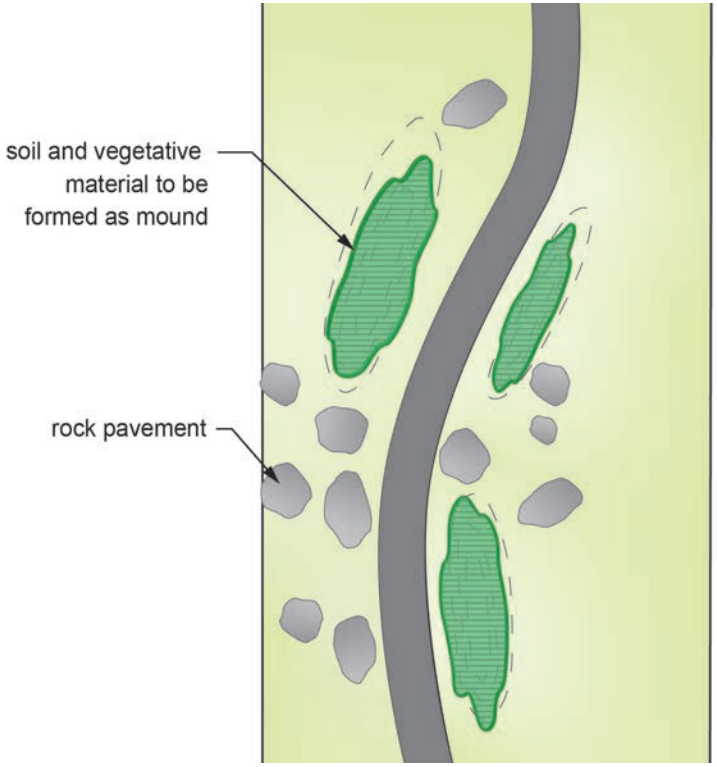


Fig. 56 Limestone pavement with shaped mounds.

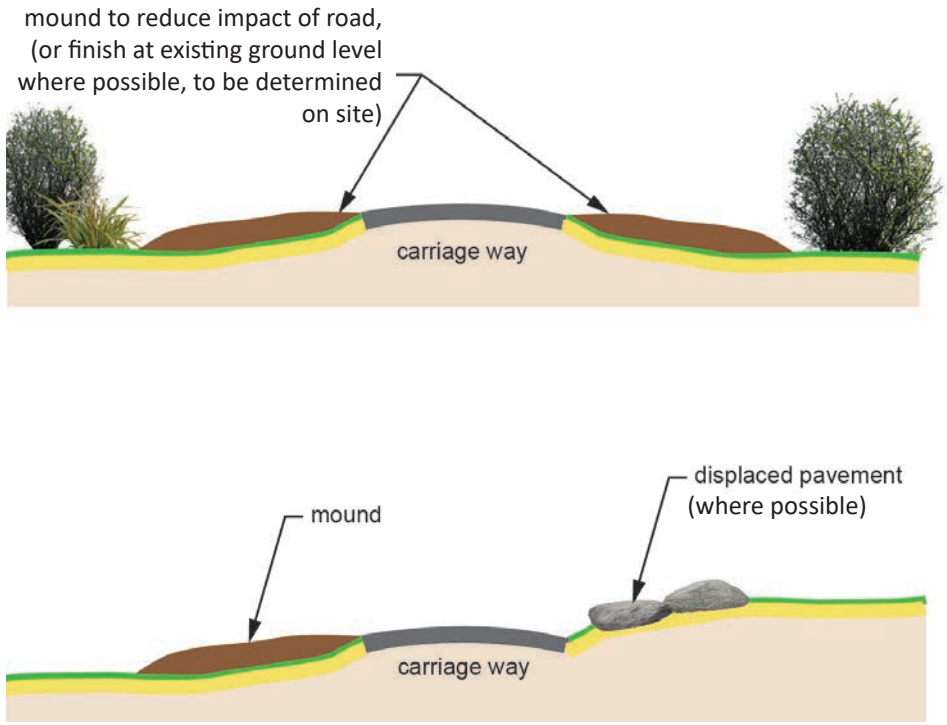


Fig. 57 Limestone pavement with shaped mounds.

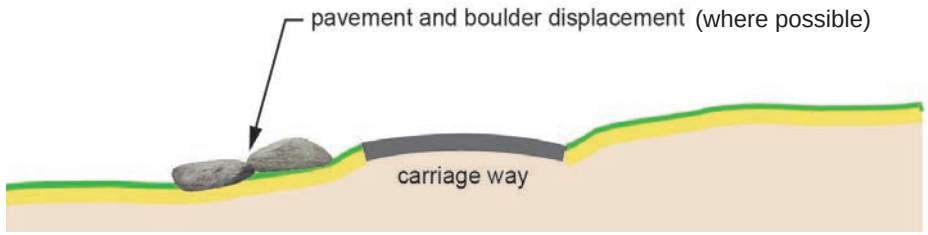


Fig. 58 Pavement boulder displacement where this is possible, otherwise the displaced pavement is to be crushed and used for fill.

(iv) Slope Finish

- Within the Weka limestone dip slope there will be up to 9 m cuts. These are to be treated as a series of benches, with a rough surface texture, as shown in Figure 60. 1) The bench spacing is to be determined by the bedding planes in the rock, with the width and spacing to be determined in the design phase. Noting that as per CoC 33. a. iv, in the turbine cuts the skyline is not allowed to be broken, which may limit the width available for benching.

