24th January 2024

Agricultural Land Use Assessment

1188 Main North Road, Pegasus ("site")

Purpose of Report

The purpose of this report is to review and consider the potential agricultural uses of the site within the context of Waimakariri District Council Zoning (Rural) and under National Policy Statement classification as Class 2 Highly Productive land.

This report assesses the technical and economic feasibility of a range of agricultural options and their suitability on the site and viability in the long term for land based primary production purposes.

Author Expertise

I am a self-employed Registered (NZIPIM) Farm Management Consultant primarily working in Canterbury but with client base between Central Otago and Nelson, and including Central Plateau, with specialisation in pastoral and arable land use systems and development.

I hold the qualifications of Bachelor Agricultural Science, Lincoln University

I work with farmers, local and central government organisations, and industry interest groups.

I specialise in advising in farm and agribusiness management with particular expertise in grazing and stock management systems, arable farming, irrigation & farm development, financial management, and supervise and contract-manage development projects.

I am familiar and experienced with all the farming practises, soils, and climate of the Central and North Canterbury area in general including the site in question.

I have worked for MAF Advisory Services Division based in Nelson and North Canterbury prior to forming my own consultancy practice, Dunham Consulting Ltd, in 2002

I regularly research and undertake feasibility and financial viability analysis for potential farming options. This has included land development strategy options for unimproved and irrigated land and intensification of land use through conversion to more intensive land use policies. This work has been over a full range of land types and farming systems.

I have acted as an expert witness in relation to various issues including land use planning, land development, farm machinery development disputes and animal welfare prosecutions.

My qualifications as an expert are set out above. The matters addressed in this report are within my area of expertise, however where I make statements on issues that are not in my area of expertise, I have stated where information has been sourced from. I have not omitted to consider material facts known to me that might alter or detract from the opinions included in this report.

SCOPE

In this report I address the following issues:

(a) The land use capability of the site

(b) The range of pastoral, arable and horticultural options that could be physically operated on a long-term basis on the site.

(c) Consideration of the climate, soils, and water environments of the site

(d) The type and extent of support industries and resources, contractors, and expertise required for a sustainable and viable farming operation.

(e) The infrastructure on the site or required on site to support a viable farming business.

(f) The site's neighbouring land uses and the potential impact of viable land use activities onto the neighbours; including reverse sensitivities.

(g) The economic viability of operating a business on the Site while being compatible with the site's District Zoning and designated under the National Policy Statement.

Site

The land ("site") is located at 1188 Main North Road, Pegasus. See Image 1 below.

Legal Description: Lot2 DP 80926

Title: CB46B/1093

Gross Area: 16.061 hectares

The Site is located east of State Highway 1 (SH1), between Woodend to the south of the Site and Pegasus Township to the north. The main access road to Pegasus Township is Pegasus Boulevard at the top of Image 1.

The entire area (coloured brown and green) combined (total 16.06 hectares) is referred to as the 'Site'. The area subject to rezoning application is the green area at the eastern end of the Site, referred to as 'Rezone Site" in this report. The Site's location and areas are shown in Image 1

Land Areas

	Hectares	
"Site"	12.25	brown
"Rezone Site"	3.81	green
	16.06	

Remnant of Site Area subject to Rezone application

Image 1

Site Zones and Classifications

District Zoning

Waimakariri District Council [WDC] Zone: *Rural*

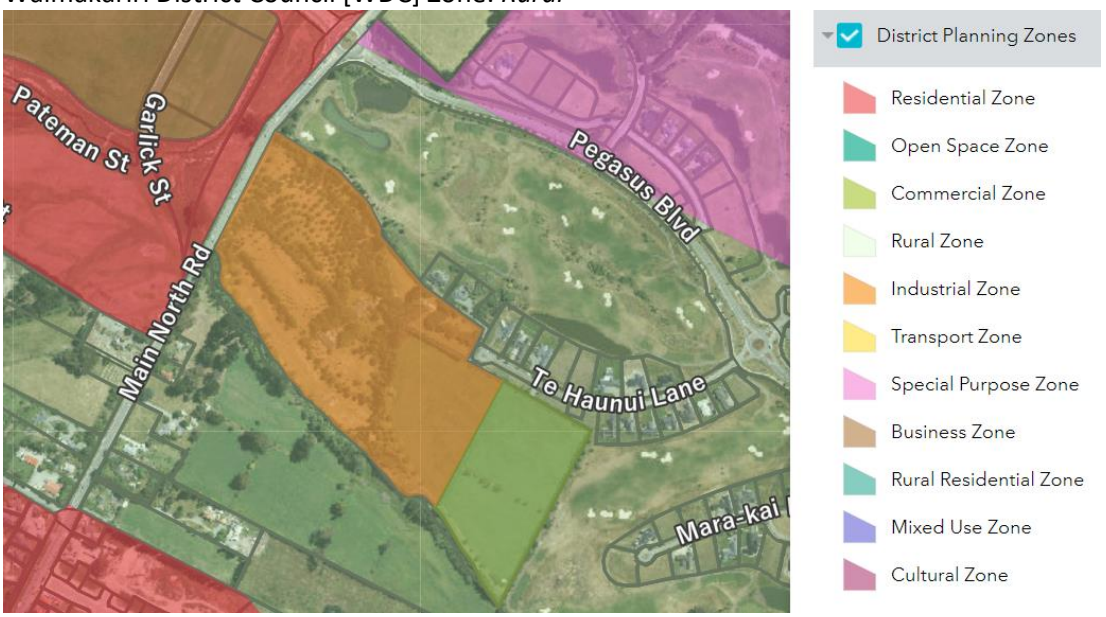


Image 2

The Site (brown + green) lies within the Rural Zone (light green colour in Image 2) and is bounded by Residential Zone (red colour) to the west (across SH1), and Pegasus Golf Club in a Special Purpose Zone (mauve colour) to the north.

National Zoning

The Site includes land with National Environmental Standard (NES) classification as:

Highly Productive Land: Class 2 National Policy Statement of 17th October 2022 (NPS-HPL)

The purpose of the NPS-HPL is to manage the subdivision, use and development of this non-renewable resource (soil), *providing a framework for Councils to enhance protection for highly productive land from inappropriate subdivision, use, and development and ensure it is available for growing vegetables, fruit, and other land-based primary production, now and into the future.*

This includes all land that is zoned General Rural or Rural Production and classed as Land Use Capability (LUC) 1, 2 or 3 which is considered as highly productive land for the purpose of the NPS-HPL.

