**Reeftide Environmental & Projects Ltd**
8 Butler Court,
Rolleston, 7614
New Zealand

t: +64 27 673 6006
e: reeftide@gmail.com

| | |
|---|---|
| TO | Two Chain Road Ltd<br>Level 2, ASB House, The Crossing<br>166 Cashel Street<br>Christchurch<br>**Attention**: **Tim Carter/Bruce Van Duyn** |
| FROM | Victor Mthamo |
| DATE | 25 August 2021 |
| FILE | 180-2021 – Two Chain Road Plan Change |
| **SUBJECT** | **7-183 Two Chain Road – Assessment of Potential Loss of Productive Land** |

☒ **Memo Report**

☐ For Information Only

☐ For Your Action

## 1. Introduction

Two Chain Road Limited are intending to submit a private plan change request with Selwyn District Council for land at 7-183 Two Chain Road. The proposed plan change seeks to rezone approximately 98.3 ha of land from the Rural Zone to Business 2A.

Two Chain Road Limited has engaged Reeftide Environmental & Projects Limited (Reeftide) to carry out a desktop study of the effects of the proposal on the productive potential of land.

## 2. Site Description - Location, Existing and Proposed Land Uses

### 2.1. Site Location

The proposed plan change land is currently rural. 77 ha of the land (at 77, 113/139, 183 Two Chain Road) is under one owner. The remaining land (#7, 15, 25, 93, 97 Two Chain Road) has multiple ownership comprising lifestyle blocks ranging in size from 3.77ha to 4.59ha.

South of the proposed plan change is the Main South railway line. There is an existing paper road with access onto Walkers Road running parallel with and close to the railway line.

**Figure 1** shows the location of the proposed plan change area.

### 2.2. Existing Features, Historical and Current Land Uses

The land has a flat topography. There are no special features on the land and currently only has dwellings and shelterbelts.

While the land is in multiple ownership as described in Section 2.1, it generally has a long history of use for lifestyle living and low intensity dryland grazing purposes. More specific land uses include:

- Low stocking rate grazing for dairy cows or yearling steers and bulls on winter feed, oats and grass or kale.
- A horse training establishment.
- Sheep and small livestock grazing on some of the lifestyle blocks.

The land across and north of Two Chain Road is generally lifestyle blocks with grazing and some home businesses.


**Figure 1 – Location of the Proposed Plan Change Area**

Current land use can be summarised as low intensity, low input dryland farming system.

## 3. General Soil Description

S-Maps[1] provides details of the soils under the proposed plan change area. The soils are Lismore, Eyre and Templeton soils. Table 1 provides the areas of each soil sub class. The key properties of these soils are summarised in Table 2 below.

**Table 1 – Area Under Each Soil Type**

| Soil Name | SMap Name | Area (ha) | Percentage |
|---|---|---|---|
| Lismore Soil | Lism_1a.1 | 54 | 54.9% |
| Lismore Soil | Lism_2a.1 | 23.5 | 23.9% |
| Eyre Soil | Eyre_1a.1 | 12.5 | 12.7% |
| Eyre Soil | Eyre_3a.1 | 2.9 | 3.0% |
| Templeton | Temp_2a.1 | 2.8 | 2.8% |
| Eyre Soil | Eyre_2a.1 | 1 | 1.0% |
| Eyre Soil | Eyre_4a.1 | 1 | 1.0% |
| Templeton | Temp_4a.1 | 0.6 | 0.6% |
| **Total Area** | | **98.3** | **100** |

