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Report on soil investigation of parts of Farm RE/502 near Stellenbosch

Report by
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1. Introduction

Johann Lanz was contracted to do a soil investigation and report on parts of Farm number RE/502 near Stellenbosch. The location is shown in Figure 1. The aim of this investigation was to characterise the different soil types and consequent agricultural potential across the site in order to provide the required information to assess the impact of a loss of this land for agricultural production. An additional aim of the investigation was to assess the soil suitability for a graveyard. Specifically the requirements were to:

- Produce a soil map of the site showing spatial distribution of different soils and including ratings of soil potential.
- Produce a soil report describing soil physical characteristics, limitations, and suitability for crop production.
- Assess the soils in terms of their suitability for a graveyard

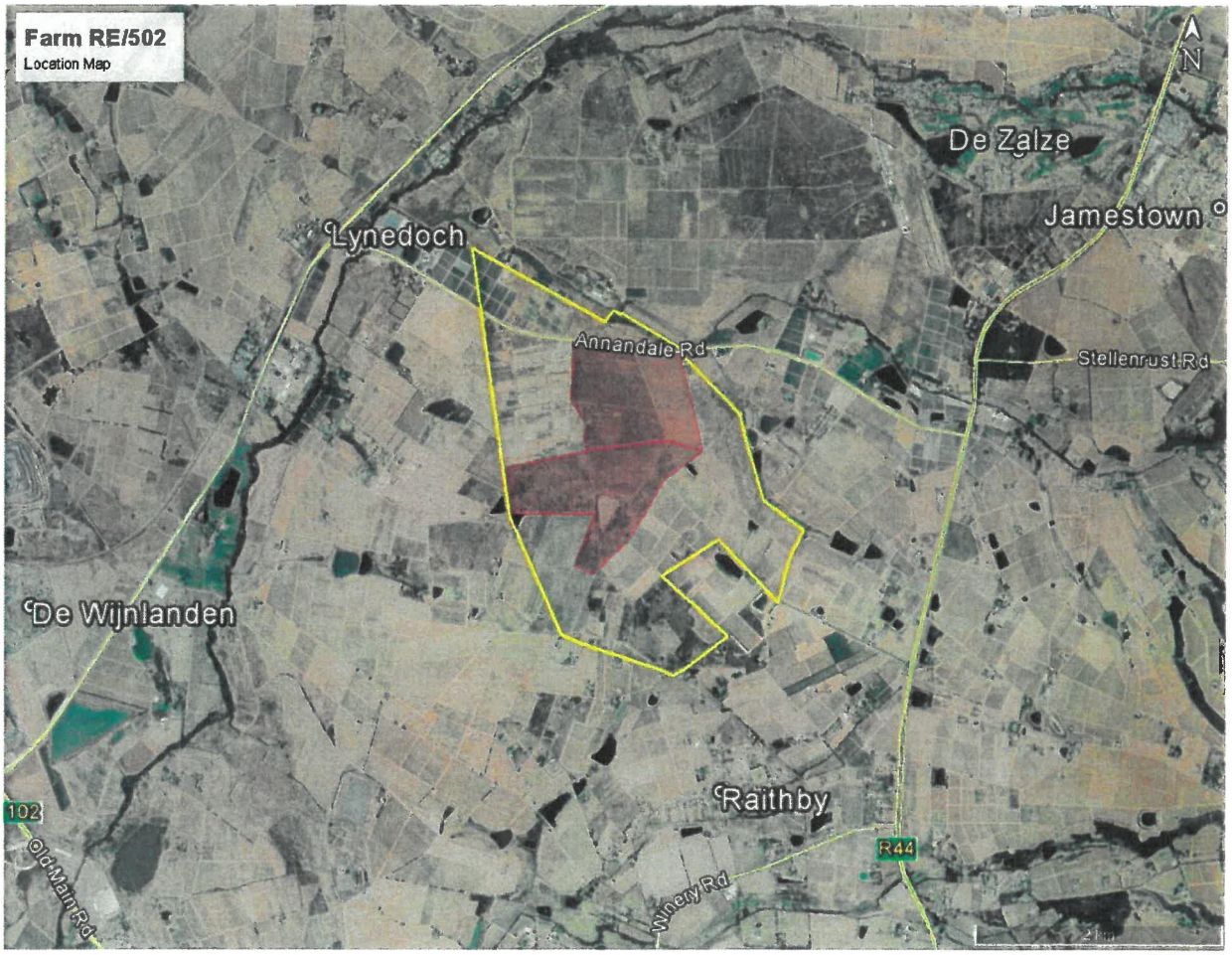

Figure 1. *Location of the farm (yellow border) and investigated site (red shading), south west of Stellenbosch.*