Land Use Capability of the Site

The Land Use Capability of the Site is summarized in Image 3 and 4 from individual LUC polygons in Images 5, 6 and 7

Site Land Use Classes

Hectares	LUC group	LUC Description	
4.00	2	2s 2	96%
11.36	2	2w 1	
0.70	4	4s 6	4%

16.06

Ref Map: LRIS Portal: NZLRI Land Use Capability 2021

Image 3

Image 4

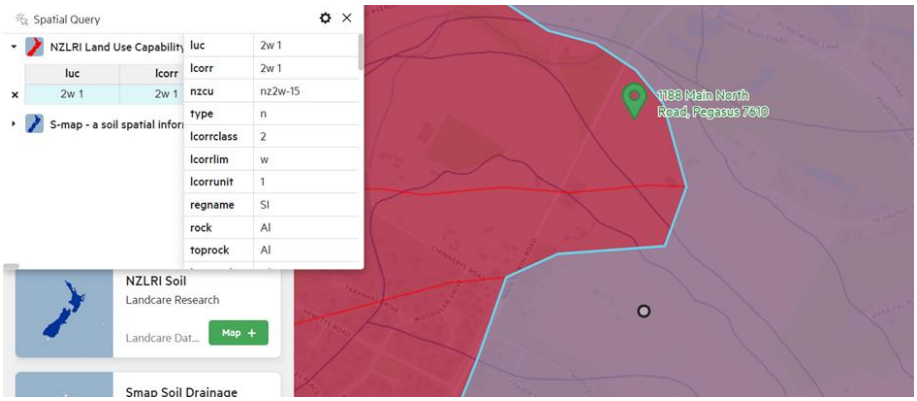


Image 5

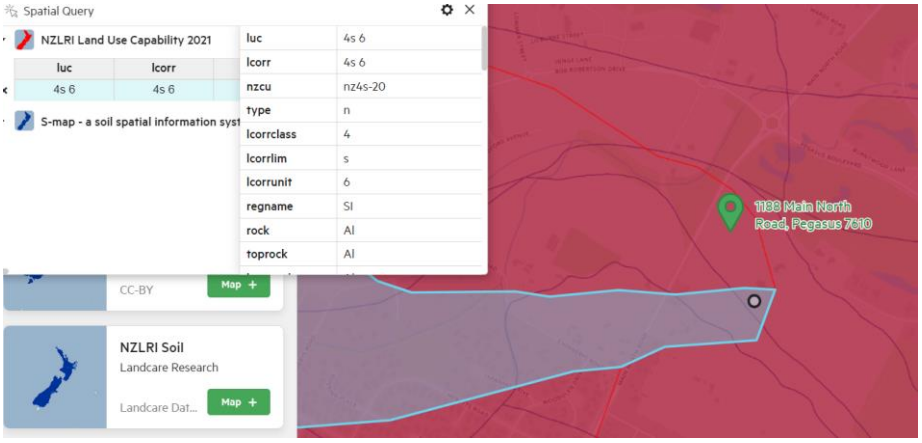


Image 6

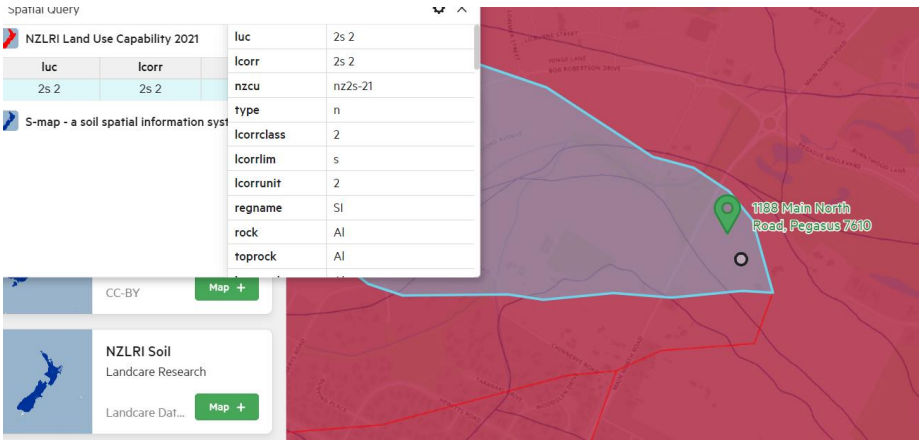


Image 7

The Rezone Site located at the eastern end of the Site falls within one LUC polygon containing Class 2 land and meets the NPS-HPL definitions. See Images 4 and 5.

For the purposes of the NPS-HPL the specific LUC rating is **'2w 1'**.

Interpretation of land Use Class Descriptions

Land Class	**2**	[versatility class]
Land Class Unit	**2w**	[restrictions to versatility]
Land Class Units	**2w 1**	[degree of versatility restriction compared to other 2w polygons]

The **Land Class** of the Site is '2' meaning:

'Land with slight limitations for arable use and suitable for cultivated crops, pasture or forestry'.

The **Land Class Unit** is '2w' meaning:

- *'w' wetness – where soil wetness resulting from poor drainage or a high-water table, or from frequent overflow from streams or coastal waters **first** limits production*

The **Land Class Units** is '2w 1' meaning:

The third numeral associates and orders polygons below the level of LUC subclass and can be disregarded as it simply allows location of land polygons with similar restriction characteristics and ranks them according to increasing degree of limitation to use.