[1] https://smap.landcareresearch.co.nz/

**Table 2 – Soils Characteristics and Properties**

| Soil Type | Lismore Soils | Templeton Soils | Eyre Soils |
|---|---|---|---|
| Area (ha) | 77.5 | 3.4 | 17.4 |
| Soil Long Name | Lismore stony silt loam or shallow silt | Templeton moderately deep silt | Eyre shallow loam/stony silt |
| Soil Texture | Silty Loam | Silty Loam | Loam-Silty Loam |
| Permeability | Moderate over rapid | Moderate over slow | Moderate over rapid |
| Soil Depth | Shallow (20-45 cm) | Shallow (45-100 cm) | Shallow (20-45 cm) |
| Soil Drainage | Well drained | Moderately well drained | Well drained |
| Root Barrier | No barrier | No barrier | Extremely gravelly |
| Run Off Potential | Very Low | Low | Very Low |
| PAW – 0.6 m | 75.6 | 105.3-107.2 | 61-103.3 |
| PAW – 1.0 m | 115.8 | 141.0-153.8 | 77.3-118.8 |

*PAW – Profile available water*

Figure 2 shows the location of the main soil types. Within these main categories are the subtypes listed in Table 1.

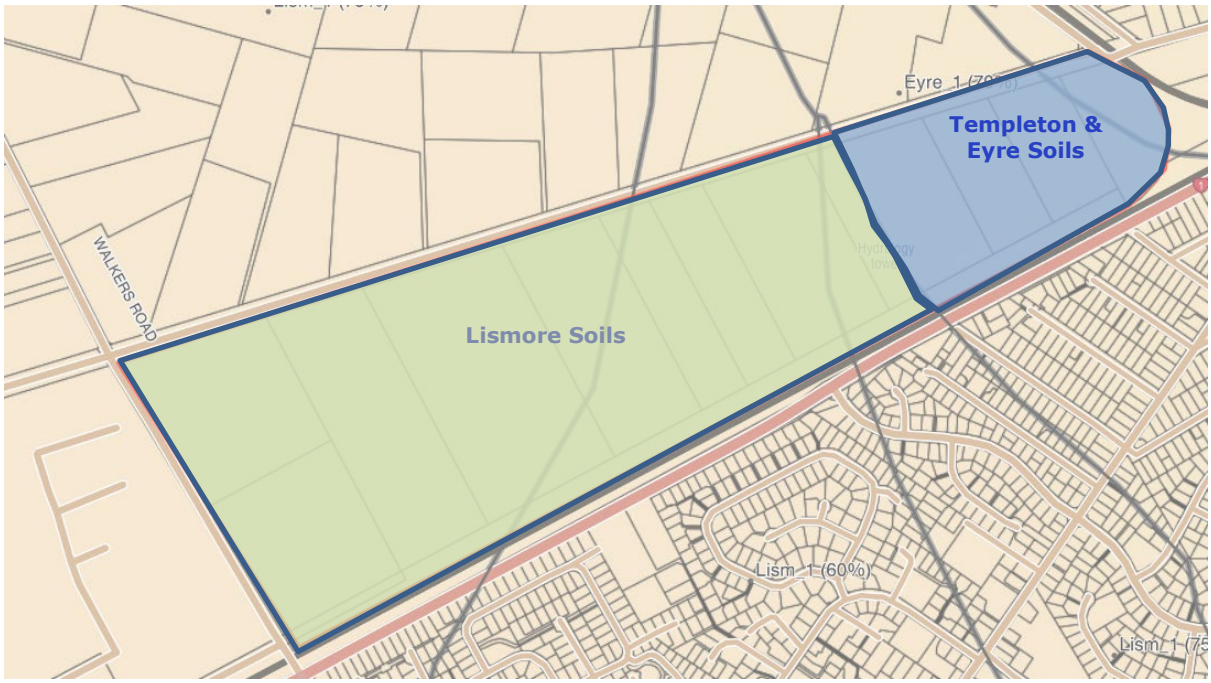


**Figure 2 – General Location of the Main Soil Types**

78.8% of the soils are the shallow stony Lismore soils. These do not hold water very well being very permeable and this affects the soils productive potential.

