Assessment Schedule – 2017

Agricultural and Horticultural Science: Demonstrate understanding of land use for primary production in New Zealand (91297)

Assessment Criteria

Question ONE: Reducing nitrogen loss

Achievement	Achievement with Merit	Achievement with Excellence
Explains the factors that determined current and / or traditional land use.	**Explains, in detail**, why the Regional Council is pushing for land use change, taking into account environmental and social factors.	**Evaluates** the positive impacts on the environment of changing the land use, and the economic impacts.

N1	Some writing, but does not explain TWO factors that determined current and / or traditional land use.
N2	Partial or insufficient explanation of TWO factors that determined current and / or traditional land use.
A3	Explains TWO factors that determined current and / or traditional land use.
A4	Explains TWO factors that determined current and / or traditional land use. Both require supporting information.
M5	Explains in detail why the Regional Council is pushing for land use change, taking into account environmental and social factors. One factor explained in detail, the other factor explained.
M6	Explains in detail why the Regional Council is pushing for land use change, taking into account environmental and social factors. Both factors explained in detail.
E7	Evaluates the positive impacts on the environment of changing the land use, and the economic impacts. Comprehensive evidence given for ONE factor, with another factor well supported.
E8	Evaluates the positive impacts on the environment of changing the land use, and the economic impacts. Comprehensive supporting evidence given for BOTH factors.

N0 = No response; no relevant evidence.

Q1	Sample Evidence
	Question: Evaluate the environmental and economic factors behind the Regional Council's new approach to future land use in the Rotorua Lakes region. In your answer: • explain the factors that determined current and / or traditional land use there • explain in detail why the Regional Council is pushing for land use change, taking into account environmental and social factors • evaluate the positive impacts on the environment of changing the land use, and the economic impacts. **Explains** the factors that may have determined current and / or traditional land use. Current land use in the Rotorua Lakes region includes sheep, beef, and dairy cattle farming, along with some forestry. The soils were formed from volcanic pumice showers from the Taupo and Kaharoa eruptions during the past 4 000 years. Pumice soils usually have a thin, well-developed organic topsoil over a sandy subsoil. These soils have traditionally been used for sheep and beef farming, although dairying has expanded in recent years. Farming this land was impossible until the early 1900s because all ruminant stock suffered from bush sickness, which was found to be caused by a cobalt deficiency in the soil. Much of the area was planted in exotic forest (Pinus radiata), the only viable land use. With the addition of cobalt, ruminant stock could be farmed and large areas were converted from forestry to pasture for sheep, beef, and dairying. Initially large amounts of fertiliser were needed to establish pasture on this land. Where the soils dry out in summer, the clover content of pasture is usually low and deficient in nitrogen the following winter and spring. Phosphorus, magnesium, boron, and possibly nitrogen and potassium are needed for exotic forestry, especially where the soil is coarse and the topsoil shallow. These farming activities therefore contribute to nitrogen leaching, which affects water quality and encourages toxic algal blooms and aquatic weed growth. To achieve better water quality and healthier lakes, nitrate leaching levels need to be reduced. This is affecting current land use and has impacted on dairy conversions. Due to the economic downturn in forestry and the high returns that can be provided from dairying, many landowners converted to dairying to gain higher and quicker returns. Forestry has about 25 years before any income arrives, whereas dairying is effective in about a year. Land in this area is cheaper than land in traditional dairying areas such as the Waikato. Since early European settlement in the 1800s, Rotorua has been a tourist drawcard. The pristine bush, lakes and geothermal-based activities have drawn tourists to Rotorua from all over the world. **Explains, in detail**, why the Regional Council is pushing for land use change, taking into account environmental and social factors. The Bay of Plenty Regional Council is pushing for land use change to reduce the nitrogen levels leaching into the lake, and to improve the water quality. The current nitrogen load on the lake is around 700 tonnes, and NIWA has estimated an annual reduction of 320 tonnes of nitrogen is required for the catchment. If left unregulated, the water may become so contaminated that bottled water would be recommended for drinking and a dead zone in the lake would develop, depleted of oxygen from algal growth.

