Before Independent Commissioners Appointed by the Canterbury Regional Council and Selwyn District Council

In the matter of	The Resource Management Act 1991
And	
In the matter of	Applications by **Fulton Hogan Limited** for all resource consents necessary to establish, operate, maintain and close an aggregate quarry (**Roydon Quarry**) between Curraghs, Dawsons, Maddisons and Jones Roads, Templeton

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SUPPLEMENTARY EVIDENCE OF VICTOR MTHAMO ON BEHALF OF FULTON HOGAN LIMITED

VERSATILE SOILS

DATED: 29 JANUARY 2020

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Introduction

1. My full name is Victor Mkurutsi Mthamo.

2. My area of expertise is the development of effective and sustainable rehabilitation plans for quarries. I focus on ensuring that a rehabilitated site can be used for as many land use options as are possible and permissible under the current statutory planning requirements. My expertise also covers soil use, soil assessments and strategies to ensure the soil production potential is maintained or realised.

3. I have previously provided three written briefs of evidence in relation to the Roydon Quarry Proposal: primary evidence dated 23 September 2019; rebuttal evidence dated 21 October 2019; and supplementary rebuttal evidence dated 30 October 2019. I also prepared a written summary of my evidence, dated 13 November 2019. I confirm my qualifications and experience as set out in Paragraph 5 of my primary evidence.

4. I also confirm I have read and agree to comply with those parts of the Environment Court Practice Note that bear on my role as an expert witness, in accordance with paragraph 11 of my earlier evidence.

Scope

5. The issue of versatile soils assumed some prominence during the last 3 days of the hearing in December 2019.

6. I understand some submitters questioned the impact of removing the existing topsoil on post-quarrying soil productivity. As a result, I understand the Panel has sought further expert opinion on this particular topic.

7. I have, therefore, been asked by Fulton Hogan to provide a brief statement which:

   (a) Addresses the presence of any versatile soils on the site;

   (b) Addresses the effect of the proposal on any such soils; and

   (c) Provides an assessment of the effects of the proposal against any relevant planning provisions, including Policy 5.3.12 in Chapter 5 of the Regional Policy Statement (**RPS**).

Description of the Existing Soils

8. S-Maps Online[1] and Canterbury Maps[2] provide details of the soils under the proposed Roydon Quarry site. The soils are primarily Templeton and Eyre stony silt loams.

9. The S-Maps for the soils under the site provide the average soil depths as follows:

9.1 The Templeton silty loams have a soil depths of up to 1 m with the topsoil depth ranging from 250-500 mm.

9.2 Eyre shallow silty loams and the Eyre stony loam soils have soil depths in the range 200-450 mm. The topsoil depths vary between 200 mm and 300 mm.

10. Fulton Hogan carried out some test pitting on the site in 2018. They found that the topsoils had an average depth of 200 mm across the site.

11. Table 1 below has been extracted from the S-Maps. It provides details of the Templeton and Eyre soils subtypes under the site, the proportion of each soil type and subtype, the profile available water at 0.6 m depth and 1.0 m depth.

Table 1 – Overview of Soils at the Proposed Quarry Site

Soil Type	**Area (ha)**	**% Area**	**0.6 m – Profile Available Water (PAW)**	**1.0 m - Profile Available Water (PAW)**
Templeton Soils				
S-Map Name				
Temp 2a.1	39.99	23.4%	104.1	133.4
Temp 1a.1	6.48	3.8%	96.6	159.6
Temp 3a.2	49.63	29.0%	109	166.9
Temp 4a.1	21.35	12.5%	58.5	69.1
Temp 4a.2	21.27	12.4%	105.1	132.5
Subtotal	**138.715**	**81.2%**		
Eyre Soils				
S-Map Name				
Eyre 1a.1	28.16	16.5%	113	122.6
Eyre 3a.1	4.025	2.4%	70.5	80.3
Subtotal	**32.185**	**18.8%**		
Totals	**170.9**	**100%**		

12. Table 1 shows that:

12.1 Over 81.2% of the soils are Templeton. They cover an area of 138.7 ha of the 170.9 ha site.

[1] https://smap.landcareresearch.co.nz/
[2] *https://canterburymaps.govt.nz/*

12.2 The Eyre soils are over an area of 32.2 ha and make up 18.8% of the site.

12.3 The Templeton soils generally have higher water holding capacity potential than the associated shallow and stony Eyre soils, which are far more free draining than the Templeton soils.