## 4. Defining Highly Productive Land and Versatile Soils

### 4.1. Introduction

The purpose of this report is to discuss the effects (if any) of the proposed plan change on the land's productive potential. Land productive potential encompasses many facets of which soil is one of them. Most discussions on soils as relates to its ability to support a multitude of productive uses refer to the soils as being versatile. The words high productive land/soil, high class land/soils, versatile soils/land are always used interchangeably (though there could be some technical differences) as Reeftide has done in this report.

High productive land or versatile soils are regarded as the best possible land or soils for agricultural production because of their properties. Various documents and statutory planning tools in New Zealand provide definitions of versatile soils.

A summary of the main definitions of versatile soils or highly productive land are given in the following sections.

## 4.2. The New Zealand Land Resource Inventory-Soils (NZLRIS)

The Land Use Capability (LUC) is described by Lynn et al. (2009)[2]. It is a general purpose, qualitative evaluation system which has been widely applied in New Zealand for planning land use, especially for management and conservation. The land use capability:

- Is the broadest grouping in the capability classification.
- Classifies land according to properties that determine its capacity for sustainable production for cropping, pastoral farming, forestry and soil/water conservation.
- Reflects general versatility of the land and gives the general degree of limitation to use, taking into account the physical limitations to sustained production.

LUC Classification system defines eight LUC Classes. Classes 1–4 are classified as arable land, while LU Classes 5–8 are non-arable. Versatile soils are defined as Class 1, 2, or 3 soils as delineated by the New Zealand Land Resource Inventory (New Zealand Soil Bureau amended 1986).

Figure 3 shows the potential land uses and the relationship between the versatility and LUC Classes.

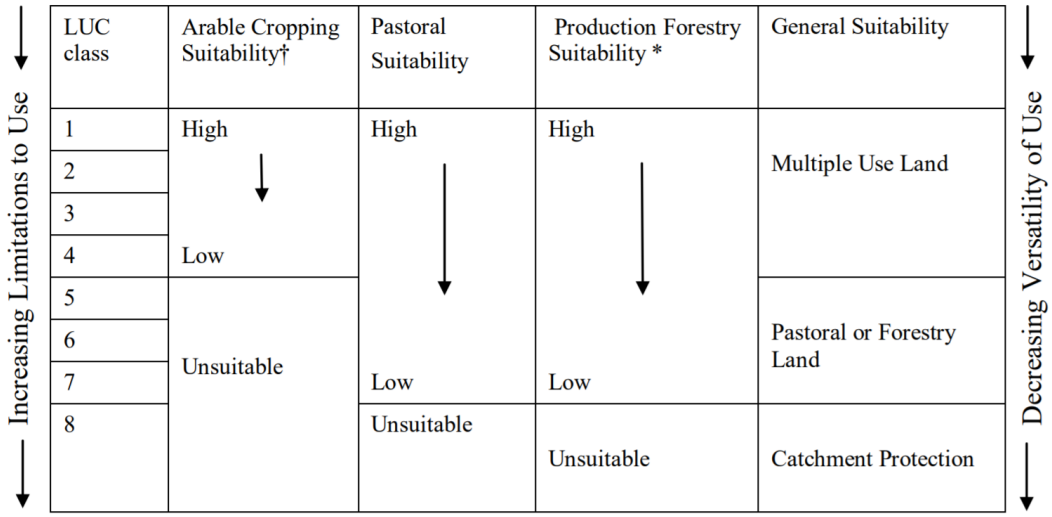


**Figure 3 – Relationship between the Versatility and LUC Classes (Lynn et al, 2009[3])**

## 4.3. Canterbury Regional Council

Canterbury Regional Council (CRC) has policies and plans that cover the use of productive land. These are highlighted in the sections below.