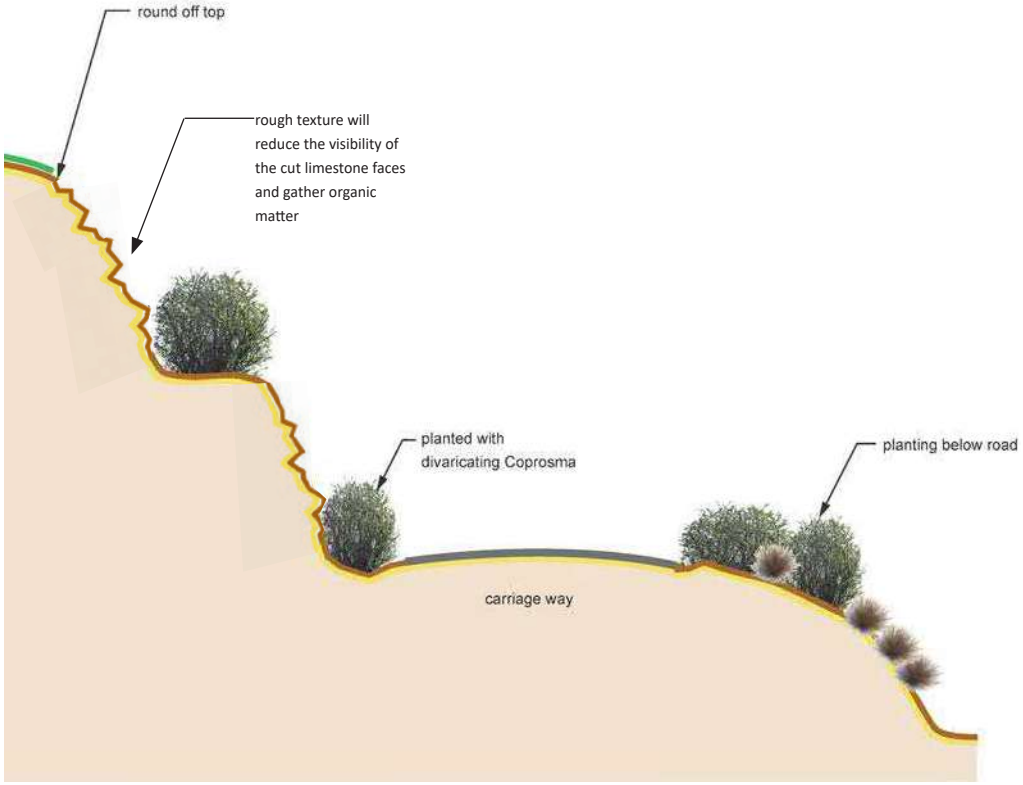


Fig. 59 Planting on terraces and below road.

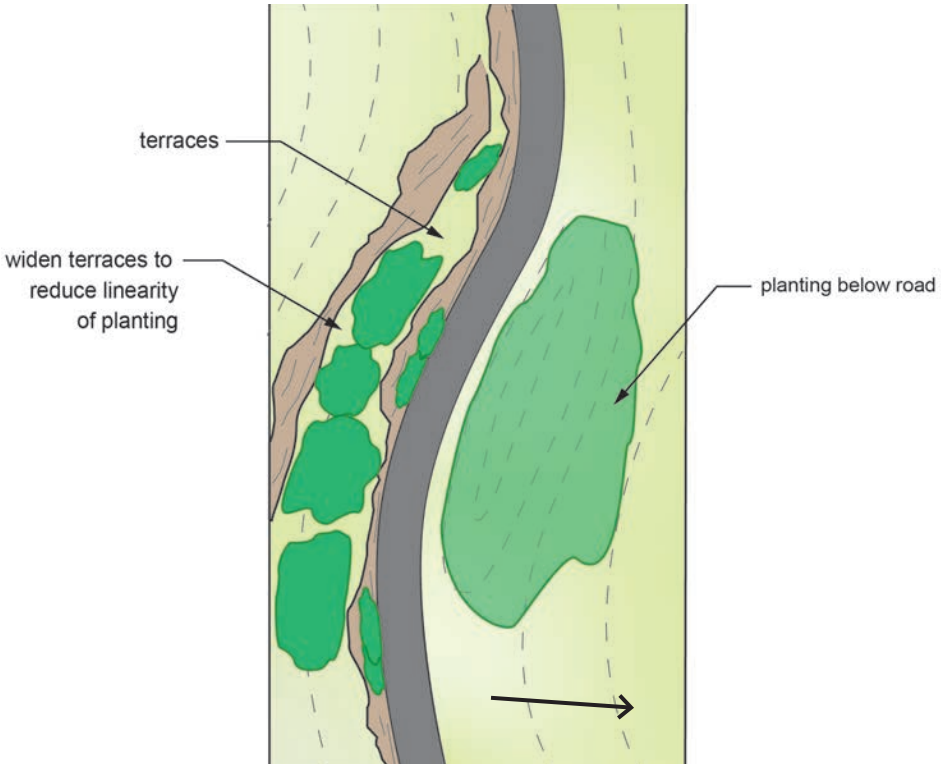


Fig. 60 Widen terraces to reduce linearity of planting.

