Before the Central Otago District Council Hearing Panel

Under	the Resource Management Act 1991
In the matter of	Plan Change 19 to the Central Otago District Plan - Hearings Panel Minute 1 – 69 Hall Road site

Statement of evidence of Dr Reece Hill on behalf of Steve Davies

16 May 2023

Introduction

1 My full name is Dr Reece Blackburn Hill.

2 I hold a Doctor of Philosophy in Soil Science from Lincoln University (2000), a Master of Applied Science in Soil Science from Lincoln University (1994), and a Bachelor of Science with a double major in Biological Sciences and Earth Sciences from University of Waikato (1988).

3 I am a past President of the New Zealand Society of Soil Science (2014-2016), and a current member of the New Zealand Society of Soil Science, New Zealand Association of Resource Management, and the New Zealand Institute of Agricultural & Horticultural Science.

4 I have 19 years' experience as a Soil Scientist at Waikato Regional Council, six years' experience as a Soil Consultant at Landsystems, of which I have been full time for the past three years, and three years' experience mapping forest soils in Tasmania.

5 I specialise in soil characterisation, soil mapping, land use capability assessment, regional soil policy, soil quality and catchment and land management. I have applied these skills in numerous projects within Waikato Regional Council and Landsystems, working with individual landowners including farmers and growers, regional and district council staff, Crown Research Organisations, Universities, and Ministry staff (MPI and MfE).

6 I was lead reviewer for the Ministry for the Environment review of national soil quality monitoring and indicators and established the soil quality monitoring programmes for Waikato Regional Council and Nelson City Council. I was lead author of the soil quality monitoring chapter of "Land and Soil Monitoring: A guide for SOE and regional council reporting".

7 I have advised central government and district and regional councils throughout New Zealand in relation to soil management, land use capability, high class soils and the use of soil map information. This included regional council representation on the Land Use Capability Classification System (LUCCS) Governance Group.

8 I have undertaken property scale soil and Land Use Capability (LUC) assessments to identify high class soils for subdivision applications in the Waikato, Auckland, Bay of Plenty, Marlborough and Otago regions.

9 As part of my role at Waikato Regional Council, I was Lead Technical Writer for the Soils chapter (Chapter 14) of the Waikato Regional Policy Statement

which became operative in 2016. Chapter 14 included a policy on High Class Soils (Policy 14.2).

10 In 2020, I provided technical soil expertise to support The Waikato District Plan (Stage 1) review, with my main input focussing on Subdivision Rules and high class soils.

11 In 2021, I provided a review of the Productive Land Classification for Tasman District Council.

12 I have undertaken soil and Land Use Capability (LUC) assessments for subdivision that have required assessment against the NPS-HPL.

Scope of evidence

13 My evidence covers matters relating to the soils, Land Use Capability and highly productive land as defined by the NPS-HPL on a 3.64 hectare site at 69 Hall Road, Bannockburn 9384 (Site).

14 In preparing this evidence, I have reviewed the following reports and statements:

(a) Available regional scale soil and LUC map information.

(b) Land Use Capability Survey Handbook (3rd Edition).

(c) Available aerial photography of the Site.

(d) An image of a soil profile from the Doctors Flat Vineyard.

(e) A contour map of the Site.

(f) Archaeological reports for the Site.

(g) Soil observation photos of the Site.

15 I have prepared this evidence in relation to:

(a) Land Use Capability Classification system definitions,

(b) the Land Use Capability classification of the Site, and

(c) assessment against the National Policy Statement for Highly Productive Land.

16 I have not undertaken a field assessment of the Site. My evidence is based on a desktop analysis of available LUC map information, interpretation of

aerial photography, a detailed contour map, archaeological reports, and on-site soil observation photos for the Site prepared under my direction.

Executive summary

17 My evidence is based on a desktop analysis of NZLRI LUC map information as it relates to the Site, a detailed contour map of the Site, images from archaeological reports covering the Site, interpretation of aerial photography, and on-site soil observation photos for the Site obtained by Mr Woodward and Mr Davies under my direction.

18 In my evidence I compare the LUC map units indicated by the NZLRI soil and LUC map information with an assessment of the current on-site soils and land for the Site. My assessment includes a map of the estimated LUC present in the subject area in its current state.

19 The NZLRI LUC map information indicates the presence of LUC map units 7s9+4e9 and 3s6+4e9 on the Site. My interpretation of the available NZLRI LUC map information and GrowOtago® soil information is that the LUC 3s6+4e9 map unit is characterised by shallow Waenga soils or moderately deep Manuherikia soils, located on flat to gently undulating slopes associated with alluvial terraces.

20 Based on my analysis of a detailed contour map for the Site, in combination with Google Earth imagery and on-site photos, it is clear that the northern part of the Site classified as LUC 3s6+4e9 in the NZLRI contains slopes greater than 15 degrees. This does not align with description of LUC 3s6 land in the NZLRI. Furthermore, the Land Use Capability Survey Handbook[1] provides that slopes of this gradient is not LUC class 3 land. I consider that part of these slopes are more properly classified as LUC 7s9+4e9 land.

21 The on-site soil observation photos, available images and slope measurements indicates an NZLRI LUC 3s6+4e9 area with shallow to very shallow soils on rolling slopes and areas of historic soil disturbance. I consider this area to be more properly classified as LUC class 4s and non-productive land.