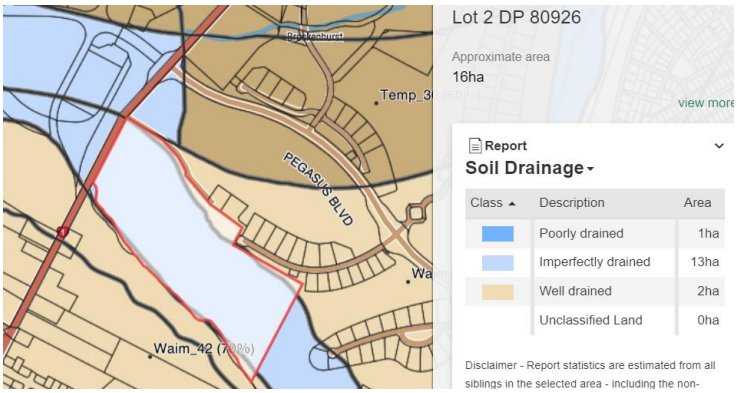
Refer to Appendix A for Land Use Capability Definitions.

Interpretation

The Class 2 land has slight limitations, in this case soil wetness properties; the key point is that the soil limitations override that broad versatility that the Versatility designation (Land Class 2) implies.

Wetness limitations of the Class 2 land on the Rezone Site

The wetness limitations primarily relate to poor drainage of the Rezone Site. Image 8 shows that the site lies almost exactly within an imperfectly drained polygon (grey colour) that runs northwest to southeast with well drained land to the northeast and southwest.



Ref: S-Maps Image 8

The Rezone Site Drainage classification of the Rezone Site is very similar to the whole Site, being approximately 95% 'imperfectly' or 'poorly' drained. See Image 9

Whole Site Drainage		
Drainage Class	Hectares	
Poorly	1.0	6.3%
Imperfectly	13.0	81.3%
Well	2.0	12.5%
	16.0	

Rezoning Site Drainage		
Drainage Class	Hectares	
Poorly	0.2	6.3%
Imperfectly	3.4	88.5%
Well	0.2	5.2%
	3.81	

Image 9

The Class 2 soils are low lying areas (only slightly lower than the surrounding free draining land) formed on alluvial floodplains (from the Waimakariri and Ashley Rivers), predominantly river silt loams that have high clay content that reduces the rate of soil drainage, resulting in imperfect drainage over geological time. See description Image 10.

si_legend	2w1
marl_legend	
nzcu_description	Flat to gently undulating floodplains and low-lying alluvial terraces below 150 m with winter wet Gley, Recent Gley, and imperfectly drained Pallic (gley and yellow grey earth) soils in low to moderate (<800 -1600 mm) rainfall areas in seasonally moisture-deficient districts.

Table Ref: LRIS Portal: NZLRI Land Use Capability 2021 Image 10

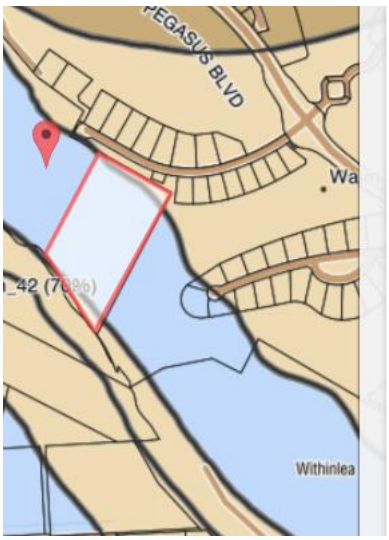
The key points are -

- Recent (geological age) soils
- Derived from river floodplains & fans
- High winter water tables
- Marked summer moisture deficit
- Deep, fertile soils

The core climatic limitation of the site is the marked seasonal moisture deficit over summer. The site has annual rainfall of 598 mm (calculated from Overseer Database Version 6.5.4) and well below the range indicated in Image 10, and with annual evapotranspiration (PET) of 918 mm [reference: Overseer version: 6.5.4], indicating a significant summer soil moisture deficit of approximately 320mm, over 50% of the annual rainfall. These soils typically experience summer droughts which significantly impacts on pasture productivity and pasture feed quality typically January to late March.

Soils on the Rezone Site

There are two types of soil identified on the Rezone Site, Kaiapoi silt loams and Flaxton silt loams, with two different types (siblings) of Kaiapoi silt loams. [reference: Landcare Research S-Maps]. The Kaiapoi soils make up approximately 81% of the Site and the Flaxton soils 9.0% of the Rezone Site soils. Small quantities of five other soil types combine to make up the remaining 10% of the area with the maximum of any of the five being < 3.3%. See Image 11.



Soil Siblings

Sibling	Area	Proportion
Kaia_1a.1	2 ha	53.9%
Kaia_4a.1	1 ha	26.9%
Flax_1a.1	< 1 ha	9.0%
Waim_3b.1	< 1 ha	3.3%
Raka_2a.1	< 1 ha	3.2%
Raka_1a.1	< 1 ha	1.5%
Waim_4b.1	< 1 ha	1.4%
Raka_10a.1	< 1 ha	0.7%

All of the siblings in the area selected are listed above - including the non-dominant siblings in each soil polygon.

Image 11

For the purposes of this report the S-Maps Summary [reference: Landcare Research S-Maps] of the Rezone Site is used which is 90% Kaiapoi soil and 10% Flaxton soil.

Soil Characteristics of Rezone Site

Site Soils Physical Characteristics

Approx hectares		ratio	Texture	Depth	PAW (100cm)	Structural Vulnerability	N Leaching Vulnerability
3.81	Kaiapoi_1a.1	60%	silt	deep	213	high	low
	Kaiapoi_4a.1	30%	silt	mod. deep	148	high	medium
	Flaxton_1a.1	20%	silt	deep	211	high	V. low
					214		

		ratio	Drainage Class	Water Logging Vulnerability	Permeability Profile
3.80	Kaiapoi_1a.1	60%	imperfectly	moderate	moderate over rapid
	Kaiapoi_4a.1	30%	imperfectly	moderate	moderate
	Flaxton_1a.1	20%	poorly	high	moderate over slow

		ratio	
3.80	Kaiapoi_1a.1	60%	Deep, imperfectly drained, mottled, weakly developed silt loams
	Kaiapoi_4a.1	30%	Mod. deep, imperfectly drained, mottled, weakly developed silt loams
	Flaxton_1a.1	20%	Deep, poorly drained, gley, weakly developed silt loams

		ratio	Diggability Depth	Topsoil Clay%	Topsoil
3.80	Kaiapoi_1a.1	60%	Deep >1.0m	12 - 30%	stoneless
	Kaiapoi_4a.1	30%	Mod. Deep 45-90cm	12 - 25%	stoneless
	Flaxton_1a.1	20%	Deep >1.0m	12 - 25%	stoneless

Image 12

Permeability graph

This graph shows the permeability profile of the siblings found in the map unit. Each horizon is coloured according to its permeability.
Click here for more information on permeability.