(v) Limestone Treatment

Another possiblilty to mitigate the visual effects of the limestone cuts, is a method already used on limestone rock work at Broken River, Canterbury. This is using the application of a 5% solution of black oxide, washed over the limestone areas.

it is important that the percentage of oxide is to be no higher than 5%, as if there is a much higher concentration of black oxide in the solution, then the resultant colour will appear unnatural.

2.7 Ancillary Activities

2.7.1 Description

Ancillary activities include other elements of the windfarm such as disposal areas, batching plant sites, loading areas and turbine platforms. These are located along the access road and in grassland areas.

2.7.2 Characteristics of the landscape

Characteristics of the landscape and visual impacts include the long term incongruity of disposal areas, batching plants and loading areas in the landscape. The areas will be returned to a natural appearance.

2.7.3 Relevant conditions of consent

57. Each spoil site shall be stabilised and planted over including being grassed (non-invasive species) or re-vegetated with silver tussock to no less than 20% cover, as soon as practicable after it has been fully utilised, in order to prevent scour and avoid sediment being washed into adjacent watercourses. Stabilisation may be staged, and stabilised areas diverted to a clean water diversion, to maintain a suitably small working catchment area.

60. Prior to undertaking any construction activities, the Consent Holder shall engage a suitable qualified and experienced ecologist to undertake a survey of the vegetation in the areas which are to be disturbed for construction purposes as detailed in condition [61]. The results of this survey shall be provided to the Hurunui District Council.

61. Site areas disturbed for pre-construction geotechnical investigations and construction purposes, but not necessary for the ongoing wind farm operation, being the concrete batching area, laydown areas, spoil disposal areas, road batters, and parts of turbine platforms, shall be rehabilitated progressively, and in any event within 12 months of the completion of construction in accordance with the Construction Management Plan. The objective shall be to rehabilitate those areas to a similar condition to the condition identified in the pre-construction survey required by condition [60], or as otherwise agreed with the Hurunui District Council.

The sites for disposal areas have been chosen where there is a large and flat area available and good access. However, the details of the shape of the disposal area and how it fits into the landscape is important as well as the type of cover.

2.7.3 Relevant conditions of consent (continued)

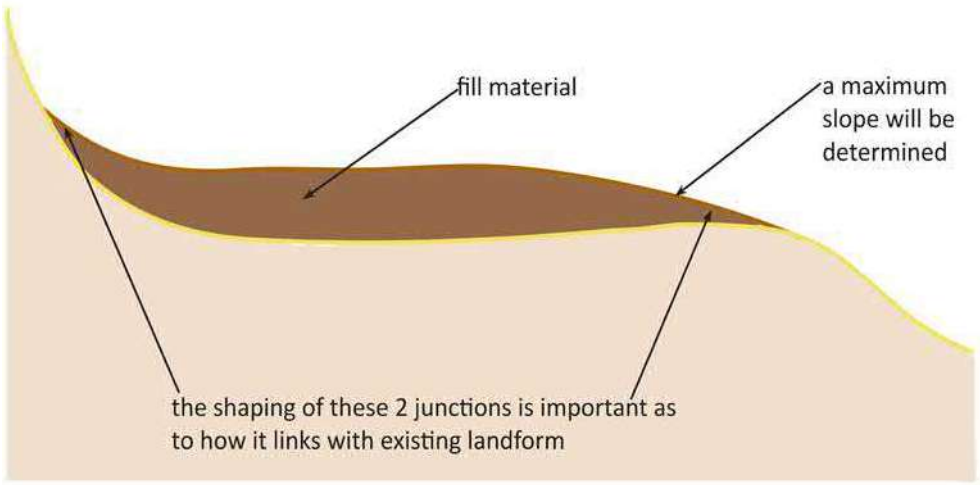


Figure 61 Where it is a pasture or tussock area, then the disposal mound is to be planted with the same ground cover. See 2.0.

2.7.4 Effects of the activities in this landscape

The impact of these activities in generally exposed grassland landscapes will result in pattern and colour changes. These changes are to be lessened by removal of objects and regrading cuts, fills and slopes, oversowing and revegetation.

2.7.5 Mitigation Measures

Once the construction has been completed, the various batching, stockpiles and loading areas require rehabilitation. The aim is that this shall take various forms:

- Removal of all hard material and cut vegetation.
- Contouring the ground.
- Spreading of topsoil.
- Oversowing with a seed mix of short rye and fescue.
- Fencing off planted areas.
- Where scars have been left, planting of native vegetation is required.

2.7.5 Mitigation Measures (continued)

Following the completion of the turbine construction, the gravel pad, except for an access way to the turbine, shall be removed, the ground scarified and soil placed onto this area. A few areas adjacent to existing bush areas will have part of the platform rehabilitated for native shrubs to be planted.

Appendices

Appendix 1: Revegetation

Appendix 2: Rehabilitation of Limestone Pavement

Appendix 1: Revegetation

1.1 Relevant conditions of consent include

Rehabilitation of disturbed areas

60. Prior to undertaking any construction activities, the Consent Holder shall engage a suitable qualified and experienced ecologist to undertake a survey of the vegetation in the areas which are to be disturbed for construction purposes as detailed in condition [61]. The results of this survey shall be provided to the Hurunui District Council.