	The use of chemical fertilisers is mostly to blame; they are used in the pasture production for dairy cattle. New Zealand is marketed as "100% green and pure", and tourism is a key industry in the Rotorua region. The high level of nitrogen in the lake and the issues associated with it would damage this industry. The council needs to balance the needs and outputs of both the tourism and agricultural industries. It is important that Rotorua continues as a tourist destination. Many people come to New Zealand only to see Rotorua and Queenstown and then leave again, spreading our name all over the world. The Regional Council is pushing for land use change as it has noticed and been informed of the declining state of the natural beauty of the Rotorua lakes in the region. If the water is in a poor state, then people in the community and tourists will not want to participate in water-based recreational activities, or use the water for drinking purposes. **Evaluates** the positive impacts on the environment of changing the land use, and the economic impacts. Nutrient leaching can be reduced by mitigation, changes in land management practices, improvements in farm production efficiency, reductions in land-use intensity, and land use change. The intensification of sheep and beef farms and the expansion of dairy farms have contributed many environmental problems such as the contamination of ground and surface water, insufficient water for irrigation during droughts, and excess nutrient losses from farms. A key water quality issue for dairy farmers is the significant amount of excess nutrients, particularly nitrogen, that leaches into waterways. The transfer of these pollutants from land to water can result in significant water-quality impairment. The nitrogen content of consumed pasture is often in excess of the cow's capacity to incorporate the nitrogen into milk protein. This excess results in high nitrogen excretion and concentrations in urine (94%), which, combined with the use of nitrogen fertiliser to increase pasture, have increased surplus nitrogen. About 39 percent of monitored groundwater in New Zealand has nitrate levels higher than natural background levels, and there are areas where concentrations exceed the drinking water standard limit of 11.3 milligrams per litre. Any reduction in these farming activities would see environmental improvements, and this is the most important factor when considering future land use in the Rotorua lake area. With an incentive fund of $40 million, alternative, lower nitrogen-based activities are being promoted. Some of these include manuka farming. The demand for New Zealand manuka honey, particularly internationally, significantly outweighs supply. Many exporters are under immense pressure to satisfy the needs of customers, and the market is expected to grow with the development of increasingly affluent, emerging economies. A change in land use to this type of industry requires a specialist workforce with different skillset to dairy farming. This would involve the cost of retraining or attracting the workforce to the area. This cost could be covered by the incentive fund. If tourists find Rotorua's lakes and surrounding areas offensive due to the water quality, they will not come to Rotorua for holidays, and not spend money in the city. Rotorua earnt, by September 2017, $806.5 million (http://www.rotoruanz.com/research-and-statistics), half from New Zealanders and half from international visitors. It is therefore essential that Rotorua is kept in its pristine state for this income to be earned. If farmers were given an incentive to change to another, less nitrogen-intensive form of farming, then they could potentially benefit from changing land use, if the money they were given could be used to set up a new farming system which could earn a similar dollar value-to-dairy per hectare. Those closest to the lake could think about a tourism / farming venture to help subsidise any drop in income with the change in land use.

Assessment Criteria

Question TWO: Dairy conversions

Achievement	Achievement with Merit	Achievement with Excellence
Explains TWO factors that were behind the drive for dairy conversions in Canterbury.	**Explains, in detail**, TWO factors that were behind the drive for dairy conversions in Canterbury.	**Evaluates** the importance of the TWO chosen factors in deciding whether or not to continue using the land for dairy farming.