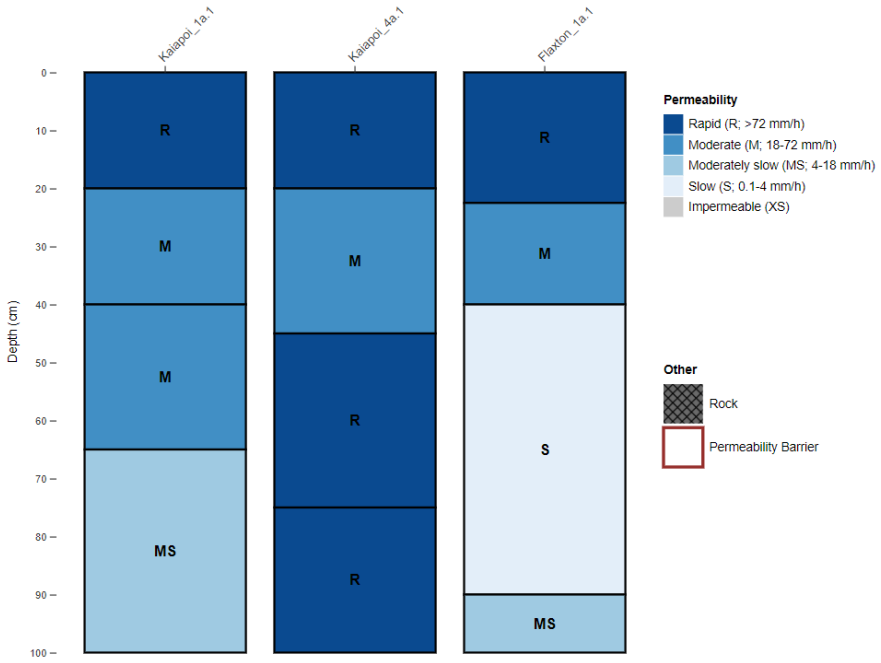


Image 13

Discussion

90% of the area consists of mottled Kaiapoi soils (spots or blotches of colour often rusty red in colour, indicating the presence of iron oxides) indicating that there are periods of restricted profile drainage, usually early winter to mid-spring.

The remaining 10% of the area (Flaxton soil) are gley soils which are more extreme in the degree of mottling or more usually have the iron and manganese oxides segregated out into layers in the subsoil and restrict rooting depth at the point of the chemical segregation.

The key point is that both soils are formed from high groundwater tables, and are imperfectly drained, and consequently trafficability (livestock and machinery) is limited when soils are wet, typically early winter to mid spring, hence the high structural vulnerability rating (e.g. from livestock pugging). Likewise pasture productivity is limited when roots lie in very wet soil particularly during early to mid-spring.

All the soils have rapid permeability of water in the top 20-25cm (see Image 13), lying over moderate permeability of varying depths. This means that excess water (high rainfall events and high rainfall event frequency) will move down through the "A" horizon and perch on top of the moderate permeability layers and only drain away at the rate of moderate layer. In practise it can mean that roots in the topsoil layer can be slightly dry while roots below 25cm are impacted by being too wet. This will also negatively impact on pasture yield and seasonality.

In all soils during waterlogged conditions many soil organisms are restricted because of anaerobic conditions also negatively impacting on pasture health and growth.

Plant available water (PAW) is rated as high on the Rezone Site at 214mm of water. In practise this means that the soils dry out and pastures come under moisture stress later (e.g. January) than in free draining soils (e.g. December) but will still experience significant periods of moisture stress January to late-March (320mm soil moisture deficit on average).

In summary, all soils on the site, with Flaxton soil being more extreme than the Kaiapoi soil, are limited in plant and crop production (and therefore in livestock stocking rates, and range of crop options and performance) while waterlogged (typically June to October, but can be May to December), and while under soil moisture deficit (typically January to mid-March, but can be mid-December to April).

Practical land-use considerations

Normal spring-established green feed crops are cultivated and drilled during September to October, on free draining soils. On this Rezone Site the soils must wait until are sufficiently dry enough (mid-October to November) to cultivate successfully. This delay impacts on crop yields.

On winter wet soils, green feed crops are more difficult to consume efficiently with higher wastage and more potential topsoil structure damage from pugging (and machinery if required for feeding out supplement). Soil damage from compaction requires longer pasture rotations (more years in pasture between green feed crops), or alternative winter feed strategies are required such as silage (typically a more expensive option) to minimise pugging damage.

Therefore, animal feed crops grazed in situ, are constrained by this winter soil wetness limitation, which limits the range of livestock policies available.

This means that arable cropping for grain & seed production will be significantly limited or infeasible due to the late planting dates and fewer growing-degree days to bring crop to maturity, and with low subsequent yields. Similarly, horticulture ground crop options are very limited by late sowing dates and summer moisture deficits. Wet winter soils rule out tree crops and viticulture as well.

In summary, primary production policies on the Rezone Site are limited to livestock policies and horticulture options being ruled infeasible by winter wet soils, late spring growth, and dry summer to late-autumn soil moisture deficits. Arable crop options are limited to late spring sown feed cereals.

Productivity

Land productivity (as assessed by LandCare Research for Class 2: 2w 1 land) on the Rezone Site is 14 stock unites per hectare with top farmers 17 su/ha and potential productivity (without scale, technological or economic limitations) at 20 su/ha. See Image 14. Note that these definitions of stock units and stocking rates were made in the 1970's and 1980's and are made assuming no climate limitations; they are different to current definitions of stock units and stocking rates but are useful for comparative purposes.

		Class 2
Hectares		3.81
LUC		2w 1
Stocking Rate*	Average	14
	Top Farmers	17
	Potential	20

Table Ref: LRIS Portal: NZLRI Land Use Capability 2021

* LRIS definitions of stock units are used for purposes of land polygon comparison and should not be used for analysis of current practise

Image 14

Current district farming practise in this location and on similar soil types are benchmarked against Beef & Lamb Farm Class 8 Survey data and adjusted with local knowledge of livestock farming practices. See Image 15.