22 The on-site soil observation photos in combination with aerial photography indicates that the NZLRI LUC 3s6+4e9 area in the south of the Site consists of a reinstated soil (Anthropic Soil) over a truncated gravel surface. The soil

[1] p56-58; Lynn, IH, Manderson, AK, Harmsworth, GR, Eyles, GO, Douglas, GB, Mackay, AD, Newsome PJF. 2009. Land Use Capability Handbook - a New Zealand handbook for the classification of land 3rd Ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science 163pp.

is shallow to very shallow and derived from mixed topsoil. As such, this the area is more correctly classified as LUC class 4s land.

23 Land that is LUC class 4 or greater is not defined as ‘highly productive land’ for the purposes of applying the National Policy Statement for Highly Productive Land (NPS-HPL).

National Policy Statement for Highly Productive Land (NPS-HPL)

24 Aspects of the NPS-HPL that relate to LUC classification are within my expertise.

25 "Highly productive land" is defined in the NPS-HPL as:

> means land that has been mapped in accordance with clause 3.4 and is included in an operative regional policy statement as required by clause 3.5 (but see clause 3.5(7) for what is treated as highly productive land before the maps are included in an operative regional policy statement and clause 3.5(6) for when land is rezoned and therefore ceases to be highly productive land)

26 My understanding is that clause 3.5(7) applies because maps produced in accordance with clause 3.4 have not yet been included in an operative regional policy statement as required by clause 3.5.

27 Clause 3.5(7) states:

> (7) Until a regional policy statement containing maps of highly productive land in the region is operative, each relevant territorial authority and consent authority must apply this National Policy Statement as if references to highly productive land were references to land that, at the commencement date:
>
> (a) is
>
> (i) zoned general rural or rural production; and
>
> (ii) LUC 1, 2, or 3 land; but
>
> (b) is not:
>
> (i) identified for future urban development; or
>
> (ii) subject to a Council initiated, or an adopted, notified plan change to rezone it from general rural or rural production to urban or rural lifestyle.
>
> "LUC 1, 2 and 3" is defined as:
>
> LUC 1, 2, or 3 land means land identified as Land Use Capability Class 1, 2, or 3, as mapped by the New Zealand Land Resource Inventory or by any more detailed mapping that uses the Land Use Capability classification.

LUC classification system

28 The Land Use Capability Classification (LUC) is a system in use in New Zealand since the 1950s that classifies all of New Zealand's rural land into one of eight classes, based on its physical characteristics and attributes. Class 1 land is the most versatile and can be used for a wide range of land uses. Class 8 land is the least versatile and has many physical limitations: it may be extremely steep, and not generally suitable for arable, pastoral or commercial forestry use.

29 LUC maps are maps created to represent the potential uses of a unit of land and its ability to sustain agricultural production based on an assessment of various indicators such as rock type, soil type, slope, erosion degree and type, vegetation, climate, the effects of past land use, and the potential for erosion. The productive capacity of the land is determined by the physical qualities of the land, soil and environment and its limitations. Limitations include susceptibility to erosion, steepness of slope, susceptibility to flooding, liability to wetness or drought, salinity, depth of soil, soil texture, structure and nutrient supply and climate[2]. Increasing limitations reduce the land's versatility for use.

30 The LUC Classification criteria and their use are defined according to the Land Use Capability Survey Handbook 3rd Edition[3] (Land Use Capability Handbook).

Regional scale LUC map information limitations

31 The LUC Classification can be applied (mapped) at any scale and regional scale LUC map units can differ from those identified at property scale[4]. Property scale mapping is typically mapped at a scale between 1:5,000 and 1:15,000, while catchment and regional maps are mapped at 1:15,000 to 1:50,000 scale. The Land Use Capability Handbook sets out recommended mapping scales for inventory surveys and LUC mapping (p100).

32 Mapping LUC at a property scale can identify different LUC units (and map units) than depicted by regional scale LUC mapping. This is because

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[2] Lynn, IH, Manderson, AK, Harmsworth, GR, Eyles, GO, Douglas, GB, Mackay, AD, Newsome PJF. 2009. Land Use Capability Handbook - a New Zealand handbook for the classification of land 3rd Ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science 163pp.

[3] Lynn, IH, Manderson, AK, Harmsworth, GR, Eyles, GO, Douglas, GB, Mackay, AD, Newsome PJF. 2009. Land Use Capability Handbook - a New Zealand handbook for the classification of land 3rd Ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science 163pp.

[4] Lynn, IH, Manderson, AK, Harmsworth, GR, Eyles, GO, Douglas, GB, Mackay, AD, Newsome PJF. 2009. Land Use Capability Handbook - a New Zealand handbook for the classification of land 3rd Ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science 163pp.

property scale mapping includes more observations compared with regional scale mapping.

33 Soil and LUC maps are usually drawn at a specific scale depending on the smallest area of interest for a particular use and the density of field observations. For example, a 1:5,000 scale map requires on average four observation/ha while a 1:50,000 scale map requires 0.04 observation/ha (four observations per 100 ha). With GIS tools and geospatial databases, it has become easy to manipulate maps, creating the temptation to rescale a map beyond its original scale of collection.

34 For the regional scale LUC map information, map unit boundaries may not align with the topography (slope) and other geographic features (such as rivers).

35 Technology such as high resolution aerial photography (and its interpretation), and detailed contour mapping enable a closer examination of the accuracy of the regional scale LUC map information to identify areas that may not agree with the mapped LUC unit(s).

New Zealand Land Resource Inventory

36 The NZLRI is a multi-factor (soil, slope, and erosion) national land resource database designed for soil conservation, erosion planning and farm management. It comprises mapping units each classified using LUC classification of eight main classes.

37 Between 1971 and 1979, New Zealand was mapped (1st edition) using LUC at a scale of 1:63 360 (1 inch to 1 mile). In the 1980s the maps were adapted to the metric 1:50,000 scale. Several regions[1] were later remapped (2nd edition). The NZLRI LUC maps can be accessed via the Manaaki Whenua Landcare Research LRIS portal[5].