A total of 25 test pits were investigated across the study area on 6 March 2019 by Johann Lanz. The positions of all investigated test pits are shown in Figure 3. The site was divided into a focus area, which was investigated in more detail, with a narrower grid spacing of test pits, and the rest of the site, which was investigated in less detail, with a wider grid spacing (see Figure 3).

During the investigation, soils were classified according to the South African soil classification system and the soil description code was recorded for each investigated profile. A brief explanation of the description code is given in Appendix 1 and all the soil codes of investigated test pits are listed in Appendix 2.

Soil potential or suitability under the applicable conditions is a function of four factors: root development potential (rooting depth and friability); water holding capacity and supply; drainage; and organic matter content. Soils are rated for potential by making an overall assessment of each soil, taking all of these factors into account. A value between 0 and 10 is assigned. This suitability rating is used by soil scientists in the Western Cape, and details of it are provided in Table 1.

Table 1. Interpretation of soil suitability ratings used by Western Cape soil scientists

Rating	**General agricultural suitability and recommendations for cultivated crop production**	
≤2	Very low	Not recommended
>2 - ≤4	Low	Not recommended
>4 - ≤5	Medium	Conditionally recommended
>5 - ≤6	Medium-high	Recommended
>6 - ≤8	High	Highly recommended
>8	Very high	Highly recommended

2. Description of soil conditions

The site straddles a low hill with an elevation difference from bottom to top of approximately 60 metres. The focus area comprises most of the north facing slopes of the hill, which have a gradient of between 2 and 5% and an aspect that varies from north west to north east. The rest of the site comprises the top of the hill and the west and south west facing slopes on the other side of it. The west slope has a similar gradient to the north slope, but the south westerly slope is lower with an approximate average slope of 1%.

The geology of the area is mainly granite and deposits of the weathering products of granite of the Kuils River-Helderberg Pluton, Cape Granite Suite. Occasional ferricrete and alluvium also occur.

The field soil investigation identified a fairly high degree of soil variation across the site, particularly in terms of soil depth. All soils are course, sandy (<5% clay) soils with high gravel content on underlying, dense clay. The depth to clay varies between 30 and >150cm. The underlying, less permeable clay causes all soils to have drainage limitations because infiltrating rain tends to build up above the clay layer and then drain laterally down slope. Periodic saturation therefore occurs above the clay during rainy periods. These soils have up to a moderate drainage limitation, which is defined as saturation occurring between 30 and 70 centimetres below surface for up to a cumulative of 30 days per year.

A hardpan laterite horizon occurs in patches across the site and is indicated by the presence of the following three soil forms: Dresden (Dr), Glencoe (Gc), and Wasbank Klapmuts (Km) is the dominant soil form across the site. Pinedene (Pn) and Vilafontes (Vf) forms occur in better drained positions.

Soils potential varies as a result of depth, presence of hardpan, and drainage.

Photographs of site conditions and representative soils are given in figures 2 and 4 to 7.