### 4.3.1. Canterbury Regional Policy Statement (CRPS)

The CRPS states that "*Soil versatility is an expression used to describe the land use capability of soils. A highly versatile soil has few limitations for use, that is it will be suitable for primary production with few inputs such as additional water or nutrients. Less versatile soil will need more inputs to achieve similar production or will simply be unsuitable for agriculture or forestry.*

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

[3] *http://envirolink.govt.nz/assets/Envirolink/83-mldc7-MarlboroughSoilsAdvice.pdf*

*In the Canterbury Regional Policy Statement, versatile soils are those soils that are classified as Land Use Capability I or II in the New Zealand Land Resource Inventory*".

Policy 5.3.12 in Chapter 5 of the Regional Policy Statement (CRPS) notes that "*Different soils are valued for different reasons. Versatile soils (Classes I and II under the Land-use Capability Classification System) are that part of the soil resource that will support the widest range of productive uses with the least inputs. Soils with lower versatility can be valued for other rural productive activities, such as vineyards*".

Therefore, in summary CRC defines versatile soils as those that are in LUC Classes 1 and 2.

### 4.4. Selwyn District Council (SDC)

Various SDC statutory documents make reference to versatile soils. For example, in the district plan:

- Objective B1.1.2 seeks to ensure that the Plan achieves s.5(2) of the RMA by ensuring that new residential or business activities do not create shortages of land or soil resources for other activities in the future.
- Policy B1.1.8 seeks to avoid rezoning land which contains versatile soils if the land is appropriate for other activities and there are other areas adjoining townships which are appropriate for residential or business development which do not contain versatile soils.
- The current Rural Volume of the district plan is concerned with the irreversible use of versatile soils.

SDC's definition of versatile soils or highly productive land relies a lot on the definition in the CRPS (Section 4.3). Therefore, versatile soils are those soils that are in LUC 1 and 2 as per the CRPS.

### 4.5. Proposed National Policy Statement for Highly Productive Land (proposed NPS-HPL)

The proposed NPS-HPL defines versatile soils as "...*those soils that fall into land use capability classes (LUC) 1, 2 and 3, meaning those soils with the fewest limitations to their use".*

The stated purpose of the proposed NPS-HPL is to improve the way that highly productive land is managed under the RMA and to protect it from inappropriate use, development, or subdivision.

The proposed NPS-HPL also discusses the importance of specific agricultural production on soil versatility and intends "….*to give councils and their communities the flexibility to identify land that has a lower LUC Class rating (i.e. the less versatile land of LUC Classes 4–8), but also contains special properties that make it highly productive and worth protecting (e.g. suitability of the climate, water availability, size of the area of land)*".

It is important to note that the proposed NPS-HPL is still in draft form and has no legal effect yet, and the provisions will likely change to some extent at least.

In summary, the proposed NPS-HPL considers land that is in LUC Classes 1-3 as highly productive land or versatile soils.

### 4.6. Summary Commentary of the Definitions of Soils Versatility

Use of LUC Classes is the main method of defining versatile soils. Depending on the reference document versatile soils are either in Class 1 and 2 (Canterbury Regional Council Regional Policy Statement) or in Classes 1, 2 and 3 (NZLRI and the proposed NPS-HPL).

## 5. Versatility of the Soils at the Proposed Plan Change Area

The NZLRIS Portal[4] maps the proposed plan change areas as LUC Classes 3 and 4. Figure 4 has been extracted from the portal and it shows the extent of the LUC Classes 3 and 4. The areas of each LUC Class within the proposed plan change area is summarised in Table 3.