N1	Some writing, but does not explain TWO factors that were behind the drive for dairy conversions in Canterbury.
N2	Partial or insufficient explanation of TWO factors that were behind the drive for dairy conversions in Canterbury.
A3	Explains TWO factors that were behind the drive for dairy conversions in Canterbury.
A4	Explains TWO factors that were behind the drive for dairy conversions in Canterbury. Both require supporting information.
M5	Explains, in detail, TWO factors that were behind the drive for dairy conversions in Canterbury. ONE factor explained in detail, the other factor explained.
M6	Explains, in detail, TWO factors that were behind the drive for dairy conversions in Canterbury. BOTH factors explained in detail.
E7	Evaluates the importance of the TWO chosen factors in deciding whether or not to continue using the land for dairy farming. Comprehensive evidence given for ONE factor, with another factor well supported.
E8	Evaluates the importance of the TWO chosen factors in deciding whether or not to continue using the land for dairy farming. Comprehensive supporting evidence given for BOTH factors.

N0 = No response; no relevant evidence.

Q2	Sample Evidence
(a)	Question: Explain, in detail, TWO factors that were behind the drive for dairy conversions in Canterbury. Factors could be economic, environmental, technological, social, political, or workforce. **Explains** TWO factors that were behind the drive for dairy conversions in Canterbury. *Economic* The development of the dairy industry has resulted in a major land use change. In 2009–2010 there were nearly 200 000 hectares in dairy farming, compared with fewer than 20 000 in 1982–1983. The reason for the increase was the increasing returns for dairy production. In the early 2000s land in the Canterbury Plains was a cheaper option than land in the expensive Waikato dairy region. Thus, purchasing a farm in this region may have been more economically viable, along with the good payout. *Social* Canterbury was viewed as a desirable area in many social aspects, including proximity to a city, infrastructure, lifestyle, and the availability of schools. This appealed to share-milkers, who often bought the farms from corporate entities. *Technological* The long history of dairy farming in New Zealand meant that the infrastructure was in place to allow the rapid growth of dairying in Canterbury. There was also technology available to enable development of underutilised water resources. Innovation and new technology were both enablers, as improvements on traditional technologies were needed to operate large, irrigated farms with large herds of cows. *Environment* The flat topography of the Canterbury Plains means that conversion to a pivot-irrigated dairy farm is easy when compared to the rolling, hilly country of other regions. Very good alluvial, free-draining soils makes grass grow well, with the addition of irrigation. Water from the Alps flowing into two major rivers, the Waimakariri and the Rakaia, meant that water was in large supply. Then, with the addition of water schemes such as the Central Plains Water scheme, water was almost guaranteed if farmers bought into the scheme. **Explains, in detail**, TWO factors that were behind the drive for dairy conversions in Canterbury. *Economic* The development of the dairy industry has resulted in a major land use change. In 2009–2010 there were nearly 200 000 hectares in dairy farming, compared with fewer than 20 000 in 1982–1983. The reason for the increase was the increasing returns for dairy production. Early conversions were driven by farmers moving in from other regions where dairy farming was not as favourable. The ability to purchase larger blocks of irrigated land at a lower cost than in other dairying areas