Production Potential of the Existing Soils

13. Templeton series soils are:

    (a) Well suited for mixed farming, market gardening and fruit growing if irrigated. On the other hand, the Eyre soils are less versatile due to low water holding capacity and are best suited for extensive grazing of sheep and urban use.

    (b) Research[3,4] indicates that yield production under Templeton soils is generally twice as much as that under Eyre soils.

14. The Eyre soils:

    (a) Range from excessively drained stony sandy loams to well drained shallow silt loams.

    (b) Are generally shallow soils and include silt loam and sandy loam scattered over gravels.

    (c) Are more susceptible to wind erosion, but only if the soils are over-cultivated.

15. Both soils:

    (a) Are seasonally droughty.

    (b) Have moderately free to very free internal drainage.

    (c) Require irrigation for intensive use or their maximum production potential to be realised.

16. The actual soil conditions under the site determine the production potential. I have noted in Paragraph 10 that the actual topsoil depth as determined from onsite test pits is 200 mm.

[3] https://www.tandfonline.com/doi/pdf/10.1080/03015521.1980.10426244
[4] https://www.tandfonline.com/doi/pdf/10.1080/03015521.1983.10427771

Soil Versatility and Classification of the Soils at Roydon

17. In this section I discuss the concept of soil versatility - the properties which describe a soil resource and of those properties, those that would determine a soil to be versatile.

18. Versatile soils are defined by various authors as follows:

    (a) Hewitt[5] describes a versatile soil as one that is capable of many uses and such a soil "…*needs* to be deep, fine-textured, moist, free-draining, loamy, and have an organic-rich topsoil. These properties best enable plant roots to take up nutrients, water and oxygen, and get enough support for rapid growth. Fertility is highest in soils young enough not to have been leached and old enough to have built up organic matter. They are also derived from parent rocks that are well supplied with essential nutrients."

    (b) Chapman[6] defines a versatile soil as one that has "…the ability to support production and management of a wide range of crops. It is mainly assessed in terms of soil and land physical characteristics, which have few limitations, such as poor drainage or slope instability".

    (c) According to Hewitt (2013)[7] "Our best soils – are called 'versatile' or 'high class soils' and are the soils that would be regarded as having the highest soil natural capital. National analysis of our most versatile soils shows the area is limited to about 5.5% of the area of New Zealand. These soils are most common among the Recent and Allophanic Soils".

19. The Land Use Capability (**LUC**) classification 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 LUC:

    (a) Is the broadest grouping in the capability classification.

    (b) Classifies land according to properties that determine its capacity for sustainable production for cropping, pastoral farming, forestry and soil/water conservation.

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[5] *Hewitt, A. E. 'Soils - What makes a good soil?', Te Ara - the Encyclopedia of New Zealand, updated 1-Mar-09 URL: http://www.TeAra.govt.nz/en/soils/*

[6] *Chapman, R. K. 2010. Soil Assessment for the Kingseat Village Structure Plan site - May - 2010. Evidence submitted to Franklin District Council.*

[7] *Hewitt A. 2013. Survey of New Zealand soil orders. In Dymond JR ed. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, New Zealand.*

(c) Reflects general versatility of the land and gives the general degree of limitation to use, taking into account the physical limitations to sustained production.

20. The LUC classification system by Lynn et al. (2009)[8] defines eight LUC classes. Classes 1–4 are classified as arable land, while LUC Classes 5–8 are non-arable. **Attachment 1** provides a description of the suitable land use for the eight LUC classes.