61. Site areas disturbed for pre-construction geotechnical investigations and construction purposes, but not necessary for the ongoing wind farm operation, being the concrete batching area, laydown areas, spoil disposal areas, road batters, and parts of turbine platforms, shall be rehabilitated progressively, and in any event within 12 months of the completion of construction in accordance with the Construction Management Plan. The objective shall be to rehabilitate those areas to a similar condition to the condition identified in the pre-construction survey required by condition [60], or as otherwise agreed with the Hurunui District Council.

Planting for mitigation and remediation of cut and fill batters

108. Other than on cut limestone faces, cut and fill surfaces shall be rehabilitated in accordance with condition [61].

109. Locations for the establishment of woody plants and silver tussock within the wind farm site for visual mitigation shall be determined through consultation between landscape and ecology experts nominated by Hurunui District Council and the Consent Holder. The location of mitigation planting shall take into account the effects arising as a consequence of visibility from important public viewpoints agreed upon by the landscape experts.

1.2 Revegetation

> *110. The pattern of plantings undertaken for visual mitigation and remediation shall reflect natural patterns of plant distribution and association, as illustrated in the site landscape pattern book (see condition [102]).*
>
> *111. The use of plants for mitigation and remediation of visual and landscape effects associated with cut and fill excavations shall be subject to conditions specified for habitat enhancement, ecological restoration and weed management."*

Rehabilitation measures necessary to reduce landscape and visual impacts associated with roads, turbine platforms, building sites and disposal pits, to reinforce existing stands of vegetation, and to enhance the general amenity, shall take the form of:

- Broadleaf planting
- Tussock planting.
- Over-sowing with grass seed .
- Hydroseeding with grass seed (south side only).

Hydroseeding with native seeds and cuttings, and direct transfer of tussocks was not considered appropriate on the northern slopes given the drought like conditions on Mt Cass, but is to be considered on the moister southern slopes.

Planting will be undertaken according to the current patterns that exist, and all plantingis to be securely fenced from grazing stock and protected from rabbits and hares. Deer and goats are to be removed from the area. The fencing includes a farm fence with chicken wire for hare and rabbit control or plants individually protected.

Plants will be propagated by Mt Cass Wind Farm Ltd at least 18 months ahead of planting season.

1.3 Location of Mitigation Re-vegetation

1.3.1 Relevant conditions of consent include

> *109. The location of mitigation planting shall take into account the effects arising as a consequence of visibility from important public viewpoints agreed upon by the landscape experts.*

There are certain areas in the landscape where the roads and turbines will be more visible from locations off site. This is due both to the type of landscape in these areas, as well as the extent and nature of works required for the installation of the turbines. These areas are key areas for focussing mitigation planting treatment.

These key areas are graded in terms of visual impact into high, medium and low impact and shown on the Visibility Map in Section 1.5. In areas where the impact is most high, there is to be more targeted mitigation planting in order to lessen the visual impact for those off site.

1.4 Types of Vegetation

Fig. 62 Escarpment boulderfield vegetation.

Fig. 63 Dip slope vegetation.

Fig. 64 Tussock Land Vegetation.

Fig. 65 Limestone Pavement Vegetation.

1.5 Broadleaf Planting

The vegetation of the Mt Cass ridgeline comprises a complex mosaic of mixed angiosperm forest remnants, regenerating divaricating shrubland communities and grasslands.

1.5.1 Vegetation Communities

1. Pasture and tussock grassland (*Poa cita*)
2. Grey shrubland (mingi mingi)
3. Forest scrub (mingi mingi, five finger, kohuhu)
4. Kowhai forest (kowhai, broadleaf)
5. Mahoe – raukawa- fuchsia forest
6. Broadleaf forest (broadleaf, five finger)
7. Mahoe – Broadleaf forest (broadleaf, lemonwood)
8. Mahoe – kaikomako- ribbonwood forest
9. Totara forest (totara, fivefinger, mahoe)
10. Totara - kowhai forest (totara, matai,kowhai, mahoe)
11. Matagouri shrubland

Suitable plant species are to be propagated from the site and Tiromoana Bush area and include:

Species	Southern Slope	Ridge and Crest
Griselinia littoralis	✓	✓
Coprosma crassifolia		✓
Coprosma propinqua		✓
Coprosma virescens	✓	✓
Coprosma robusta	✓	
Pittosporum tenuifolium	✓	
Hebe salicifolia	✓	
Sophora microphylla	✓	
Pittosporum eugenioides	✓	
Plagianthus regius	✓	
Myoporum laetum	✓	
Olearia avicenniaefolia		✓
Poa cita		✓
Podocarpus totara		✓

The planting shall take place on cuts and fills of the road alignment, crevices and ledges where the planting pockets are large enough, ramp roads, open ground where broadleaf species are found adjacent to the site, adjacent to limestone pavement (turbines 8-10).

1.6 Tussock Grassland

1.6.1 Relevant Conditions of Consent Include

92. Where silver tussock is disturbed for pre-construction geotechnical investigations or construction purposes, but not necessary for the ongoing wind farm operation it shall be rehabilitated in accordance with condition [61] Rehabilitation of the area shall be to the standard identified in the preconstruction survey.

93. Where areas of silver tussock of a median greater than 10% density as identified on Golders Associates Plan CG241 dated 17 November 2010 are permanently removed as a result of wind farm development, an equivalent quantity of silver tussock shall be established and maintained on the wind farm site using direct vegetation transfer, planting, or other appropriate method."