	was the main driver in the move to Canterbury. The second economic factor pushing dairy conversion was the entrance of large corporate entities. However, due to the low operating profits, many corporate farmers had left the industry by the early 1990s, and this meant many farms were sold to their share-milkers, creating a new generation of younger farm owners. The final stage of conversion in the 2000s was the traditional sheep / crop farmers converting to obtain higher levels of profitability. The rate of conversion was influenced by the aggressive lending to dairy farmers by financial institutions. The farms became larger and more intensive with more investment from non-farming investors. Lack of profits in other farming systems provided the opportunity for individuals and co-operatives to purchase cheaper land to convert to dairy farming. Increased land prices in the North Island in the early 1990s led North Islanders to move south in search of cheaper land and bigger farms. *Political* The New Zealand government was thought to have little effect on the growth of the industry. However, government-sponsored projects such as irrigation infrastructure were important to the development of the dairy industry. The government formed the New Zealand Dairy Board, which played a role in the increasing number of dairy conversions in Canterbury. The development of a successful processing co-operative was an important enabler, as the processing of milk meant that growth continued. World trade liberalisation and increased demand for dairy products led to higher prices for dairy products, facilitating growth and increasing profitability. The absence of a capital gains tax in New Zealand may have provided an incentive to farmers to purchase and develop land. *Workforce* As the dairy industry grew, the infrastructure and associated workforce also developed. With a large city nearby, and the land traditionally used for beef and sheep farming, workforce requirements could be met with some retraining. A number of businesses such as electricians, plumbers, engineers, fertiliser spreading and trucking companies were able to expand, and service the growing dairy industry. This allowed farmers to access services they needed, and therefore allow further dairy conversions.
(b)	Question: Evaluate the importance of the two factors you chose in (a) in deciding whether or not to continue using the land for dairy farming. The most important factor in deciding to continue land use is economic. The decision to continue dairying would be mainly based on whether or not it was economically viable. If milk prices drop and profit is reduced, other factors may be outweighed by lack of profit and loss of lifestyle. Workforce considerations are largely linked to the economics of production. If a workforce can be retained at an economically viable cost, then this land use can continue. The current workforce is skilled in current land use and replacements are readily available, due to the location of the industry near large towns and cities. New technologies can be implemented only if in line with economic returns: an initial outlay is needed to enable production to continue. Political factors include funding for new technologies and incentives for production; these can make the current land use viable, or if withdrawn, can encourage a change in land use. Environmental considerations will be included whether the changes need to be made, and how they will affect profit. If an alternative land use can meet environmental considerations and is more economically viable, then it is more likely that a change in land use will be seen. A possible reason not to carry on with dairy farming is that farmers are coming under a lot of public pressure. This is mainly due to the fact that Canterbury is not a

	region that will naturally grow enough grass for dairy cattle production without irrigation. Canterbury is known to have “leaky” soils which means that nitrogen can easily leach through the soil. It also means that the soil will not “hold” onto water easily, meaning a lot of water is needed to keep the pasture at the right dry matter level for peak dairy production. Some sources say that there is an increasing urban / rural divide, caused by anger from the public about lower water levels and eutrophication levels in rivers, which impacts on their recreation and water consumption. If the Labour Party’s water tax policy is implemented, and if farmers are in large debt from the loans that banks were allowing to happen over the dairy boom, then pressure from economics and the general public may be a reason for change out of dairying. With the increased awareness by the public about animal welfare, they are also voicing concern about the fact that when pivot irrigators are used, trees need to be removed which reduces the biodiversity of farms and decreases animal shelter.

Assessment Criteria

Question Three: Piggeries and viticulture

Achievement	Achievement with Merit	Achievement with Excellence
Explains TWO factors that could have determined the land's use as a piggery from the 1950s until 2016.	**Explains**, in detail, TWO factors that could have determined the land's use as a piggery from the 1950s until 2016.	**Justifies** the chosen land use by comparing and contrasting with the other potential land use, considering TWO factors.

N1	Some writing, but does not explain TWO factors that could have determined the land's use as a piggery from the 1950s until 2016.
N2	Partial or insufficient explanation of TWO factors that could have determined the land's use as a piggery from the 1950s until 2016.
A3	Explains TWO factors that could have determined the land's use as a piggery from the 1950s until 2016.
A4	Explains TWO factors that could have determined the land's use as a piggery from the 1950s until 2016. Both require supporting information.
M5	Explains, in detail, TWO factors that could have determined the land's use as a piggery from the 1950s until 2016. ONE factor explained in detail, the other factor explained.
M6	Explains in detail, TWO factors that could have determined the land's use as a piggery from the 1950s until 2016. BOTH factors explained in detail.
E7	Justifies the chosen land use by comparing and contrasting with the other potential land use, considering TWO factors. Comprehensive evidence given for ONE factor, with another factor well supported.
E8	Justifies the chosen land use by comparing and contrasting with the other potential land use, considering TWO factors. Comprehensive supporting evidence given for TWO factors

N0 = No response; no relevant evidence.