		Current District Stocking Rates	
		Beef & Lamb NZ*	Local Adjusted
Hectares		3.81	3.81
LUC		2w 1	2w 1
Stocking Rate	Average*	10.5	11.5
	Top Farmers	13.7	15.0
Total Stock Units	Average*	40	44
	Top Farmers	52	57

* Beef & Lamb NZ: Farm Class 8: SI Mixed Finishing

Image 15

Discussion

Livestock farmers in the district on comparable soils and climate are stocking slightly higher than the Beef & Lamb benchmarks, but for practical purposes it makes little difference to the total livestock able to be run.

For the purposes of this report, the stocking rates of top farmers have been used, that is 57 stock units in total.

It is therefore assessed that the loss of the Class 2 Highly Productive Land, is 57 stock units (3.81 ha at 15.0 su/ha).

Rezone Site - access, neighbours, and infrastructure

General access to Rezone Site

Access to the Rezone Site is from SH1, along approximately 1.2km of 50 km/hr urban roads (Pegasus Boulevard and Te Haunui Lane). Twelve residential houses lie along approximately 525m on the north side of Pegasus Boulevard, and the access route passes through fifteen residences along approximately 340m of Te Haunui Lane. See red line in Image 16

Image 16

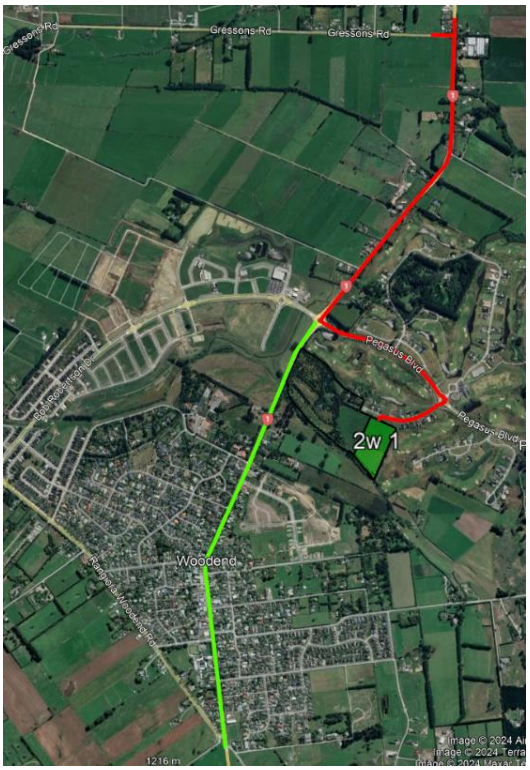


Image 17

Access by contractors or suppliers such as cultivation & drilling, chemical spraying, harvesting, stock trucks, fertiliser application etc. in support of primary production land use activities will predominantly be from the north along SH1, with contractors based west in the Rangiora or Oxford areas turning onto SH1 at Gressons Road, approximately 1.7km north of the SH1-Pegasus Boulevard intersection. Contractors coming from further north from Sefton or Amberley areas must cross the Ashley River Bridge approximately 3.8km north of the H1-Pegasus Boulevard intersection. See red line in Image 17

Contractors from south of the Rezone Site must either travel approximately 2.4km along SH1 but through high traffic, 50 km/hr. urban controlled Woodend Township, see green line in Image 17; or divert west around Woodend Township and approach from Gressons Road.

All contractors will have to manage journeys with consideration of peak road traffic times, school, and other educational locations, and manage mud and dirt transfer from vehicles particularly tractors.

Some site access is required to be time-specific such as chemical spraying which must be done in very low wind conditions, and managing traffic flows and local wind conditions can be difficult to manage. Harvesting activities of grains or supplement feeds is also often dictated by requirement for low wind conditions and warm drying weather. Crop-specific conditions can be any time during the day or evening and traffic will need to be taken into consideration.

Truck delivery or removals (e.g., livestock) are less likely to be time bound or difficult to manage on urban roads.

The SH1 – Pegasus Boulevard roundabout is a very busy intersection particularly at the start and end of business day with Pegasus residents commuting to and from Christchurch (primarily) or during start and end of the school day. Pegasus Township has its own primary school, but secondary students either travel west to Rangiora High School or south to Kaiapoi High School. These high traffic peaks will have a significant impact on farm contractors and suppliers as well as well as on other users.

Irrespective of activities contractors will heavily favour accessing the Rezone Site from the north.

The Rezone Site effective area is very small (3.81 ha). Experience supervising farming activities adjacent to urban areas would indicate that most contractors would be unwilling to put up with the difficulties of managing traffic and potential mud and noise pollution issues for such a small job. It would be uneconomic for them at normal contract rates and even if they were willing to do the work, they would not prioritise work on the Rezone Site over and above closer and larger long-standing clients.

In summary this means that the pool of available contractors is small and less likely to respond when needed for time-sensitive or condition-sensitive activities.

Access onto Rezone Site

There are three legal access points (see Image 18). Two are onto the applicant's land (from SH1 and at the western end of Te Haunui Lane), and with one access point onto the Rezone Site at the northern end, directly off Te Haunui Lane.

Image 18

Neighbours

Rezone Site direct neighbours are (see Image 18):

East - Pegasus Golf Course with 23 residential lots (Mara Kai Place)
North - 18 residential lots (Te Haunui Lane)
West – over SH1, residential under development
South – Crown owned land designated for roading purposes

Image 18

Potential impacts from primary production activities that may be carried out on the Rezone Site include agricultural chemical spraying, dust from land cultivation and fertiliser spreading, and noise pollution from machinery and vehicle use.

These activities are not expected to have negative impacts on Rezone Site neighbours to the south or west (meaning the residential development rather than the rump of the applicant's land), because of either designated use or distance respectively.

Two existing residential subdivision either lie directly on the north boundary or in close proximity east of the Rezone Site. The houses in the Te Haunui Lane subdivision lie between 20m to 235m straight-line from closest Rezone Site boundary, while the houses in the Mara Kai Place subdivision lie within 110 to 480m. Both subdivisions are expected to be potentially impacted by rural activities on the Rezone Site

In summary it is expected that primary production activities will have direct impact on all 41 immediate and close neighbouring residences, as well as 12 residences along the route through Pegasus.