Silver Tussock planting will be undertaken where roading alignments and turbine platforms will create impacts and disturb the existing tussock cover. This occurs more at turbine 3 and the associated road, NTR adjacent to turbines A12, 17, 18 and 19.

Silver Tussock planting is to be undertaken where roading alignments and turbine platforms will create impacts and disturb the existing tussock cover. This occurs more at turbine 3 and the associated road, NTR adjacent to turbines A12, 17, 18 and 19.

1.6.2 Effects of Activities in this Landscape

Hydroseeding is to occur on the moister southern sites. Hydroseeding with NZ Browntop, fescue and ryegrass seed is to be applied to cuts as a wet mix comprising soil, cow manure at a ratio of 2:1 with seeds and a wetting and bonding agent. The aim is that this occurs occur on the ramp road cuts.

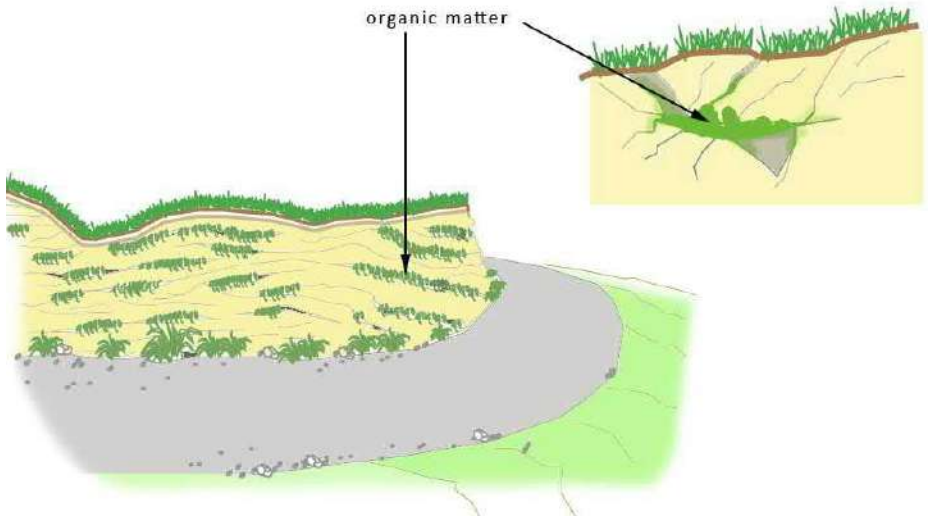


Fig. 66 Hydroseeding of cuts on the moister southern sites.

1.7 Over-sowing

Over-sowing of the batter slopes will take place in the existing pasture areas on the SAR and NTR (turbine A1, below A5, A6, A7, A8, A9, A10, A11, A12 and A13, A20, A21, A22).

Over-sowing shall also occur elsewhere on the ramp roads, especially on gentle batter slopes of less than 1v:3h surrounded by existing pasture. The sites will be graded, top soiled and over-sown with a grass seed mix of short rye, Fescue and NZ Browntop.