38 The NZLRI mapped LUC unit boundaries do not always align with topography (e.g. slope) and other geographic features (such as rivers). This is primarily because the NZLRI LUC mapping is based on hard copy maps showing 20 metre topography. As noted above, more recent technology enables a much closer examination of the land.

39 For farm-level mapping, soil descriptions from existing soil surveys, reference to the NZLRI, together with detailed field observation of landform and landscape processes, rock type regolith composition, and soil profile characteristics, can be used to delineate soil boundaries appropriate to the

[5] https://lris.scinfo.org.nz/layer/48076-nzlri-land-use-capability-2021/

scale of mapping[6].New Zealand soil manuals and handbooks provide modern standards for describing soil profiles[7], and criteria and standards for classifying soils using the New Zealand Soil Classification system[8].

Anthropic Soils

40 The New Zealand Soil Classification system provides the definition and criteria for Anthropic Soils:

Anthropic Soils are soils that have been made by the direct action of people, including truncation of natural soils by earth-moving equipment, drastic mixing of natural soils so that their original character is lost, or by deposition of thick layers of organic or inorganic material. Anthropic Soils occur in land surfaces that are made by people. Their classification reflects the way in which they were made and the kinds of materials used.

Note that soils that have been drastically disturbed but have been restored to the extent that they will meet the requirements of orders other than Recent Soils or Raw Soils, will not be assigned to Anthropic Soils. For this reason Anthropic soils are placed late in the Key to Orders but before Recent Soils and Raw Soils.

NZLRI LUC units on the Site

41 The regional scale Land Use Capability (LUC) map information available (and relied on) for the Site is provided by the 1:50,000 scale New Land Resource Inventory which can be accessed via the Manaaki Whenua Landcare Research LRIS portal[9].

42 The NZLRI LUC map information indicates that the LUC map units for the site are 3s6+4e9 and 7s9+4e9.

43 The LUC unit 3s6 is characterised by Waenga soils (Waenga shallow sandy loam)[10]. These soils (and the 3s6 LUC unit) are likely to occupy the undulating main terrace topography. In places there can be a thin veneer of loess parent material evident over the gravels.

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[6] p19, Lynn, IH, Manderson, AK, Harmsworth, GR, Eyles, GO, Douglas, GB, Mackay, AD, Newsome PJF. 2009. Land Use Capability Handbook - a New Zealand handbook for the classification of land 3rd Ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science 163pp.

[7] Milne JDG, Clayden B, Singleton P.L, Wilson AD. 1995. Soil Description Handbook. Lincoln, New Zealand, Manaaki Whenua Press. 157p.

[8] Hewitt AE (2010) New Zealand Soil Classification. 3rd ed. Landcare Research Science Series No. 1. Lincoln, Manaaki Whenua Press.

[9] https://lris.scinfo.org.nz/layer/48076-nzlri-land-use-capability-2021/

[10] https://lris.scinfo.org.nz/layer/48076-nzlri-land-use-capability-2021/

44 GrowOtago® soil map information[11] identifies the dominant soil in this area as moderately deep Manuherikia fine sandy loam on flat to gently undulating slopes.

45 The LUC 4e9 unit is common to both LUC units identified for the Site and most likely occupies the rolling slopes (slope class C) of the 3s6+4e9 unit, and the rolling slopes of the 7s9+4e9 unit.

46 The LUC 7s9 unit is represented on mining tailings on undulating to rolling slopes with some soil development[12].

47 The NZLRI map information indicates that the dominant soil associated with the 7s9+4e9 unit is Becks soils (Becks silt loam). These soils are described as being formed in 20-40 cm of loess and alluvium over lacustrine clays and sands to greater than 100 cm[13].

48 GrowOtago® soil map information[14] identifies the dominant soil in this area as shallow sandy German soils, and a sub-dominant very stony loamy sand soil on tailings on undulating slopes.

49 For reference, a photo provided by Mr Davies of a soil profile representing the soils in the vineyard, and most likely representing soils in the LUC 3s6 unit, is provided in Appendix 1.

50 The soil profile shows a mixed A horizon overlying a fine textured yellow brown B horizon (likely formed in loess) over BC and C horizons formed in schist gravels and stones.

On-site assessment

51 In the following parts of my evidence I provide an assessment of LUC classification of the Site using the NZLRI LUC maps, aerial photography from Google Earth (provided in Appendix 2), images from archaeological reports[15] (Appendix 3), a detailed contour map provided by LANDPRO (provided in Appendix 4), and on-site soil observation photos provided by Mr Woodward and Mr Davies under my direction (refer Appendix 5 for photo locations, and Appendix 7 for photos).

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[11] https://maps.orc.govt.nz/OtagoViewer232/?map=a3d75c9e135142e68f4e02b6fb64eaf7

[12] National Water And Soil Conservation Organisation. 1983. The South Island Land Use Capability Extended Legend for the New Zealand Land Resource Inventory (Edition 2). DRAFT 9 (27.1.84).

[13] Leamy ML, Saunders WMH. (1967) Soils and land use in the upper Clutha Valley. Otago. Soil Bureau Bulletin 28. DSIR, Wellington.

[14] https://maps.orc.govt.nz/OtagoViewer232/?map=a3d75c9e135142e68f4e02b6fb64eaf7

[15]

52 As part of my assessment I did not undertake the on-site assessment, However, on-site soil and site observations were made under my direction. These observations in combination with slope measurements and aerial photo interpretation is equivalent to the information I would collect and use to determine the LUC classification for a site.