21. 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).

22. Figure 1 shows the potential land uses and the relationship between the versatility and LUC classes.

Figure 1 – Relationship between the Versatility and LUC Classes (Lynn et al, 2009[9])

Increasing Limitations to Use ↓

LUC class	Arable Cropping Suitability†	Pastoral Suitability	Production Forestry Suitability *	General Suitability
1	High ↓	High ↓	High ↓	Multiple Use Land
2				
3				
4	Low			
5	Unsuitable	Low	Low	Pastoral or Forestry Land
6				
7				
8		Unsuitable	Unsuitable	Catchment Protection

↓ Decreasing Versatility of Use

23. The Eyre and Templeton soils at proposed Roydon quarry:

(a) Have properties that qualify them as versatile soils:

(i) Based on properties such as physical limitations, land use suitability, slope limitations, characteristic soil stoniness, depth and workability, texture, drainage salinity and elevation, fall into LUC Class 2-3.

(ii) As described in **Attachment 1**.

[8] *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.*

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

(b) However, they are unlikely to be in LUC Class 1 as:

(i) These classes are reserved for the high natural capital soils described by Hewitt (2013) in Paragraph 18(c) above.

(ii) The soil depths observed on site are not consistent with the description in **Attachment 1**.

24. Most of the Templeton soils (except the shallower Temp 4a.1) are more versatile and are likely to be in Class 2 than the shallower and stonier Eyre soils as I have outlined in Paragraph 13. I consider the Eyre soils and the Templeton Temp 4a.1 to be Class 3 soils.

Post Quarrying Soil Status

25. The proposed minimum 300 mm topsoil will enhance the desired rehabilitated outcomes as it will be able to sustain plant growth. However, there are a number of factors that determine the extent to which this is achieved. These are:

(a) The topsoil's biological, chemical and physical characteristics which determine the soil fertility.

(b) The key chemical properties are pH, electrical conductivity, phosphorus and exchangeable sodium percentage (ESP). Physical properties include permeability, water holding capacity, soil density and drainage characteristics. Soil profile characteristics such as soil structure, soil texture, stoniness, soil depth, depth to rock, observed root depth, colour and mottling provide an indication of the soil fertility and usefulness for plant growth.

26. Having been to some of the current sites operated by Fulton Hogan, I note that Fulton Hogan has gained considerable experience in managing rehabilitated areas to enhance the above soil properties and hence plant growth. I am, therefore, confident that the rehabilitation processes and the rehabilitated areas will be managed and operated to ensure that the minimum 300 mm of soil will have good soil health and will enhance optimal plant growth.

27. The observed sites show that the rehabilitated land seems to be sustainably growing grass over the topsoil which is similar to what is proposed under this proposal.

28. Use of the stockpiled soil and overburden materials for rehabilitation (as described in Section 3.3 of the Draft Rehabilitation Plan) would be similar to reconstructing the topsoil pre-quarrying. If the stored soil is reused for rehabilitation, I would recommend that the work be carried out when the soil materials are friable. Wet or damp soils are easily compacted and will be much less able to grow plants than if they were handled when friable (as discussed in Section 3.5 and Table 5 of the Draft Rehabilitation Plan, where the need to ensure that the soil is not compacted (i.e. is friable) is emphasised).

29. Thorough site preparation will be important to ensure that the soil will support the plantings. For example, if the soil gets compacted during placement this can be addressed by ripping the soil to break the pans and ensure good root aeration, water movement through the soil etc as noted in Section 3.5 of the Draft Rehabilitation Plan.

30. In Paragraphs 19-22 I have discussed the LUCs. It is my expert opinion that the proposed 300 mm topsoil rehabilitation will result in a landform and soils that also fall under LUC Classes 2 and/or 3 as described in **Attachment 1**.