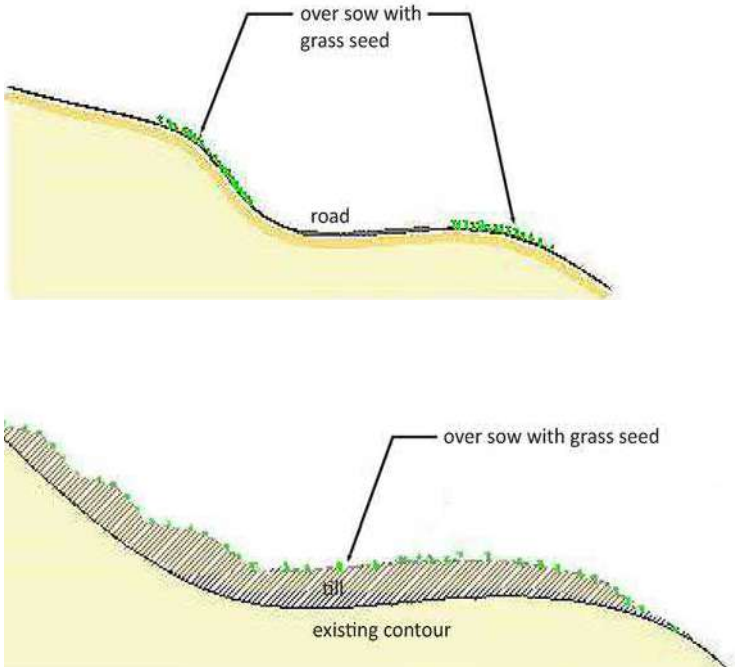


Fig. 67 Oversowing of grass seed

1.8 Livestock and Pest Management

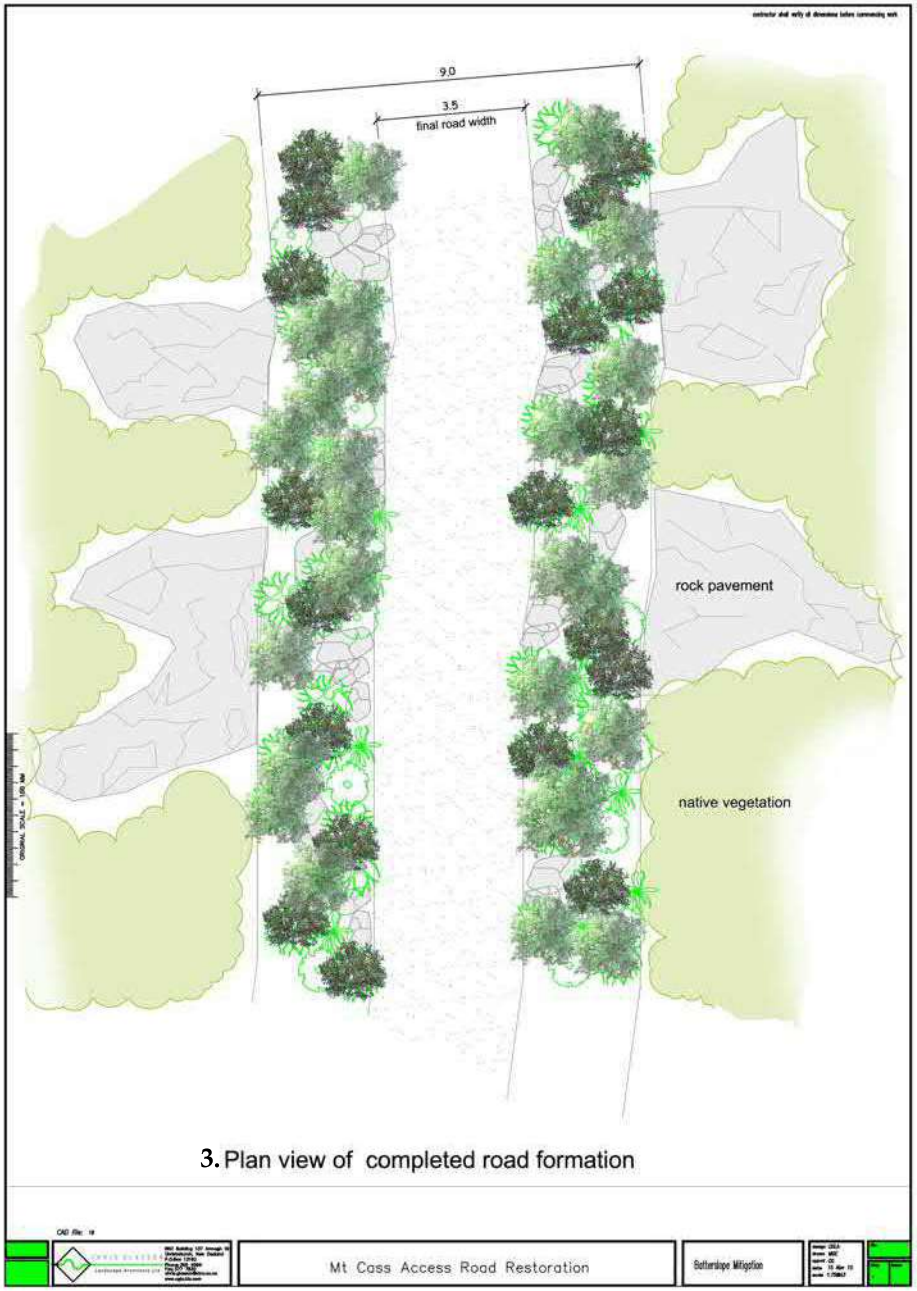
All areas of new planting require livestock and pest removal. This includes cattle and sheep grazing, deer, goats, pigs, possums, stoats, rabbits and hares.

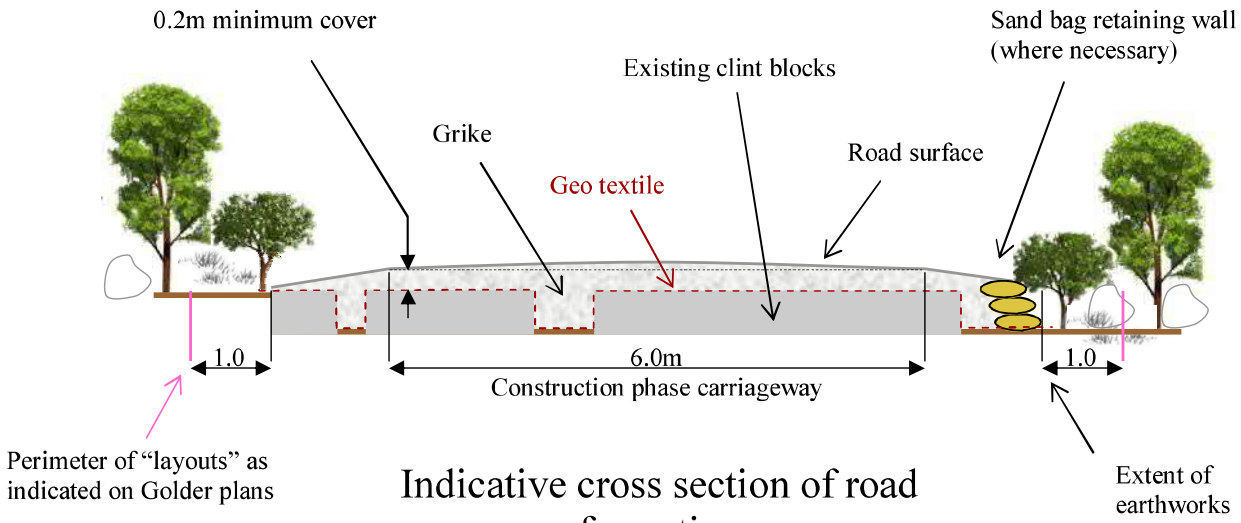
Appropriate fencing and combi guards shall exclude such animals and pests, and this is to include a farm fence with chicken mesh covering the wires as well as burying the mesh footing to prevent burrowing pests.