53 In my opinion, this assessment provides a more detailed representation of the soils and LUC classes present on the Site in its current state than the regional scale NZLRI LUC map.

On-site soils and LUC classification

54 The historic aerial photography (from 2012 to 2022) and images from the archaeological reports for the Site (see Appendix 2 and Appendix 3) indicate that the soil has been extensively modified by the placement of tracks, earthworks, the placement of fill and historic soil disturbance such as the excavation of water races and sluicing tunnels for mining operations.

55 Based on the soil observation photos, available aerial photography, and an archaeological assessment of the Site showing historic mine workings, the Site has had removal or substantial modification of the soil profile. These modified soil areas are classified as Anthropic Soils[16] and in the absence of a well-defined A horizon and subsoil development a Land Use Capability class and unit cannot be assigned. These areas are most appropriately considered non-productive land.

56 The LUC 7s9+4e9 map unit area mapped by the NZLRI map information on the Site is dominated by such earthworks.

57 The southern LUC 3s6+4e9 map unit area mapped by the NZLRI map information on the Site has undergone gravel extraction[17] with the lowered gravel extraction surface being remediated with the placement of 20-30 cm of mixed soil. Based on aerial imagery, this remediation looks to have occurred in 2014.

58 The soil observation photos at locations 1, 2 and 3 (refer Appendix 5 and 7) show the soil profile formed in the reinstated soil following gravel extraction. The soil profiles are characterised by a compact mixed gravelly fine textured poorly defined/developed A horizon of 20-30 cm depth, over a compact truncated surface of gravels and stones.

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[16] Hewitt AE (2010) New Zealand Soil Classification. 3rd ed. Landcare Research Science Series No. 1. Lincoln, Manaaki Whenua Press.

[17] Also confirmed by Mr Davies.

59 Based on the slope measurements for this area (see Appendix 6), the soils are on undulating slopes (B slope class).

60 Although the soil looks to have a weakly developed topsoil (developed since placement in 2014), the soil examples are not characteristic of the Waenga soil indicated by the NZLRI, the Manuherikia soil indicated by GrowOtago®, or the example soil profile for the Doctor's Flat Vineyard.

61 The soil observation photos at locations 9, 10 and 11 show a soil profile with a very shallow (<5 cm) poorly defined gravelly fine textured A horizon (topsoil) over gravels with sparse vegetative cover. Surface gravels are common (see Photo 8 in Appendix 7).

62 Based on the slope measurements for this area (see Appendix 6), the soils are on mostly north facing strongly rolling to steep slopes (D-F slope class).

63 This part of the Site classified as LUC 3s6+4e9 in the NZLRI contains slopes greater than 15 degrees and does not align with description of LUC3s6 land in the NZLRI.

64 The soil observation photos at locations 5, 6, 7 and 8 show a soil profile with a mixed poorly defined gravelly fine textured A horizon (topsoil) over gravels. These soils are not characteristic of the Becks soils indicated by the NZLRI but do resemble the very stony loamy sand soils on tailings. Surface gravels are common (see Photo 7 in Appendix 7).

65 Based on the slope measurements for this area (see Appendix 6), the soils are on rolling slopes (C slope class).

66 The soil observation at location 4, provides an example where no soil is present. This is an example of non-productive land on the site.

67 Based on the on-site soil observations in combination with historic images showing soil modification across the Site and the slope measurements, a revised map of LUC units for the Site in its current state is provided (Appendix 8).

68 The map shows the distribution of three LUC map units identified for the Site, the balance of the site is considered non-productive land.

69 In the revised map provided, the area covering the NZLRI LUC 7s9+4e9 unit is classified as LUC 7s9+4e9 on the strongly rolling to steep slopes and LUC class 4s+non-prodcutive land on the rolling slopes. This map unit extends slightly south of the NZLRI LUC 7s9+4e9 area.

70 The NZLRI LUC 3s6+4e9 area in the north of the Site (excluding the non-productive land area is classified as LUC 7s9+4e9 on the strongly rolling to steep slopes.

71 The remediated soil area within the NZLRI LUC 3s6+4e9 unit is classified as LUC class 4s.

Land productivity

72 Based on the soil observation photos and available aerial photography, the Site comprises a reinstated soil (Anthropic Soils), modified soil areas that do not have a developed soil profile and are considered non-productive land, and very shallow gravelly soils.

73 Although the reinstated Anthropic Soils are considered productive land, the compact shallow topsoil over densely packed gravels are not suitable for cultivation and arable use due to moderate to severe soil depth limitations and are suitable only for pastoral use.

74 In my opinion the productive land (land excluding the non-productive land) on the Site is not suitable for arable use primarily due to limitations of soil depth and low to very low water holding capacity.

NPS highly productive land on the Site

75 Based on the NZLRI map information the Site has LUC units 7s9+4e9 and 3s6+4e9 represented.

76 LUC unit 7s9+4e9 is not considered highly productive land when applying the NPS-HPL, and the LUC unit 3s6+4e9 is considered highly productive land, for the LUC 3s6 land within the map unit.

77 NPS-HPL clause 3.5(7)(a) allows for detailed mapping that uses the Land Use Capability classification.

78 I have used the Land Use Capability classification criteria provided by the Land Use Capability Handbook in combination with interpreted aerial photography, site images and on-site soil observation photos to classify the LUC class(s) for the Site in its current state.

79 In my opinion, this assessment provides a more spatially accurate property scale estimate of the LUC classes present on the Site than the regional scale NZLRI LUC map information.