30.1 Achieving a consistent Class 2 soil (as defined in **Attachment 1**) across the rehabilitated quarry floor by reducing the physical limitations to arable use is possible. This can be done by achieving a flatter (i.e. fewer undulations) quarry floor landform, better management of the land/soils, reducing the erosion potential (to a level better that the Eyre soils I mentioned in Paragraph 14(c)) and making the soils easier to work with as described in **Attachment 1** for Class 2 soils. It is my opinion that the methodology described in the Draft Quarry Rehabilitation Plan, and the use of some of the existing topsoil for rehabilitation will inherently produce a similar outcome. However, I think the resulting soils post rehabilitation, whether they fall into Class 2 and/or 3, will be versatile (as defined by the LUC classification discussed in Paragraph 21) and just as productive as the current soils.

30.2 However, the reduced soil matrix depth post-rehabilitation will likely reduce the total water available for abstraction in the soils compared to the existing soils. Soils with lower water holding capacity (such as Eyre 3a.1 and Templeton 4a.1 and Templeton 1a.1 in Table 1 above) will require more frequent irrigation water than those with higher water holding capacities to sustain the same level of productivity. However, the reduction in water holding capacity may be immaterial depending on what is grown. Some crops have shallow rooting systems and so are able to abstract all their

moisture requirements within the available soil depth irrespective of the overall soil water holding capacity or the total water available for abstraction.

31. Water holding capacity can, also, improve overtime. Revegetation can improve soil properties such as water holding capacity and soil plant growth conditions through extensive root systems development, increased soil organic matter, lower bulk density and moderate soil pH, thereby improving soil nutrient availability. Thus, over time I would expect the topsoil used for rehabilitation to continue to improve.

Factors that have an Impact on the Productivity Potential of Versatile Soils

32. Versatile soils are inherently fertile and are considered to be capable of producing abundant yields of crops, pasture, plants and other primary products (**Attachment 1**).

33. However, placing high importance on the productivity potential by having regard only to the classification of versatile soils only, fails to take into consideration other factors that are essential for an agricultural production system to be viable. For example, the availability of moisture through rainfall or irrigation is important for maximum yields to be attached.

34. In Paragraph 46.1 of my evidence in chief (dated 23 September 2019) I noted that intensive farming on the property both pre and post quarry development would likely be hindered by other factors such as the availability of irrigation water and statutory constraints:

    (a) With regards to irrigation, the existing consent CRC182422 provides sufficient water for the irrigation of only 32 ha. Thus, based on water supply only 32 ha could be intensively used for agricultural production.

        (i) The likelihood of getting more water is very low because the property is in a fully allocated groundwater zone which means applying for an increased or new groundwater allocation will likely be non-complying at best (under Rule 5.129 of the CLWRP) or at worst a prohibited activity (under Rule 5.130 of the CLWRP).

        (ii) Therefore, the current production potential of the soils will also be limited by the available moisture.

    (b) The other factors that I considered as limiting in Paragraph 46.2 of my evidence, were the current and future regional planning rules. I noted that:

(i) "The Canterbury Land and Water Regional Plan (CLWRP)'s Selwyn Te Waihora Sub-regional plan has limits on the discharge of nitrates and phosphorus from various farming activities. For example, according to the plan, if the nitrogen loss for a property is more than 15 kgN/ha/yr, further reductions are required by 2022. These reductions are sector specific, with 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.

(ii) The proposed CLWRP Plan Change 7 will also limit some more farming activities (e.g. commercial vegetable growing operations) due to the proposed nutrient limits.

(iii) "…some farming activities would not be economically feasible due to nutrient limits".

35. I agree with work by others (e.g. Treadwell, 1997[10]) that versatile soils/land should not be based just on the soils inherent properties but must be based on broader considerations than the land use capability, that I discussed in Paragraphs 19-24 and outlined in **Attachment 1**.