Current Rezone Site land cover and infrastructure

The Rezone land is dryland and has no farming consents on it. It is currently livestock fenced into two paddocks of perennial pasture, and there is no reticulated electricity onto the Rezone Site.

There are troughs and water reticulation via alkathene pipework with water supplied from the domestic house supply from Site land (M35/0432). Note that three other bores recorded on Site are inactive (M35/6831, M35/8884 M35/0430). There are no bores or wells on the Rezone Site.

There is one small hayshed in south-east corner (43m², 2-bay, 1-wall (south side), dirt floor, height clearance to store tractor under cover), but no stock yards.

Class 2 Primary Production Land Use Options

In order to analyse possible primary production land uses on the Class 2 land, the following assumptions have been made.

1 Stock water

While water demand for sheep is relatively low, and higher for cattle, livestock water is required for production and for animal welfare reasons.

A shallow bore can be installed to source water for stock use. Environment Canterbury designate livestock water as a permitted activity from groundwater sources as long as take is less than 10m³ per property per day, which is more than would be required for the Rezone Site.

It is estimated that an < 25m installed well with a surface pump driven by a small pump run from a petrol or diesel generator, auto switch on/off controls, 35,000-litre tank, and a small protective pump-shed would cost approximately $17,000 - $22,000 and depending on final depth.

Annual running costs of approximately $400/year for fuel.

2 Irrigation water

While the Class 2 land is rated as having high Water Holding Capacity at 214mm PAW_{100}, the dry summers typically experienced at the site mean that the high evapotranspiration rates place pastures or crops in moisture deficit conditions typically between December to late March in most years. A pasture-based stock system can be designed around this limitation with its implicit lower summer animal productivity performance, but any more intensive or higher productivity requirements, or intensive arable crop or soil based horticultural activity will require irrigation water.

The cost of a bore, screen, pumps & electrics, 3-phase power supply to the Class 2 land (assuming consents and easements are achieved across neighbouring land), and a water application system tailored to the land use activity (but assumed to be sprinkler based) would cost approximately $200,000 - $230,000 including consenting fees.

Annual running costs are seasonally dependent estimated at $1,000 - $1,500/year, with annualized consent renewal fees, consent audit fees, Farm Environment Plan costs, water use monitoring charges estimated at an additional $1,500-$2,000/year.

Irrigation consents would be required to take water and to use water. This is not guaranteed and gaining appropriate consents with satisfactory water use conditions that don't restrict crop irrigation timing or volumes (the water must be reliable in daily flow during the crop growing to harvest period, and with sufficient total annual volume). Consent application would also require that the applicant's well would not impact on existing wells and bores within 1.5km of the planned well site.

It is considered that the likelihood of obtaining irrigation consents is low to very low given the location and the e general over-allocation of groundwater resources in the Waimakariri Irrigation

Zones. The applicant will also need to be prepared to take a total loss of approximately $50,000 - $60,000 if the consent is not granted (drilling a test well, flow rate testing, preparation of application, ECAN application fees, etc).

In summary, as the likelihood of being granted an irrigation consent is highly unlikely, I have ruled out primary production land use activities that require irrigation. This excludes viticulture and horticulture and market gardening activities; while these could be pursued as dryland ventures, in my opinion no prudent land user would undertake investment with the levels of summer and autumn drought risk involved.

3 Physical Access
Access is from the formed road through the residential subdivision.

4 Electricity Supply
It is assumed that livestock fencing power would be provided by way of batteries or portable solar panels (cost approximately $500) and pumping of livestock water is done by way of small petrol or diesel generator (cost included in livestock water; item #1).

5 Stock yards and load-out ramp
There are no yards on the Rezone Site land. A small set of yards that can handle sheep and cattle, and with a load out ramp could be standalone or built into the existing covered hayshed; cost approximately (materials & labour) $10,000.

6 Sheep Shearing
Normally a shearing shed is needed, but given the small number of sheep, it is assumed that shearing outdoors or under cover of the existing shed with electric battery shears is sufficient to harvest wool and meet sheep welfare requirements (flystrike, etc).

7 Fencing
It is assumed that the Rezone Site has permanent livestock fencing around it. Any further fencing beyond the existing two paddocks is assumed to be provided by temporary electric fencing, energized by solar powered battery.

8 Contractors
It is assumed that all the contractors required, depending on the type of land use activity, are available in the district, and are not limiting in terms of potential land use choices available.

9 Other costs
The land will have rates costs from the Waimakariri District Council and Environment Canterbury (GST exclusive, calculated pro rata on land area) of approximately $1,027 per year.

Farming Land Use Options

Technically feasible options for this site are:

- Dry-stock sheep
- Dry-stock cattle
- Dairy heifer contract grazing
- Mixed cropping (arable and dry-stock sheep)
- Sale of hay and baleage

Discussion of Options

Dairy heifers and dairy cows
The two dairy contract grazing options while technically feasible are highly unlikely to occur as no dairy farmer would entertain placing such small numbers of stock (respectively 12-13 heifer calves per year (Rising 1yr old & Rising 2yr old) grazing on the site when grazing contracts typically are for herd sizes of 125 -150 calves.

Dry stock Sheep
There are a number of permutations, but district practise sheep policy would be breeding ewes, selling the progeny finished to a processor or store to other farmers to finish. Usually with small flocks, replacement ewes are purchased, rather than bred and grown out.

Using the *Beef & Lamb NZ Economic Service; Class 8 SI Finishing* as a benchmark, the site would carry 45 breeding ewes (52 stock units). However typically, small blocks carry slightly higher stocking rates, at +10% would therefore carry 50 breeding ewes (57 stock units).

Dry stock cattle
The usual small block cattle policy is to purchase yearling cattle and graze for approximately 12-14 months before sale to meat processors, however given the very wet winter soils, the policy is more likely to be purchase of calves at weaning (March/April) and sell forward-store prior to the second winter as 21-month-olds. Using the Beef & Lamb Economic Service data, and at +20% higher small block stocking rate, this site would be expected to carry 12-13 head.