Appendix 2: Rehabilitation of Limestone Pavement

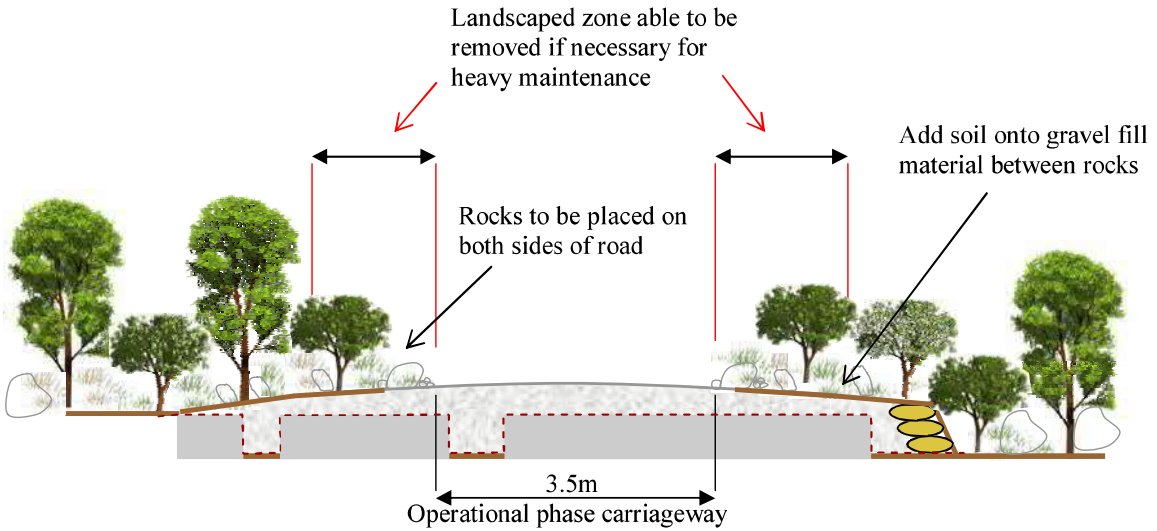
2.1 Rehabilitation of Limestone Pavement

The following sheets are from the consent hearing, Appendix 3 to Conditions, showing the treatment of limestone pavement and rehabilitation.



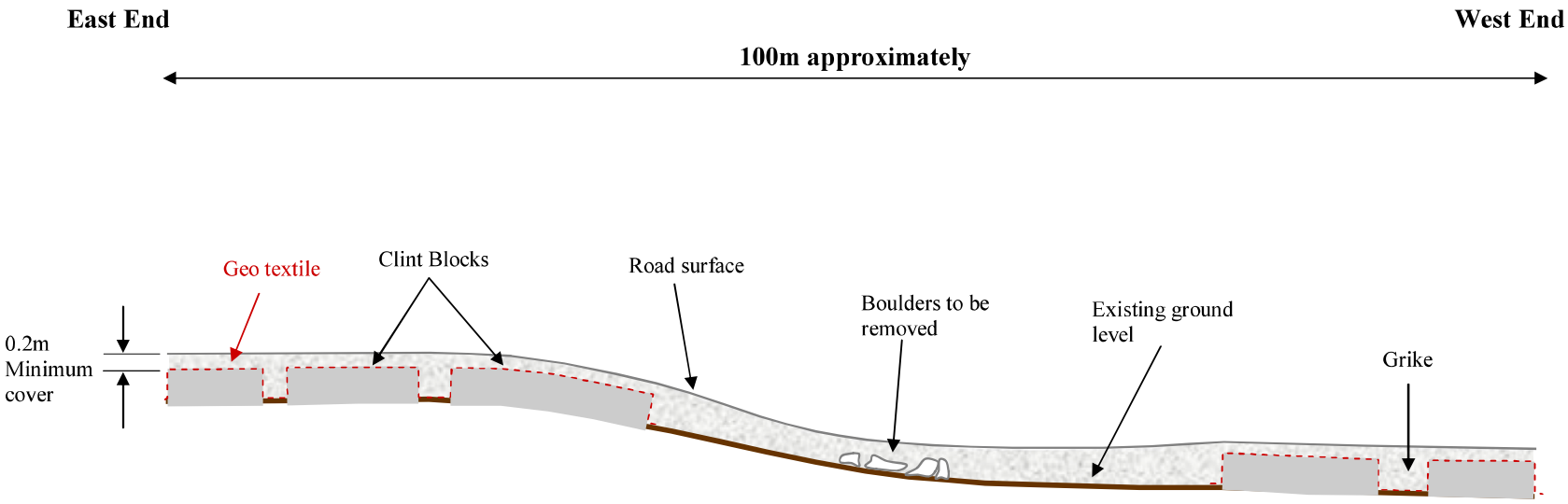


Indicative cross section of road formation



Indicative cross section of completed road formation and mitigation measures

Road crossing over limestone pavement between location 800 to 950



Indicative long-section of road formation

Long-section showing road crossing over limestone pavement between station 800 to 950