36. A comprehensive list of factors that should also be considered when defining versatile soils is provided in Table 2. Based on my experience, I agree with most of the factors listed in Table 2 – especially those that relate to the soils, site, climate and crops. A good soil that falls into the LUC Classes 1-3 can still be disqualified for a farming use by one or several of the factors in Table 2.

Table 2 – List of Factors Determining Versatility (Treadwell, 1997[10])

Soil texture	Soil structure	Soil water holding capacity
Soil organic matter stability	Site's slope	Site drainage
Temperature of the site	Aspect of the site	Stormwater movements
Flood plain matters	Wind exposure	Shelter planted
Availability of irrigation water	Transport, both ease and distance	Effect of the neighbours on the use
Access from the road	Proximity to airport	Proximity to port
Supply of labour	Previous cropping history	Soil contamination
Sunlight hours	Electricity supply	District scheme
Economic and resale factors		

[10] *Canterbury Regional Council v Selwyn District Council [1997] NZRMA 25, Judge Treadwell presiding.*

Summary and Conclusion

37. By LUC definition alone, the Eyre and Templeton soils are versatile soils as I described in Paragraph 23.

38. Following rehabilitation, the soils on the site will:

    (a) At the least, be just as versatile as the existing land. I consider, however, a consistent Class 2 soil is possible (but not necessary) if the methodology proposed in the Draft Rehabilitation Plan is implemented. This will make the overall soils across the site potentially better than the current soils which are a mixture of LUC Classes 2 and 3. In summary, the soils post rehabilitation will be no less versatile than they are pre-quarrying.

    (b) Possibly require more inputs than the existing Class 2 soils as the existing Class 2 soils are deeper in some parts of the land e.g. the rehabilitated soils may require more frequent watering that some of the Templeton and Eyre soils in Table 1 that have higher water holding capacities, but may require the same or less water than the soils in Table 1 that have lower holding capacities.

39. However, I consider that the existing versatility of the soils is impacted by several other factors and therefore should not be overstated in assessing whether or not the current agricultural production system is any more viable than the post quarrying agricultural land uses. Importantly, the site has limited access to irrigation water and is subject to restrictions on nitrate discharges.

40. It is possible that the post rehabilitation land/soils might actually be more versatile given the level of management/attention that will be required to comply with the various consent conditions (such as the requirements under CRC192408 and CRC192409 to use clean fill materials that meet the Canterbury region background concentrations; the requirement under Condition 2 for only clean soil to be brought to the site; the requirement under CRC192413 to ensure that soils from HAIL areas within the site, validated as being below applicable standards/guidelines for rural residential land use but above background soil levels for the local soil type, not be deposited more than 5 m below original ground level) that will be put in place should the commissioners grant the quarrying consents.

41. While the physical and chemical attributes of the existing soils show that they are versatile soils, when other site constraints such availability of irrigation water, statutory planning constraints and those in Table 2 are taken into account it is my opinion the productivity potential of the existing soils is fairly limited and will not be materially different post-rehabilitation.

Planning Provisions

42. I have been asked to comment on whether the proposal is consistent with Policies 5.3.12 and 5.1.1 in Chapter 5 of the Regional Policy Statement (**RPS**) and Objective 3.23 in Chapter 3 of the RPS.

Assessment of the Proposed Activity Against Policy 5.3.12

43. Policy 5.3.12 seeks:

43.1 To enable the use of natural and physical resources to maintain the rural productive base as a foreseeable need of future generations.

43.2 "To maintain and enhance natural and physical resources contributing to Canterbury's overall rural productive economy in areas which are valued for existing or foreseeable future primary production".

43.3 The management of those areas of rural Canterbury for which inherent characteristics and location meaningfully contribute, or will foreseeably contribute, to the rural productive economy of Canterbury.

44. The natural resources referred to in the policy include soil. The policy notes that:

44.1 *"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.*

45. I note that Policy 5.3.12 only considers Class 1 and 2 soils as versatile soils whereas the LUC Classification defines versatile soils as soils that fall into the LUC Classes 1-3 (Paragraph 21).