Q3	Sample Evidence
(a)	Question: Explain, in detail, TWO factors that could have determined the land's use as a piggery from the 1950s until 2016. **Explains** TWO factors that could have determined the land's use as a piggery from the 1950s until 2016. *Economic* The current land use began as a way of using a waste product. This allowed profit to be made due to low input cost. The land was cheap and the lower transportation costs due to the good road network meant that production was economically viable. *Workforce* The workforce availability would have been high due to the location of the piggery near Blenheim. The commute would have been easy as the township was located nearby. The skills of a trained workforce allowed the continued use of the land as a piggery. When the piggery was established in 1950, the war had just finished, so returned servicemen would have been available to fill vacancies. *Social* The piggery activities would have been far enough from the township to have had a limited impact, at first. The problems due to smell, noise, and industry processes would have become more pronounced as the township grew and encroached on the piggery. This would have made the continued use of the land as a piggery more difficult. But the handy location also brought jobs to the area and a sense of community. *Environmental* Cheaper rural land, enough land to easily dispose of effluent and other wastes. If pigs are housed, then the quality of the soil is not important. **Explains, in detail**, TWO factors that could have determined the land's use as a piggery from the 1950s until 2016. *Social* When the Rivernook Piggery was established it was a long way from the urban areas in a rural setting. As the population of the city grew, more houses needed to be built, which meant areas that were traditionally rural were being developed and used for housing. When areas such as these begin to encroach on rural properties used for primary production such as pig farming, there can be a conflict between the producers and the house owners. Management practices which previously caused no issues for the rural community can begin to affect the new house occupiers. In the example above, the smell from the piggery would have disturbed people and most likely caused complaints from the local community.

	Economic The producer had a workforce and infrastructure for growing and producing pigs. It was profitable as waste products such as food scraps and excess milk could be used to feed the pigs. This allowed profit to be made from pork production due to low input costs. The land was cheap due to its distance from the city, and transportation costs were lower, due to the good road network. This meant that pork production was economically viable.
(b)	Question: Justify either urbanisation or viticulture as a future use for the land the piggery occupies. In your answer, compare and contrast urbanisation with viticulture, considering TWO of the following factors: economic, environmental, technological, social, political, and workforce. **Justifies** the chosen land use by comparing and contrasting with the other potential land use, considering TWO factors. *Urbanisation* More houses are built as the population increases, and this will continue to encroach on the land. People living nearby are in conflict with rural industry activities such as smell and noise. Residents move to rural areas for peace and quiet, and this often does not fit with production land areas. A change to an urbanised area would minimise the impact of noise and smell on the residents. The discharge from the land after continued effluent application due to traditional land use would need to be considered for future land use. Urbanisation would mean less irrigation compared to viticulture, and this could reduce nutrient leaching. Despite increased urbanisation the workforce is no longer specialised to work at the piggery, so without a trained workforce the use of the land for further urbanisation may be the better option. Blenheim is part of the largest viticulture area in New Zealand, therefore a skilled workforce would already be established in the area, and the Marlborough NMIT, based in Blenheim, has viticulture training. Also, once the quality land is lost, it cannot be returned to primary production. The land, 2.8 ha, is not large, in terms of the commercial production of wine, so it could be sold and subdivided, and the money used by the family to purchase more land further from Blenheim. *Viticulture* The land and the weather conditions are suitable for grape growing. Current export prices for wine are high, and the financial returns to growers would be improved. However, similar issues with urban encroachment may be felt if the land was used for viticulture. Industry activities would be noisy, and sprays could be viewed as a nuisance to local residents. Transport links are still proving viable for produce and processing, and a workforce may be available in the town. Blenheim is a tourist area known for its wine tours. Having a small vineyard on the outskirts of town would mean that tourists would not have to go far for a wine experience. The farmer could possibly convert one of the dairy farms to viticulture too, and then merge them, which would make the venture more economically viable. Or they could work with another viticulture grower, selling their product from the 2.8 ha as part of a larger venture.

Cut Scores

Not Achieved	Achieved	Achieved with Merit	Achieved with Excellence
0–6	7–12	13–18	19–24