80 My revised LUC classification for the Site includes areas of non-productive land, an area of LUC class 4s with non-productive land, and an area of reinstated soil classed as LUC 4s.

81 I conclude that the Site in its current state does not include LUC class 1, 2 or 3 land, and is not highly productive land as defined by the NPS-HPL.

Conclusion

82 The regional scale Land Use Capability (LUC) map information available for the Site is provided by the 1:50,000 scale New Land Resource Inventory.

83 The NZLRI LUC map information indicates that the LUC map units for the site are 7s9+4e9 and 3s6+4e9. The 3s6 land within the LUC unit is defined as highly productive land when applying the NPS-HPL. The other LUC units are not considered highly productive land.

84 My assessment based on the interpretation of the available soil related information for the Site indicates that historic and contemporary earthworks that have resulted in removal or modification of the original soil profile.

85 Historic aerial photographs (back to 2012) do not indicate the past presence of soils that would be associated with LUC 3s6 land (as is present on the Doctor's Flat Vineyard).

86 My assessment based on the interpretation of the available soil related information for the Site indicates that the Site is not LUC class 3 land (i.e. not LUC 3s6 as indicated by the NZLRI map information).

87 In my opinion, the Site land in its current state does not contain land that is characteristic of the LUC 3s6 unit and is not highly productive land as defined by the NPS-HPL.