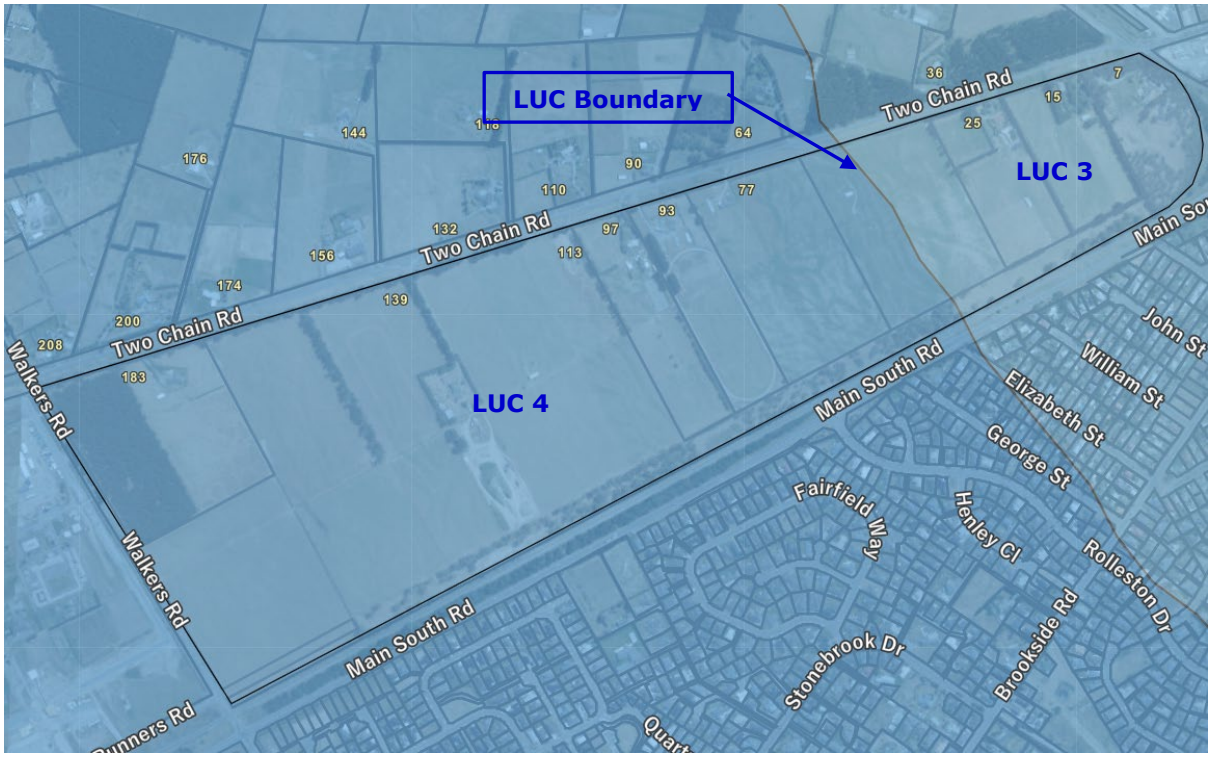


**Figure 4 – Extent of the LUC Classes**

**Table 3 – Area Under Each LUC Class**

| LU Class | Soil Types | Area (ha) | Percentage |
|---|---|---|---|
| LUC4 | Lismore, Templeton, Eyre Soils | 80.2 | 81.6% |
| LUC3 | Templeton, Eyre & Lismore[1] | 18.1 | 18.4% |
| **Total Area** | | **98.3** | **100%** |

*1 – The LUC boundary encroaches into the Templeton and Eyres Soils – as a result some Templeton and Lismore Soils are in LUC 4*

LUC Class 3 is defined as land that:
"*LUC Class 3 lands are arable land with moderate limitations to arable use, which restrict the choice of crops able to be grown and/or make special conservation practices necessary*".

LUC Class 4 is described as land that:
*"..severe physical limitations to arable use. These limitations substantially reduce the range of crops which can be grown and/or make intensive soil conservation and management necessary. In general, class 4 land is suitable only for occasional cropping (once in five years or less) although it is suitable for pasture, tree crops or production forestry. Some class 4 land is also suited to vineyards and berry fields".*

With 100% of the soils being in LUC Classes 3 and 4, the proposed plan change area soils are not highly productive or versatile according to:

- The Canterbury Regional Council Regional Policy Statement as the soils do not fall into the LUC Classes 1 and 2.
- The SDC classification of versatile soils which is aligned to the CRPS definition.