Figure 2. *Site conditions looking down the focus area part of the site.*

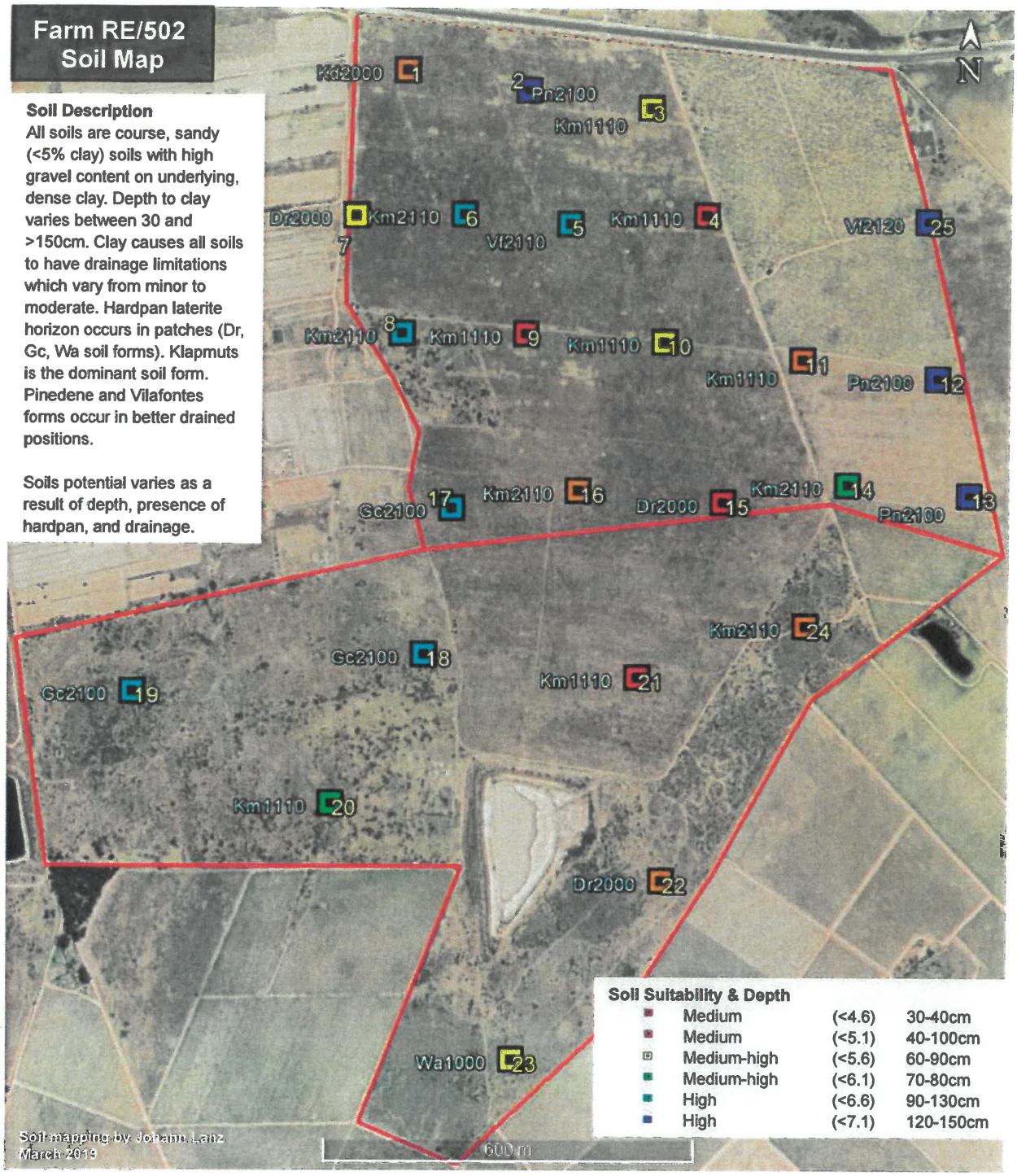

Figure 3. *Soil map of the site showing all investigated test pits. At each test pit, soil form and family are indicated, and soil suitability is indicated by colour coding. The focus area is the northern part, and the rest of the site is the southern part, as indicated by the red borders. Detailed data for each test pit is given in Appendix 2.*