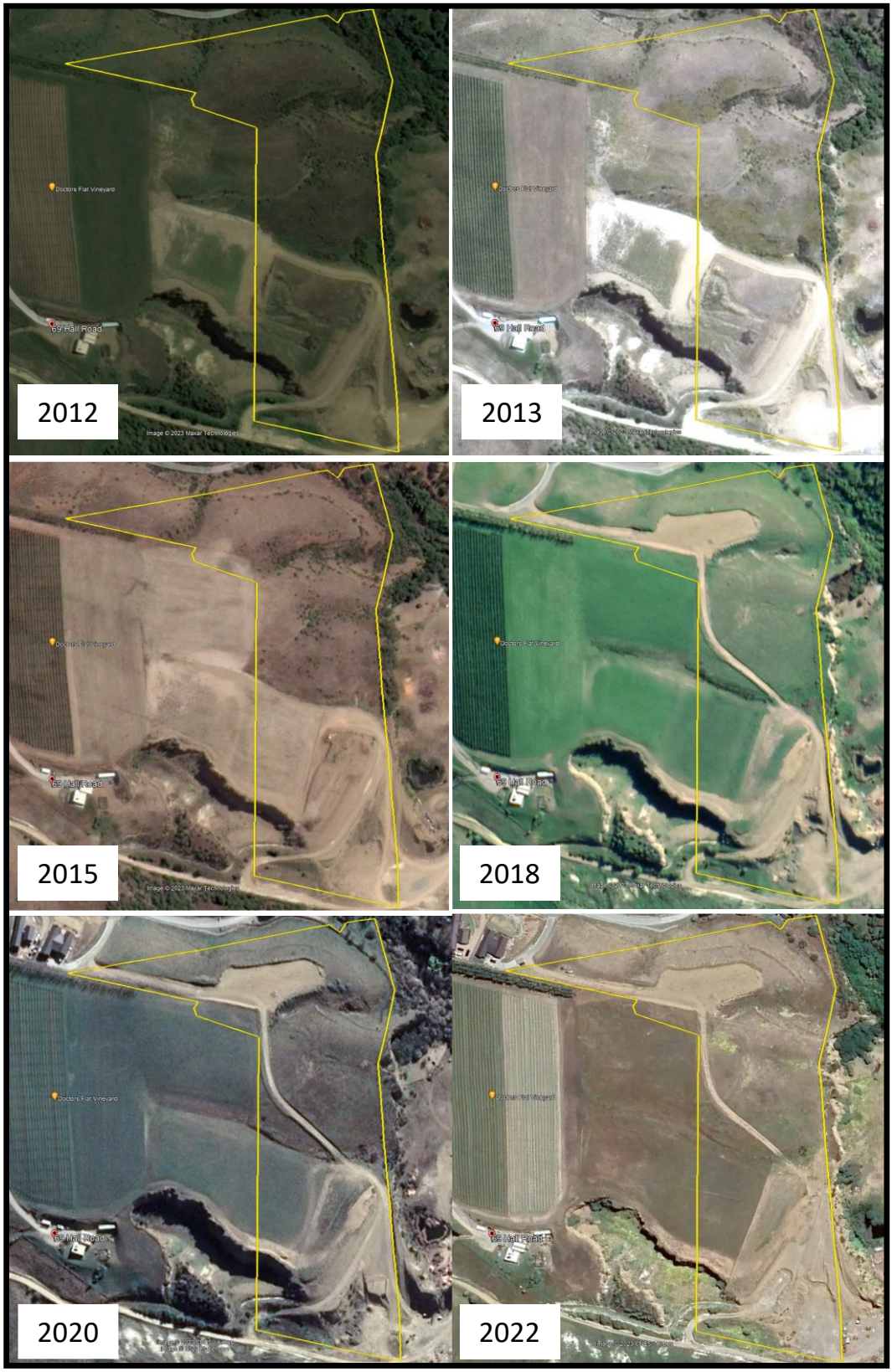
Reece Blackburn Hill

16 May 2022

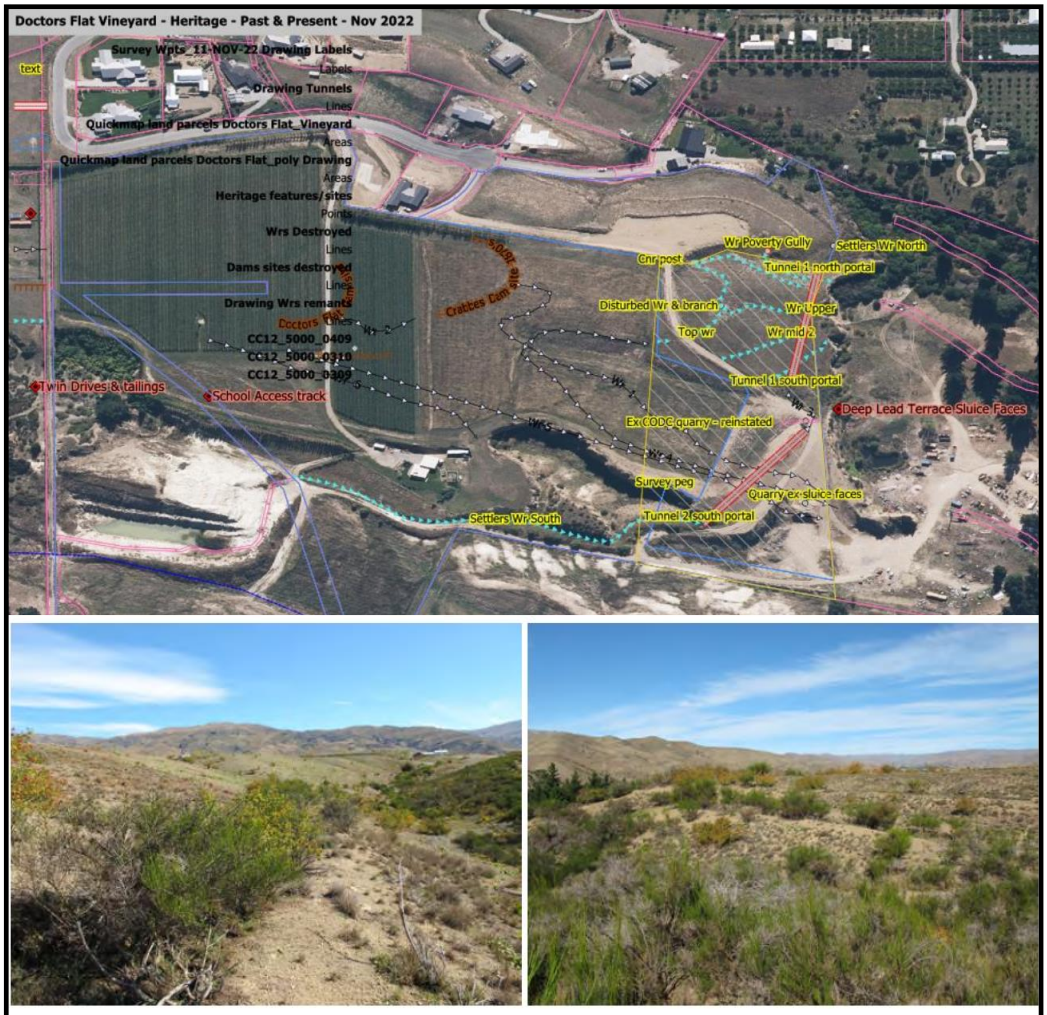
Appendix 1: Example soil profile of NZLRI LUC 3s6 land from the Doctor's Flat Vineyard.

Soil profile on LUC 3s6 land from Doctor's Flat Vineyard

Appendix 2: Aerial photographs 2012 to 2022 (Google Earth).