[4] https://soils.landcareresearch.co.nz/soil-data/the-lris-portal/

Extending the definition of highly productive soils beyond that in the CRPS, only 18.4% or 18.1 ha would be classed as highly productive under the definitions in the:

- The NZLRIS which consider LU Classes 1-3 as highly productive.
- The proposed NPS-HPL which includes Class 3 soils in its definition of HPL.

With regards to the proposed NPS-HPL, we note that this in its draft form and it is possible that the final definition could be differ from what is currently proposed given that there was a large number of submissions that proposed changes to the definition as outlined in the draft.

## 6. Assessment of the Productive Potential and Potential Loss of Productive Land

### 6.1. General

In this section we discuss the actual or potential effect of the proposed plan change on highly productive soils.

### 6.2. Scale of Reduction in High Productive Soils

Depending on the LUC definition used, either 100% or 81.6% of the soils are not highly productive. If the CRPS definition is used, then 100% of the soils do not have the same value as the:

- 52,633 ha of versatile soils within Selwyn District comprised of 6,522 hectares of Class 1 land and 46,111 hectares of Class 2; or.
- 293,700 ha of versatile soils within Canterbury comprised of 23,200[5] hectares of Class 1 land and 270,500[5] hectares of Class 2.

Under the CRPS definition there will be no loss in highly productive land.

Table 4 attempts to give a sense of the proportional loss of highly productive soil as a result of the proposed plan change under the proposed NPS-HPL definition.

**Table 4 – Potential Loss in HPL As a Result of the Proposed Plan Change**

| LU Class | Canterbury (ha) | Selwyn (ha) | Plan Change Area (ha) | Percentage of HPL Loss | |
|---|---|---|---|---|---|
| | | | | Canterbury | Selwyn |
| LUC 1 | 23,200 | 6,522 | 0 | **0.0022%** | **0.034%** |
| LUC 2 | 270,500 | 46,111 | 0 | | |
| LUC 3 | 543,000 | N/A | 18.1 | | |
| **Total Area** | **836,700** | **52,633** | **18.1** | | |

If the proposed NPS-HPL definition is adopted the reduction of highly productive land in the region and district would be 0.0022% and 0.034% respectively. The 0.034% reduction in productive land in Selwyn is conservative as this does not include the total area under LUC Class 3 soils in the district.

These potential reductions in highly productive land are important given recent case law. In Jay Gock and Fay Gock v Auckland Council [2019] NZHC 276, the High Court in that case found the Environment Court in error for not considering the proportion of soils on the site relative to the wider region. The bench summarised the case as follows:

"*The Environment Court, in assessing whether the relevant areas of premium soils were significant for their ability to sustain food production, had erred by failing to take into account the insignificant area of such soils involved in the present case (100 ha) in the context of the total area of such soils in the Auckland region (63,000 ha)".*

[5] https://www.tandfonline.com/doi/full/10.1080/00288233.2015.1092996

## 6.3. Moisture Availability and Irrigation

### 6.3.1. Soil Moisture Deficit

The Selwyn District climate can be very hot and dry during in spring and summer at a time when most agricultural production needs moisture the most. These weather conditions significantly affect crop production and ultimately compromises the soil's natural capital or productive potential as it will not matter how inherently fertile or productive the soils are as moisture or irrigation is critical to support crop growth.

To better understand the soil moisture deficits and the need for irrigation in the proposed plan change area Reeftide assessed the soil moisture deficits using data from the NIWA climate database (Cliflo[6]). The nearest (to the proposed plan change area) climatic data available is from the Selwyn District Council Burnham Wastewater Treatment Plant (Agent No 4880). This station has data from 1953 to 2020. Tables 5, 6 and 7 provide summaries statistics on:

- Moisture deficit days,
- Mean moisture deficits; and,
- Maximum moisture deficits.