24 July 2011

GLASSON HUXTABLE
LANDSCAPE ARCHITECTS

P.O. Box 13162, Christchurch 8141

Phone:(03) 365 4599

Email: info@ghla.co.nz

www.ghla.co.nz

APPENDIX B – Landscape Rehabilitation Plans

ISO A1 594mm x 841mm

AECOM

CONSULTANT

AECOM New Zealand Ltd.
NZ.B.N 942 903 209 1335
www.aecom.com

PROJECT

MT CASS
WIND FARM
EARLY WORKS
DESIGN

CLIENT

Mt Cass Wind Farm

172 Fernside Road, RD1
Kaiapoi 7691

PRELIMINARY

0 31.25 62.5 m

1:1250 (A1) / 1:2500 (A3)

PROJECT MANAGEMENT INITIALS

PM	DA	NB
DESIGNER	CHECKED	APPROVED

PROJECT DATA

DATUM	NZVD2016	SURVEY	NZTM2000

ISSUE/REVISION

I/R	DATE	DESCRIPTION
C	3/03/2020	DESIGN UPDATE
B	3/11/2020	EXPERT PANEL REVIEW
A	16/10/2020	PRELIMINARY DESIGN

PROJECT NUMBER

60642250

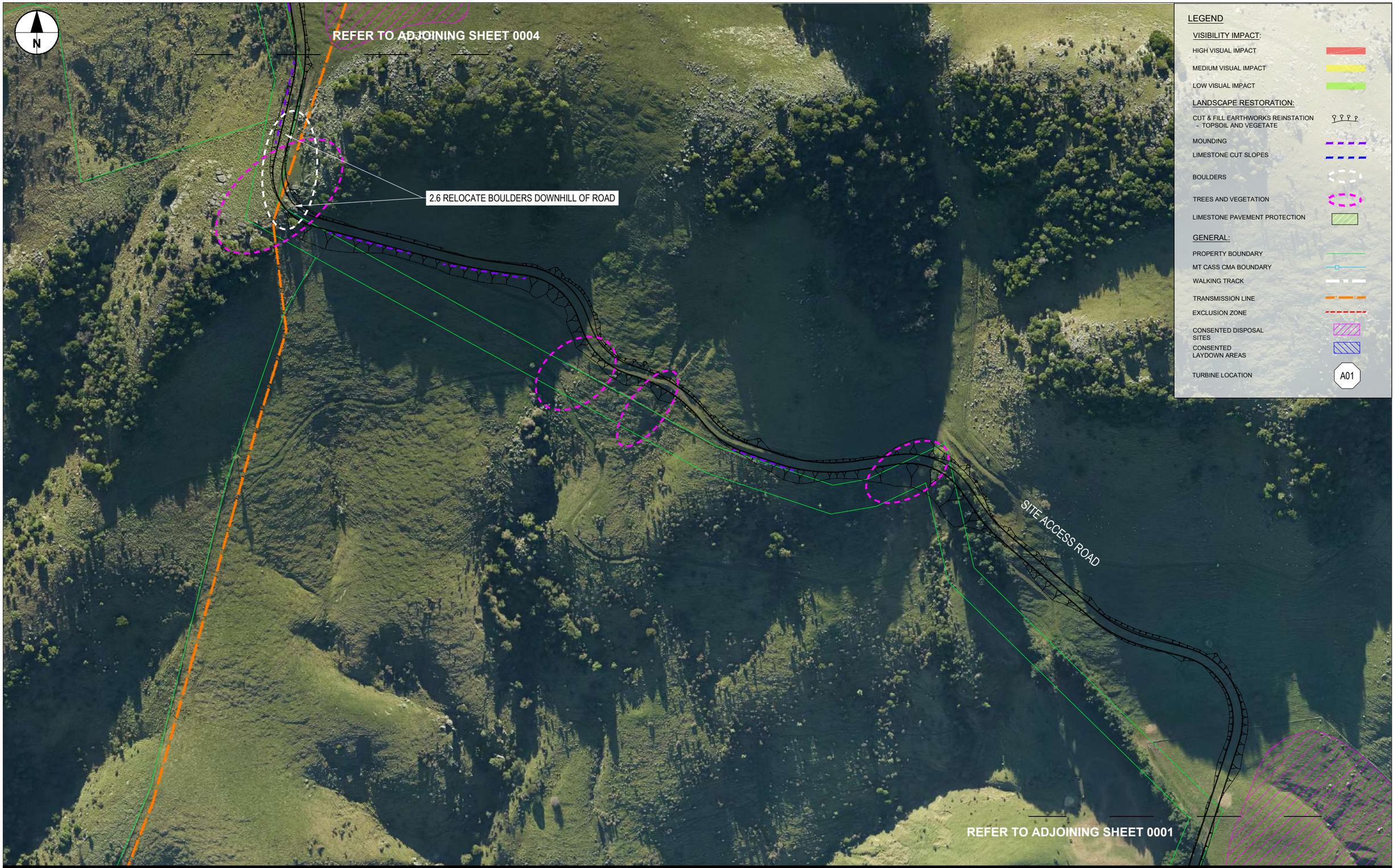
SHEET TITLE

EARTHWORKS
LANDSCAPE REHABILITATION
SHEET 1 OF 12

SHEET NUMBER

CI-0001

ISO A1 594mm x 841mm



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I/R	DATE	DESCRIPTION

PROJECT NUMBER

60642250

SHEET TITLE

EARTHWORKS
LANDSCAPE REHABILITATION
SHEET 2 OF 12

SHEET NUMBER

CI-0002