45.1 The definition in the CLWRP is more limiting and under this definition only some of the Templeton soils would be considered versatile as the Eyre soils and the Templeton Temp 4a.1 soils are in LUC Class 3 and therefore not considered versatile soils under the RPS.

46. I have discussed the versatility of the existing soils and the post rehabilitated soils and landform in Paragraphs 19-39 above. I concluded in Paragraphs 37-38 that the rehabilitated soils may primarily be in the LUC Classes 2 compared to the existing soils which are approximately 68% LUC Class 2 and 32% LUC Class 3. Therefore:

47. The post rehabilitated soils will not limit the range of possible land uses on the site compared to the pre-quarry state. However, the soils' management requirements may be more, for example, with respect to the use and management of fertilisers as I outlined in Paragraph 57.3 of my evidence dated 23 September 2019.

47.1 The productivity potential post quarrying will be materially the same to the pre-quarrying levels. In other words, the soils will inherently be capable of producing just as much as the pre-quarrying soils. However, the level of management and inputs required might be higher post quarrying because of:

(a) the need to comply with the various consent conditions (such as the requirement to provide irrigation for grass establishment in Condition 70 of the district council consent RC185627; the monitoring and grass management required under Condition 30 of CRC192408 and CRC192409) for post quarrying land use management.

(b) The additional inputs and management requirements required to yield the same production, given the reduced depth to groundwater e.g. during an irrigation event the application depth would need to be smaller than under the existing pre-quarrying management but more frequent applications would be required. The same applies to fertiliser applications – small applications but more frequent.

(c) If under cropping or pasture (i) and (ii) above may or may not result in increased production costs.

48. In my opinion, the existing (and most likely future) statutory controls and limitations on available irrigation water will be the main productivity constraint.

49. In my opinion soil versatility is not defined on the basis of LUC Classes alone. There are other factors that impact productivity potential that should also be considered in deciding whether a soil is versatile or not. It is my opinion that the post-quarrying soils will not be too different from the pre-

quarrying soils with regards to the production potential. This is especially so when:

(a) The proposed rehabilitation methodology is taken into account whereby as much of the existing topsoil as possible will be reused during rehabilitation as described in Section 3.3 of the Draft Quarry Rehabilitation Plan.

(b) The proposed mitigation (outlined in Table 5 of the Draft Quarry Rehabilitation Plan and in Paragraphs 34.6-34.8 and 57.3 of my evidence dated 23 September 2019).

(c) The potential productivity for the existing soils is already limited by constraints such as a lack of irrigation water and statutory nutrients limits.

50. It seems clear to me that the wording in Policy 5.3.12 had in mind the potential loss of productive soils as a result of urban expansion and subdivision of land for residential purposes. It is worth noting that the use of the land for quarrying will not result in the complete loss of productive land. The post quarrying rehabilitation will result in continued availability of the site for productive land use.

Assessment of the Proposed Activity Against Issue 5.1.1(7)

51. Issue 5.1.1(7) is concerned with:

> *The adverse effects on the environment of particular concern is the reduction in the rural primary productive base of Canterbury;*

52. The planned quarry rehabilitation will ensure:

(a) That a 300 mm depth of topsoil is provided, as I have discussed in Paragraphs 25, 26 and 30.

(b) As a result, I consider the productivity potential of the soils post-rehabilitation will just be as effective as they are pre-quarrying (as discussed in Paragraphs 32, 34, 46 and 49).

53. Therefore, the proposed quarry will not necessarily cause the adverse effects raised in Issue 5.1.1(7). The only reduction in productive land that I can envisage will be the areas that may (by choice e.g. accessways) not be planted post quarrying as these will not be able to be used for productive uses.

Assessment of the Proposed Activity Against Objective 3.23

54. Objective 3.23 seeks to ensure:

    (a) Soils are healthy and productive, and

    (b) Human-induced erosion and contamination are minimised.