**Table 5 – No of Monthly Deficit Moisture Days**

| Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 21 | 18 | 14 | 9 | 3 | 0 | 0 | 0 | 1 | 6 | 15 | 19 | 109 |
| Minimum | 7 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 62 |
| Maximum | 30 | 26 | 30 | 28 | 21 | 1 | 8 | 0 | 18 | 28 | 28 | 31 | 167 |

Table 5 shows that there was an average of 109 and a maximum of 167 days per year when soil moisture deficits were experienced. Most of these deficits were from later in spring and throughout the summer months. For some crops peak growth occurs in the December, January and February and this when soil moisture is most limiting to crop growth. The average number of deficits in January is 21 days out of 31 days in the month. There were a few times over the years when deficits were experienced every day in January.

**Table 6 – Monthly Mean Moisture Deficits (mm)**

| Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 122 | 123 | 109 | 91 | 62 | 29 | 13 | 11 | 27 | 57 | 94 | 113 |
| Minimum | 60 | 44 | 35 | 18 | 2 | 1 | 0 | 1 | 2 | 8 | 26 | 55 |
| Maximum | 146 | 142 | 143 | 143 | 124 | 104 | 66 | 63 | 87 | 129 | 133 | 138 |

**Table 7 – Monthly Maximum Moisture Deficits (mm)**

| Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 135 | 135 | 127 | 112 | 84 | 47 | 23 | 21 | 45 | 81 | 115 | 129 |
| Minimum | 101 | 75 | 61 | 46 | 5 | 2 | 2 | 4 | 6 | 23 | 56 | 86 |
| Maximum | 149 | 147 | 146 | 146 | 144 | 112 | 88 | 74 | 105 | 142 | 140 | 146 |

Table 6 and 7 show that:

- The mean monthly moisture deficits in the summer months range from 55-146 mm.
- The maximum moisture deficits in the summer months range from 86-149 mm.
- These deficits explain the low intensity production within the proposed plan change land.

### 6.3.2. Irrigation Water Availability

The deficits in Tables 6 and 7 would need to be compensated for by providing irrigation. For example, the average deficit of 122 mm in January would need at least an equivalent amount

[6] https://cliflo.niwa.co.nz/

of irrigation water to ensure that the soil moisture stayed between field capacity and the allowable depletion point.

For completeness, Reeftide has used IrriCal[7] to estimate the irrigation requirements in 9 out of 10 years for pasture assuming an irrigation system with an 80% efficiency. IrriCalc is a tool for calculating irrigation water demand. It is an approved method and meets the CLWRP Schedule 10 requirements. Table 8 summarises the monthly irrigation application depths based on long term climatic data.

**Table 8 – Irrigation Requirements for Pasture in the Plan Change Area**

| Statistic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 116 | 92 | 24 | 3 | 0 | 0 | 0 | 0 | 9 | 56 | 72 | 115 |
| 90%tile | 132 | 132 | 88 | 44 | 0 | 0 | 0 | 0 | 44 | 88 | 88 | 132 |

Table 8 shows that 116-132 mm of irrigation is required in January to maintain a good pasture system. These irrigation requirements are consistent with the moisture deficits in Tables 6 and 7 with any differences due to the range of climatic data used by the different tools.

The Canterbury Maps GIS[8] was interrogated, and it shows that there are no resource consents for taking groundwater for irrigation in any of the properties making up the proposed plan change area. This means that the high evapotranspiration rates and low rainfall and the accompanying moisture deficits significantly reduce the productive potential of the land. Therefore, irrigation is critical for production.

The proposed plan change area is within the Christchurch West Melton Groundwater Zone. This zone is overallocated and consequently new applications to take groundwater for irrigation are prohibited activities under the CLWRP. In other words, no new consents to take water for irrigation will be granted.