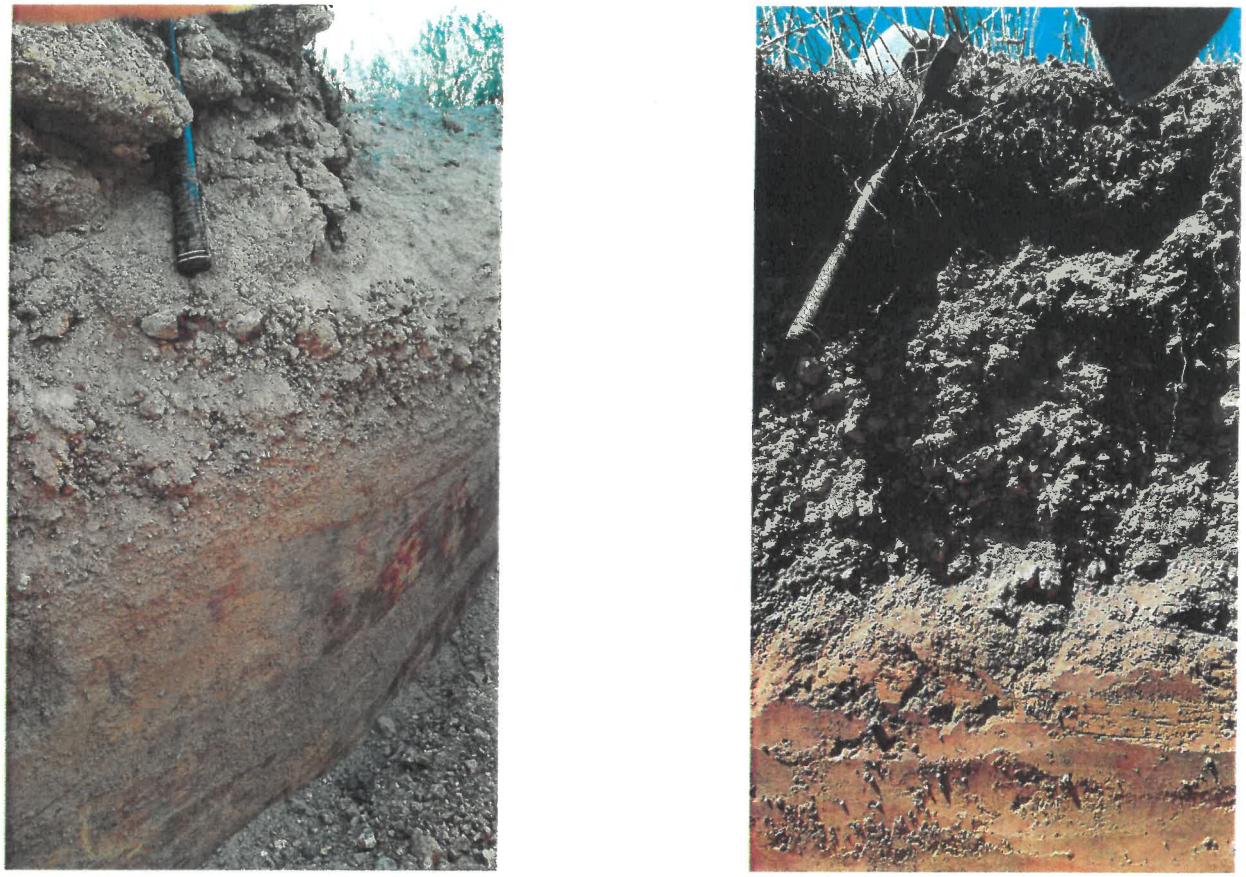

Figure 4. *Examples of typical shallow soil profiles from site, limited by the dense clay that occurs in the subsoil.*

Figure 5. *Vineyards in fairly poor condition on the site.*

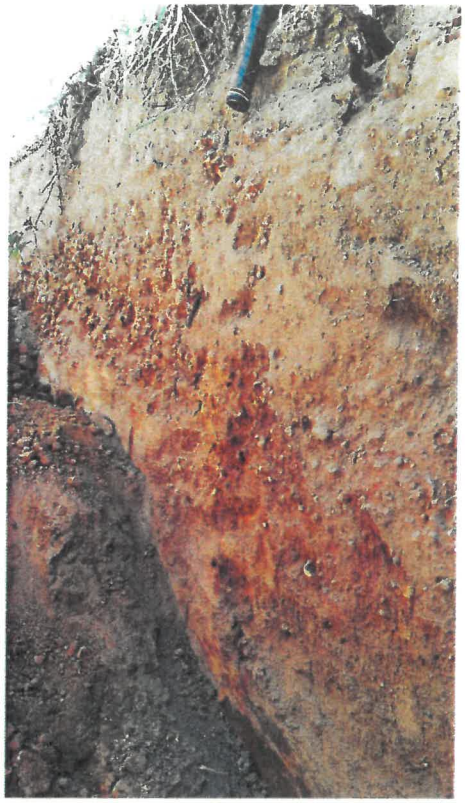

Figure 6. *Example of typical soil profile from site in which the clay occurs relatively deep.*