55. I consider that the proposal will achieve the goals of Objective 3.23 because:

    (a) As I have discussed in Paragraphs 37-39 and Paragraphs 46-49, the versatility of the soils will be maintained post-rehabilitation and the soil's productive potential will be maintained such that the range of available land uses post-rehabilitation are similar to the range currently available. The soils post-rehabilitation will be healthy and productive just as well as they are pre-quarrying.

55.2 The final quarry floor levels will be lower than the existing levels. This means the effects of the winds on soil erosion will be less than under the current state, which I mentioned in Paragraph 14(c).

55.3 The final quarry floor level will also be flat and not as undulating as the current state of the site. This means that potential effects of rain on erosion will be a lot lower than under the current rolling and undulating landform. I have also noted in Paragraph 30.1 that ensuring that erosion potential is minimised post-quarrying will make for better soils that will fall in the LUC Class 2.

Conclusion regarding planning provisions

56. In conclusion, the matters and the proposed rehabilitation and mitigation measures outlined in the Draft Quarry Rehabilitation Plan, in conjunction with the draft consent conditions (I have outlined in Paragraphs 40 and 47.1), will ensure that the proposal is consistent with Policy 5.3.12, Objective 3.23 and Issue 5.1.1(7) of the Regional Policy Statement.

Victor Mthamo
29 January 2020

ATTACHMENT 1 – LAND USE CAPABILITY CLASSES

LUC Class	General Description	Suitable Land Uses
1	Versatile multiple-use land with minimal physical limitations for arable use. Flat to undulating land with deep resilient and easily worked soils and a minimal erosion risk under cultivation.	Highly suitable for cultivated cropping (many different crop types), viticulture, berry production, pastoralism, tree crops, and production forestry.
2	Very good land with slight physical limitations to arable use readily controlled by management and soil conservation practices. Flat to undulating land with moderately deep soils, slightly difficult to work with a slight erosion risk under cultivation.	Suitable for many cultivated crops vineyards and berry fields, pasture, tree crops, and production forestry
3	Land with moderate physical limitations to arable use. These limitations restrict the choice of crops and intensity of cultivation, and /or make special soil conservation practice necessary. Undulating to rolling land with shallow &/or stony soils, often difficult to work with a slight to moderate erosion risk under cultivation.	Suitable for cultivated crops, vineyards and berry fields, pasture, tree crops, and production forestry
4	Land with 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. Ranges from flat to strongly rolling land with very shallow &/or stony soils, often difficult to work with a severe erosion risk under cultivation.	Suitable for some cultivated crops, vineyards and berry fields, pasture, tree crops, and production forestry
5	High-producing land with physical limitations that make it unsuitable for arable cropping, but only negligible to slight limitations or hazards to pastoral, vineyard, tree crop or production forestry use. Includes non-arable land with a slight erosion limitation or hazard under permanent vegetation cover.	Negligible to slight limitations or hazards to pastoral, vineyard, tree crop or production forestry use.
6	Non-arable land that has slight to moderate physical limitations and hazards to use under a perennial vegetative cover. The majority is stable productive hill country but also included are flat to gently undulating stony and shallow terraces and fans, rolling land with a significant erosion risk too great to allow sustainable cropping.	Suitable uses include grazed pasture, tree crops and/or forestry, and in some cases vineyards. Erosion is commonly the dominant limitation, but it is readily controlled by appropriate soil conservation and pasture management.
7	Non-arable land that has severe physical limitations or hazards under perennial vegetation. Consequently, it is high-risk land requiring active management to achieve sustainable production.	Suitable uses include grazing provided intensive soil conservation measures and practices are in place, and in many cases it is more suitable for forestry.
8	Non-arable land with very severe to extreme physical limitations or hazards that make it unsuitable for arable, pastoral or commercial forestry use	Erosion control, water management and conservation of flora and fauna are the main uses of this land