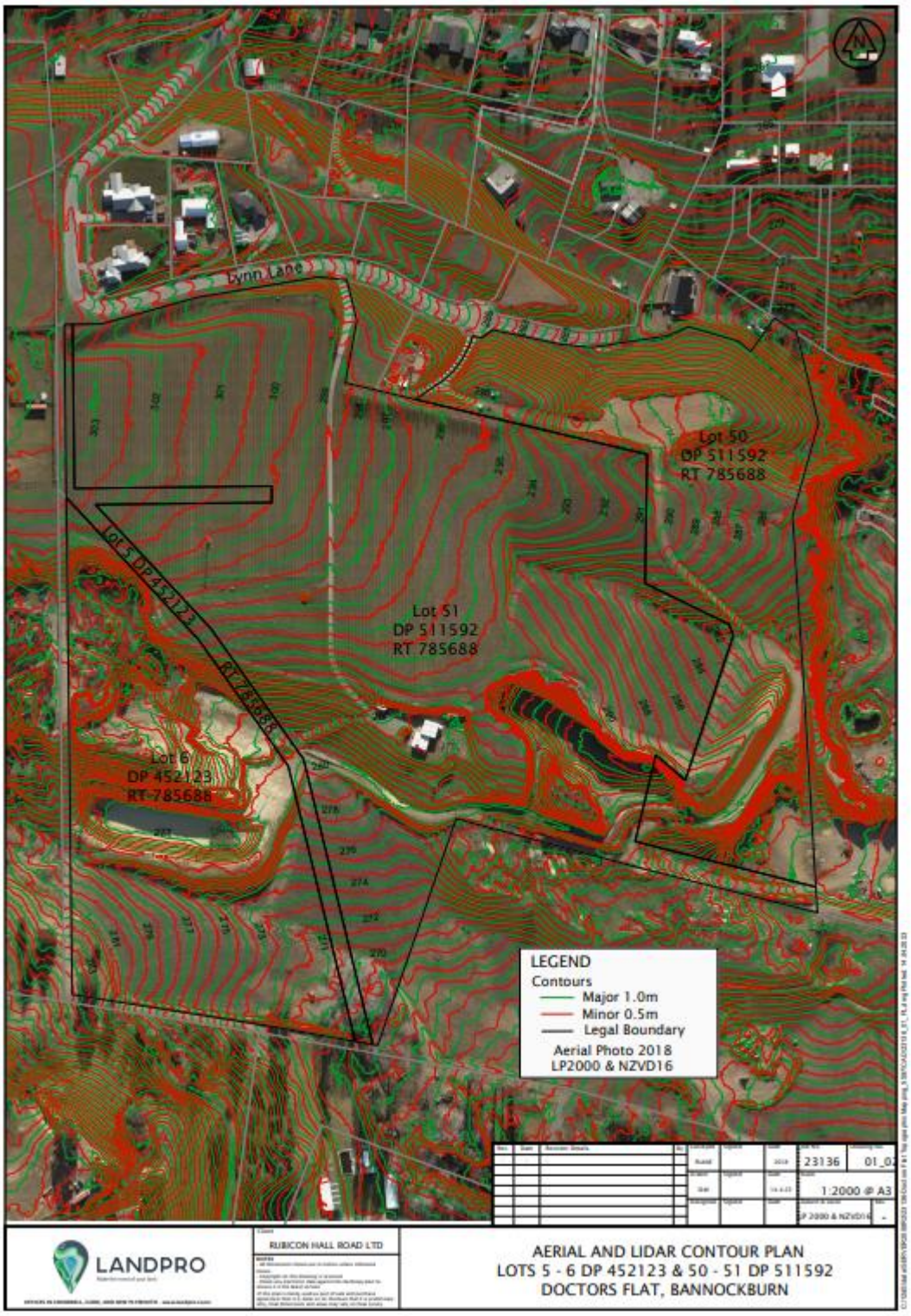


Appendix 3: Site images from archaeological reports.

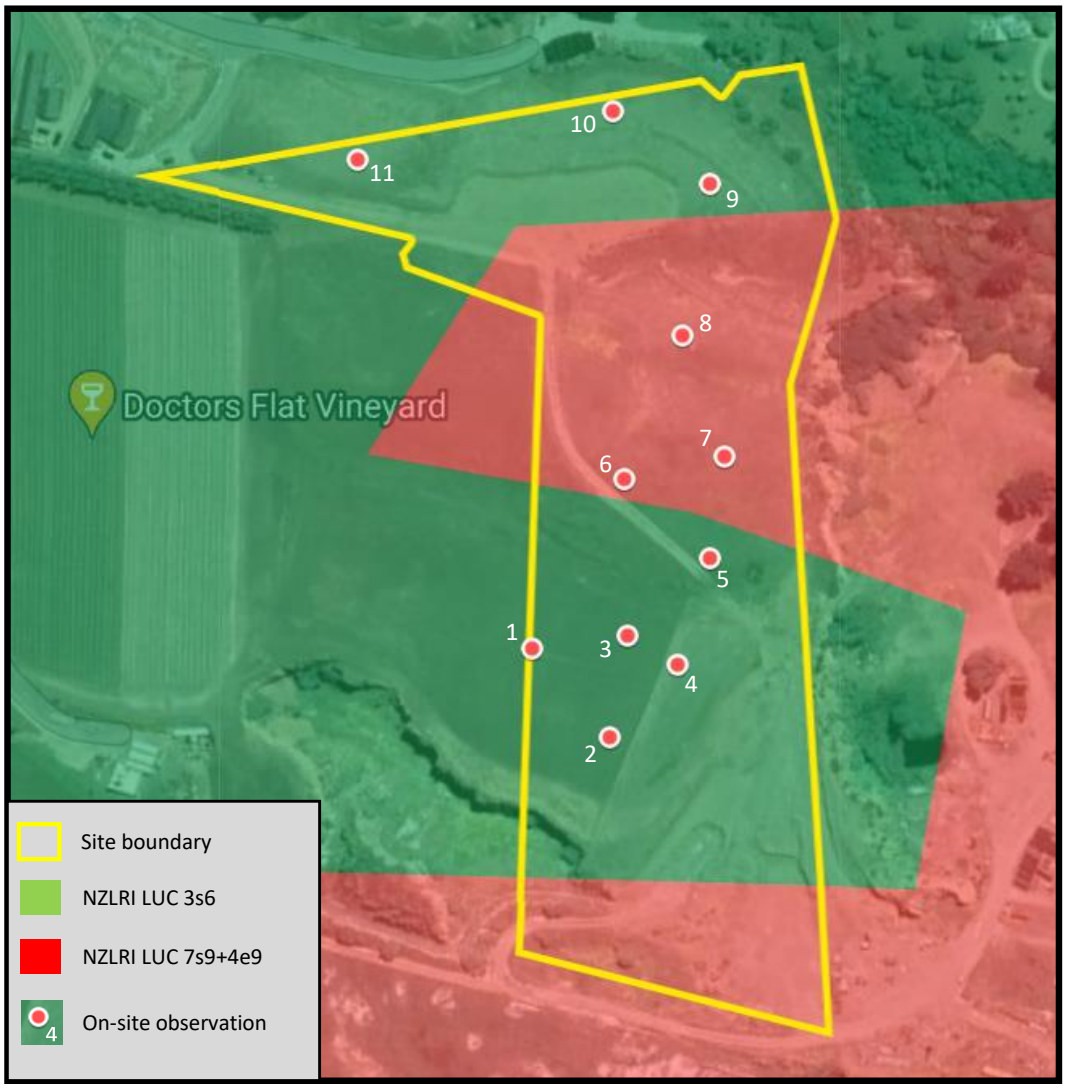


Images showing historic mining earthworks (top), and modified soil associated with water races (bottom).