Mixed cropping
Dryland arable cropping is carried out in Canterbury on a small scale and as part of an integrated crop and stock policy. Typically, the crops grown are barley, and sometimes low-specification old varieties of perennial grass seed. Given the winter wetness limitations from high water tables, it is typically not until late spring before soils are dry enough to prepare a viable seed bed; yields are expected to be average.

Rotations typically would be spring sown barley, to permanent pasture for 4-5 years, then repeat; with sheep or cattle grazing the pasture.

Dryland barley yields 5.5 t/ha, and barley straw at 4 medium round bales per hectare; and during pasture years 43 breeding ewes.

Supplementary feed hay or baleage
Permanent perennial pasture with commonly two spring and early summer cuts, and two mid-late autumn cuts provided there has been sufficient autumn rainfall. Harvest 114 bales hay or baleage (34+34+15+31).

Note: in all scenarios, perennial pastures require replacement after 6-8 years to maintain quality & vigour.

Economic Viability

The four technically feasible options with markets to support them, and able to be undertaken as part of normal farming practise year-in-year-out are:

- Dry-stock sheep
- Dry-stock cattle
- Mixed cropping
- Sale of hay and baleage

The economic viability of each option is detailed on page 18.

Summary

All land use options are able to generate sufficient income to cover direct operating expenses.

	Net annual trading result (rounded)
• Dry-stock sheep	+$6,800
• Dry-stock cattle	+$4,200
• Mixed cropping	+$6,700
• Sale of hay/baleage	+$2,800

Capital investment is required to purchase livestock and to provide the infrastructure to efficiently carry out most land use options. If the cost of capital required is calculated at 5.0% and principle payments are made over 5-years for livestock and 10-years for infrastructure, then annual losses are:

	Total investment	Net annual cash result (rounded)
• Dry-stock sheep	$30,500	+$600
• Dry-stock cattle	$30,500	-$2,800
• Mixed cropping	$30,500	+$700
• Sale of hay/baleage	$0	+$2,600

Only the dry-stock cattle policy is unable to generate sufficient income to cover direct expenses, cost of livestock and cost of infrastructure improvements (interest & principle), however dry-stock sheep and Mixed cropping are essentially at breakeven financially.

While making and selling of supplementary feed makes the highest net cash surplus at $2,600 this is primarily due to not requiring infrastructure improvement or to purchase any livestock. This $2,600 cash surplus is considered to be very small with low profit resilience and combinations of input cost increases and normal seasonal variations in yield resulting from poor climatic conditions (primarily late spring and longer summer dry periods) would easily result in a breakeven position in approximately five years in ten.

In this analysis there is no provision for owner's labour & time committed to managing the activities, or other labour costs (excluding contractors labour) and there is no allowance made for cost of capital invested in purchasing the Rezone Site land.

No prudent farmer would view any of these options as economically viable on this site.

Sheep

Policy: 50 ewes, 140% lambing, all lambs to kill, 4.2 kg wool/ssu, 5.1% deaths

Effective Hectares	3.81				
SU/ha (+10% higher)	15.00				
Total SU	57.15				
Gross Income - incl sire costs		**$9,821**			
Direct Farming Expenses					
Rates (pro rata)	$1,026				
Insurance	$182				
Animal health	$195				
Shearing	$495				
Annual fertiliser	$640				
Pasture renewal - annualised	$100				
Hay/Baleage made	$243				
R&M	$53				
Freight IN	$51				
ACC	$43				
Administration contribution	$0				
Vehicle Opex Contribution	$0	**$3,030**		**$6,791**	A
Livestock Loan Interest	$323	5.0%	$6,460		
Livestock Loan Principle	$1,292	5-years			
		$1,615		**$5,176**	B
Improvements Loan Interest	$1,525	5.0%	$30,500		
Improvements Loan Principle	$3,050	10-years			
		$4,575		**$601**	C

Beef

Policy: 12-13 calves purchased, sold store at 21mths, no deaths

Effective Hectares	3.81				
SU/ha	15.00				
Total SU	57.15				
Gross Income - net of purchase costs		**$6,985**			
Direct Farming Expenses					
Rates (pro rata)	$1,026				
Insurance	$182				
Animal health	$40				
Shearing	$0				
Annual fertiliser	$640				
Annual Pasture renewal	$100				
Hay/Baleage made	$468				
R&M	$53				
Freight IN	$254				
ACC	$43				
Administration contribution	$0				
Vehicle Opex Contribution	$0	**$2,806**		**$4,179**	A
Livestock Loan Interest	$476	5.0%	$9,525		
Livestock Loan Principle	$1,905	5-years			
		$2,381		**$1,798**	B
Improvements Loan Interest	$1,525	5.0%	$30,500		
Improvements Loan Principle	$3,050	10-years			
		$4,575		**-$2,777**	C

Barley + Pasture Rotation

Policy: 1yr Barley at 5.5 t/ha, 4b straw; & 5yrs sheep

Effective Hectares	3.81				
SU/ha	15.00				
Total SU	57.15				
Gross Income - annualised		**$9,725**			
Barley price average last 5yrs less 10% for sale off header					
Direct Farming Expenses					
Rates (pro rata)	$1,026				
Insurance	$182				
Animal health	$163				
Shearing	$413				
Annual fertiliser	$533				
Pasture renewal - annualised	$100				
Hay/Baleage made	$202				
R&M	$53				
Freight IN	$43				
Barley Crop Direct Exp	$313				
ACC	$43				
Administration contribution	$0				
Vehicle Opex Contribution	$0	**$3,072**		**$6,653**	A
Livestock Loan Interest	$269	5.0%	$5,384		
Livestock Loan Principle	$1,077	5-years			
		$1,346		**$5,307**	B
Improvements Loan Interest	$1,525	5.0%	$30,500		
Improvements Loan Principle	$3,050	10-years			
		$4,575		**$732**	C