### 6.3.3. Summary

Without irrigation both the LUC Class 3 and 4 soils will never achieve their full productive potential. Without irrigation, the 18.1 ha of LUC Class 3 soil loses its natural capital as a potential highly productive under some definitions (e.g. the proposed NPS-HPL).

Therefore, the proposed plan change is unlikely to reduce the productive potential of the LUC Class 3 land as this is already a low intensity and low input production system that is compromised by the lack of water for irrigation to compensate for the soil moisture deficits.

## 6.4. Canterbury Land and Water Regional Plan

The CLWRP's Selwyn Te Waihora Sub-regional plan has limits on the discharge of nitrates and phosphorus from various farming activities. The CLWRP Plan Change 7 also limits some farming activities (e.g. commercial vegetable growing operations) due to the proposed nutrient limits.

The CLWRP requires that baseline nutrient budgets be established based on the farming activities during the period 2009-2013. As the productivity has always been low due to lack of irrigation water and the baseline nitrogen leaching rates are also very low. Future nitrogen leaching rates are required to not to exceed the baseline rates and where they exceed the 15 kg N/ha/year, the plan requires reductions be implemented by 2022 on the following basis:

*"…dairy farmers being required to reduce by 30%, dairy support by 22%, pigs by 20%, irrigated sheep, beef or deer by 5%, dryland sheep and beef by 2%, arable by 7%, fruit, viticulture or vegetables by 8% and all other sectors 0%. Properties do not need to reduce if their nitrogen loss is below 15kgN/ha/yr".*

[7] http://mycatchment.info/
[8] https://canterburymaps.govt.nz/

These considerations potentially limit future increases in inputs to enhance crop/pasture yields and this in turn limits the future productivity. Therefore, any natural capital that the 18.1 ha of LUC Class 3 soils has, is negated by the statutory constraints imposed by the CLWRP.

## 7. Summary and Conclusions

The soils in the proposed plan change area fall in LUC Classes 3 (18.4% or 18.1 ha) and 4 (81.6% or 80.2 ha) and are, therefore, not versatile soils according to the definition in the CRPS.

Taking a more conservative approach and assuming that the proposed NPS-HPL definition (Section 4.5) is adopted, the 18.1 ha of LUC Class 3 soils could be defined as highly productive soils. However, whatever natural inherent capital these soils have to be classed as highly productive soils will be affected and compromised by:

- The soil moisture deficits experienced in the areas. Data from NIWA shows that an average of 109 days per year experience moisture deficits and the average summer deficits range from 55-146 mm and the maximum summer deficits 86-149 mm. These deficits occur during the summer months when the crops/plants at peak and critical growth phases.
- Irrigation water would be required to overcome the deficits and meet the crops' water requirements without which productivity is severely constrained. However, the land has no consents to take groundwater. The proposed plan change area is in an overallocated groundwater zone and new consents to take water for irrigation are a prohibited activity. Therefore, the production potential of the land is unlikely to ever increase beyond what dryland agriculture can achieve and this is well below the potential of the land.
- The land is currently used for grazing and is not intensely farmed. Under the CLWRP and the provisions in the Selwyn Te Waihora Sub-regional plan intensive farming may not be possible as due to restrictions on nutrient losses being limited to the dryland agriculture baseline based.
- The proportion of land that is LUC Class 3 is only 0.0022% and <0.034% in Canterbury and Selwyn respectively. The Jay Gock and Fay Gock v Auckland Council case established the need to take into account the expected proportional reduction in highly productive soils.

In conclusion, the proposed plan change land is not highly productive land as it is not in LUC Classes 1 and 2 as defined in the CRPS. If the proposed NPS-HPL becomes operative, the 18.1 ha of LUC Class 3 makes up only 18.4% of the plan change area. The 18.1 ha is unlikely to be highly productive due to a number of constraints (as listed above).

Therefore, we conclude that it is unlikely that changing the land use from Rural to Business 2A will reduce the quantities of the highly productive land in the district and in the Canterbury region.