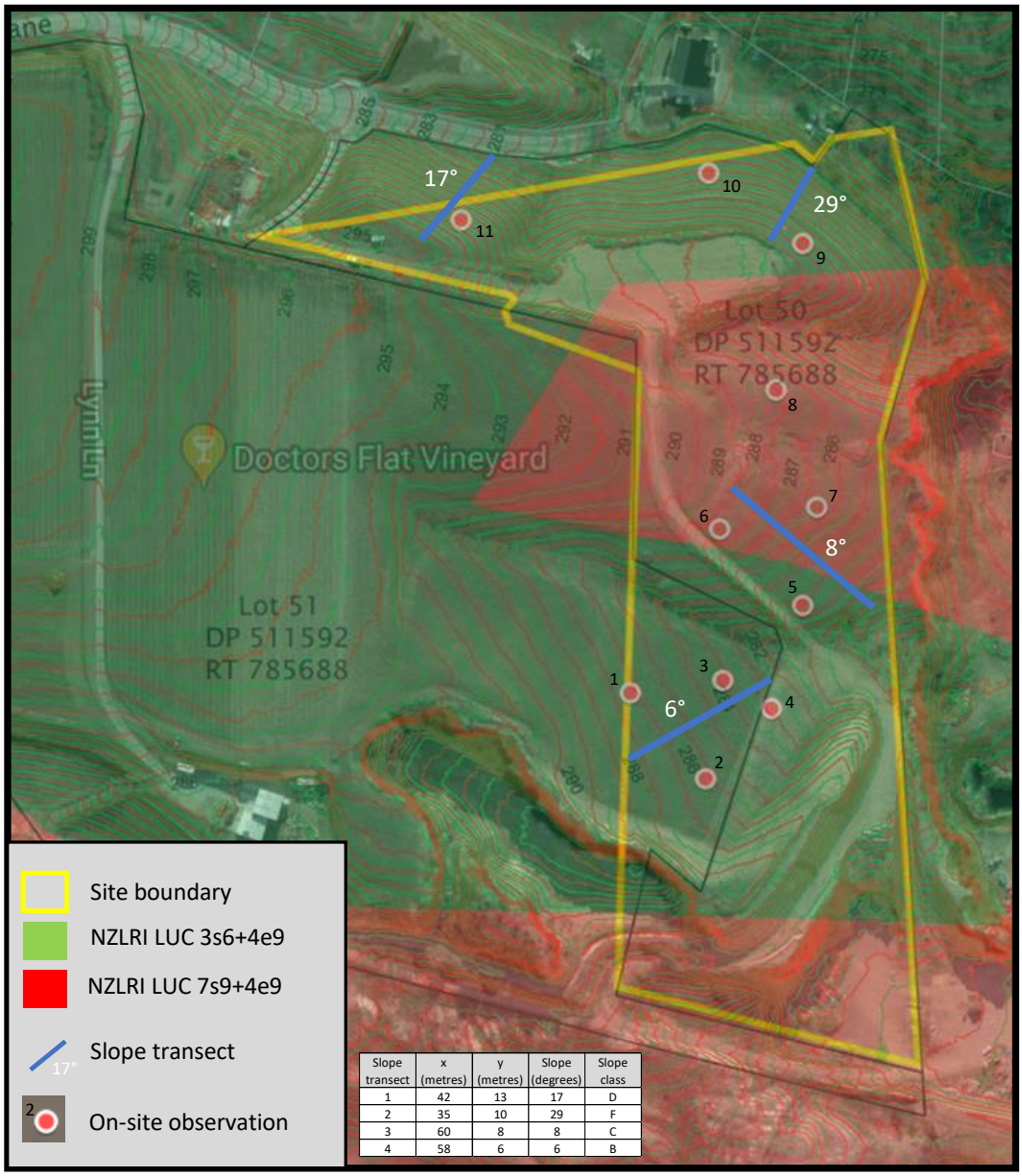
Appendix 4: Detailed contours provided by LANDPRO.



Appendix 5: On-site soil observation photo locations.



Appendix 6: Slope measurements.



Slope transect	x (metres)	y (metres)	Slope (degrees)	Slope class
1	42	13	17	D
2	35	10	29	F
3	60	8	8	C
4	58	6	6	B

Appendix 7: On-site soil observations.

1. Reinstated soil - shallow stony soil with compact mixed topsoil over compact gravel surface.

2. Very shallow stony soil with disturbed A horizon.

3. Reinstated soil - shallow stony soil with compact mixed topsoil over compact gravel surface.

4. No soil present – Non-productive land.

5. Very shallow stony soil with disturbed A horizon.

6. Very shallow stony soil with disturbed A horizon.

7. Very shallow stony soil.

8. Very shallow stony soil.

9. Very shallow stony soil.

10. Very shallow stony soil.

11. Very shallow stony soil.

Appendix 8: Revised LUC classification map.

69 Hall Road, Bannockburn

Subject site (3.64 ha)

Estimated LUC map units

Assessment area/subject site

Soil observation

4s - Reinstated soil area (Anthropic Soil) with compact mixed very shallow to shallow topsoil over compact truncated gravel surface. The reinstated (Anthropic Soil) in this area is classified as LUC class 4s in its current state.

4s+non-productive land - Very shallow stony soils and non-productive land areas on rolling slopes. The area is classified as LUC class 4s+non-productive land in its current state.

7s9+4e9 - Very shallow stony soils on predominantly north facing strongly rolling to steep slopes and some non-productive land areas. The area is classified as LUC 7s9+4e9 in its current state.

No soil present – non-productive land.