Hay/Baleage Supplement

Annual Policy: 114 bales (4x cuts) grass, stored & sold during winter

Effective Hectares	3.81				
SU/ha	15.00				
Total SU	57.15				
Gross Income		**$10,038**			
Direct Farming Expenses					
Rates (pro rata)	$1,026				
Insurance	$182				
Animal health	$0				
Shearing	$0				
Annual fertiliser	$888				
Pasture renewal - annualised	$150				
Hay/Baleage made	$4,908				
R&M	$11				
Freight IN	$0				
ACC	$43				
Administration contribution	$0				
Vehicle Opex Contribution	$0	**$7,208**		**$2,830**	A
Delayed sale Interest	$5,796	5.0%	$217		
		$217		**$2,612**	B
Improvements Loan Interest	$0	5.0%	$0		
Improvements Loan Principle	$0	10-years			
		$0		**$2,612**	C

Summary and Conclusions

- The Rezone site is classified as Land Use Class *2w 1* which brings it under the NES Highly Productive Land regulations.
- The Kaiapoi soils on the site are winter wet from high water tables and have slowly permeable lower soil horizons which limits the range and types of primary production that can be undertaken.
- The winter wet soils are also structurally vulnerable soils that are easily damaged by livestock pugging or by machinery and vehicle activity such as winter feeding out of supplements. This limits the range and type of livestock policies especially those including heavier cattle.
- There is a marked summer soil moisture deficit (320mm) which limits pasture production requiring conservative stocking rates, animal growth rates, and arable and supplement yields expectations.
- Spring establishment of arable crops or green feed crops will be late (October) by the time soils are sufficiently dry, which will reduce crop yields.
- A very limited range of arable crops can be grown dryland (typically barley), if grown infrequently with long periods of pasture in-between for soil restoration.
- Livestock grazed on pasture will minimise pugging risk as compared to green-feed crop grazed in situ during winter but will require more expensive supplement options such as baleage compared to green-feed crops. Despite this some pugging is expected from all livestock policies.
- The Rezone Site is dryland and has no current source of stock water or mains electricity, or stock yards.
- Irrigation consents are highly unlikely to be granted on this site, so only dryland land use options are available. This excludes horticulture and viticulture options.
- Even in the unlikely event of irrigation consent being granted, the high capital cost of up to $230,000 would add approximately $11,500 per year in interest costs (5%) and $11,500 per year in principle repayments (20-year term)
- While the full range of contractors and suppliers are expected to be available from the North Canterbury hinterland, the site's urban fringe location significantly limits the ability of contractors to reliably deliver time-critical work for some weather condition-specific activities such as spraying & harvesting, and consequently when combined with the small size of the Rezone Site, contractor costs are expected to be higher per-hectare than normal.
- There is expected to be high potential impact on site neighbours to the north and east from dust, spray-drift, and noise as well as mud & debris on the access roads.
- There are five technically feasible land use options, but one relies on supply of contract grazing dairy cattle which is not likely on a site of this size.
- Potential land use options include dryland sheep, dryland beef cattle, mixed cropping arable & sheep, and selling supplementary feed (hay or baleage)
- All options are able to produce a trading profit and cover direct expenses (range +$2,800 to +$6,800).

- Total infrastructure development (stock water, stock yards) on average over the four options is $22,900 with a range between $0 and $30,500.
- Livestock purchase costs (interest and principle) ranges between $5,400 and $9,500
- When the cost of capital (5.0% interest) and principle payments are included, then total Net Cash results are breakeven for dry-stock sheep and dry-stock beef (average +$670/yr.), a small loss for mixed cropping (-$2,800) and a small profit for supplementary feed sales at +$2,600; however the latter is not considered a financially resilient or reliable result given normal climate variability.
- Livestock economic viability has been calculated using stocking rates higher than the district benchmark averages by using stocking rates of top-farmers, which indicates that higher stocking rates are not able to overcome lack of economic viability while at the same time significantly increasing productivity risk with more stock being grazed during summer drought months.
- It is difficult to see any prudent land user placing themselves under these kinds of risks to farm the land on this site and with little likelihood of recouping any capital invested into land purchase; full recovery of cost of improvements is at risk given the essentially breakeven status of the land use options.
- The small scale of the site, high vulnerability of the soils to structural damage from high water tables, marked summer drought periods, late spring crop establishment timing, restrictive site access for contractors, very low chance of obtaining irrigation water consents, as well as very expensive irrigation infrastructure means that there is no long term economically viable primary production land use for this site.

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Appendix A

Land Use Capability Definitions

Land Classes 1 to 4 are suitable for arable cropping (including vegetable cropping), horticultural (including vineyards and berry fields), pastoral grazing, tree crop or production forestry use.

Land Classes 5 to 7 are not suitable for arable cropping but are suitable for pastoral grazing, tree crop or production forestry use, and, in some cases, vineyards and berry fields. The limitations to use reach a maximum with LUC class 8.

Land Class 8 land is unsuitable for grazing or production forestry and is best managed for catchment protection and/or conservation or biodiversity.

LUC 1	Land with virtually no limitations for arable use and suitable for cultivated crops, pasture, or forestry.
LUC 2	Land with slight limitations for arable use and suitable for cultivated crops, pasture, or forestry.
LUC 3	Land with moderate limitations for arable use and suitable for cultivated crops, pasture, or forestry.
LUC 4	Land with moderate limitations for arable use and suitable for occasional cultivated crops, pasture, or forestry.
LUC 5	High producing land unsuitable for arable use, but only slight limitations for pastoral or forestry use
LUC 6	Non-arable land with moderate limitations for use under perennial vegetation such as pasture or forestry
LUC 7	Non-arable land with severe limitations for use under perennial vegetation such as pasture or forestry
LUC 8	Land with very severe to extreme limitations or hazards that make it unsuitable. for cropping pasture or forestry.

Land use capability subcategory

Each LUC unit has a subcategory of the LUC class through which the main kind of physical limitation or hazard to use is identified. Four limitations are recognised:

- 'e' erodibility – where erosion susceptibility, deposition, or the effects of past erosion damage *first* limits production
- 'w' wetness – where soil wetness resulting from poor drainage or a high-water table, or from frequent overflow from streams or coastal waters *first* limits production
- 's' soil – where soil physical or chemical properties in the rooting zone such as shallowness, stoniness, low moisture holding capacity, low fertility (which is difficult to correct), salinity, or toxicity *first* limits production.
- 'c' climate – where climatic limitations such as coldness, frost frequency, and salt-laden onshore winds first limits production