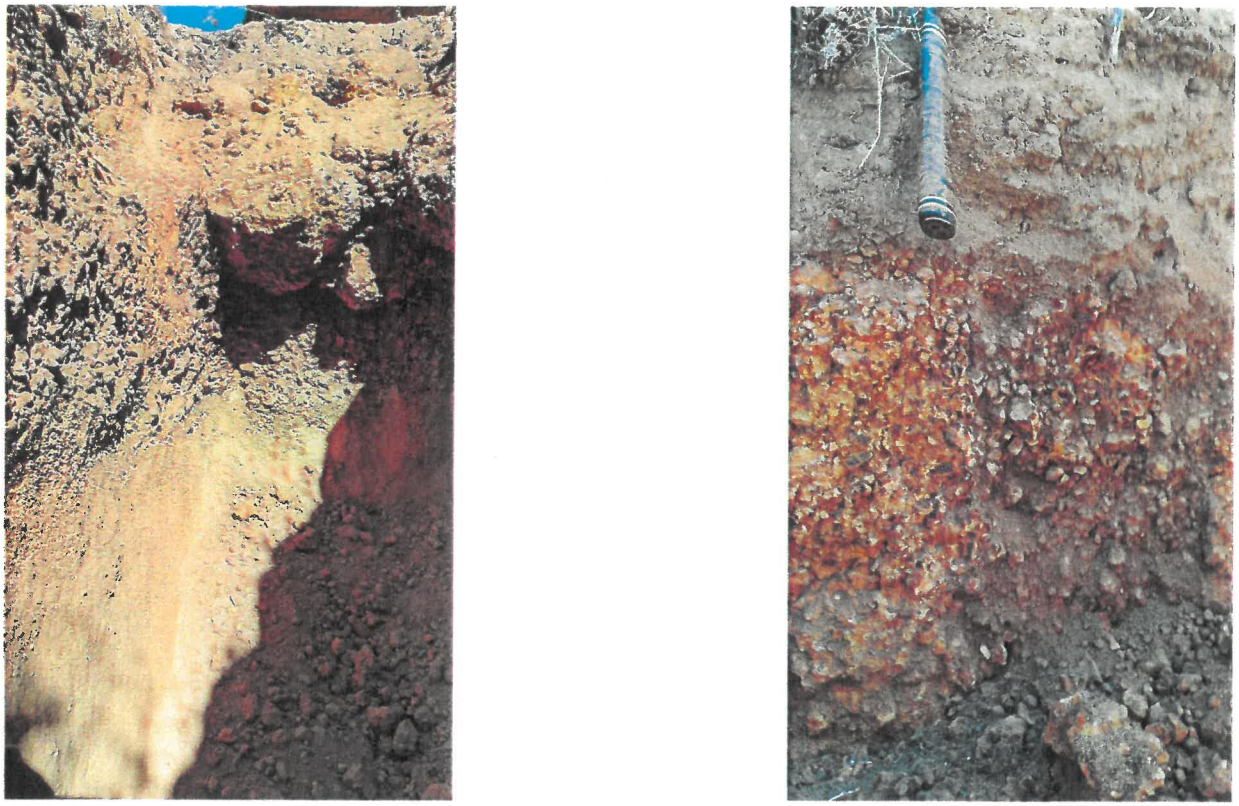

Figure 7. *Examples of soil profiles from site, that contain a hardpan laterite horizon.*

3. Soil suitability for crop production

The suitability rating indicated in the soil map is applicable to wine grapes. Soils rated as medium (red and orange) are only conditionally recommended for wine grapes and will be marginal for wine quality. Those rated medium-high and above are all suitable for quality wine production.

The sandy texture and high gravel content of the upper soil horizons means that all soils have a low water holding capacity, which is a serious limitation for non-irrigated crop production.

The variation of soil conditions, especially soil depth and the occurrence of patches of very shallow soil, is a limitation of the site for vineyards.

All the investigated soils are suitable for shallow rooted crops (such as vegetables) under irrigation.

4. Land use

Most of the site is not currently, and has not been for at least 10 years, used for agricultural production, other than as natural grazing land.

Only a strip along the north eastern boundary of the site contains 19.4 hectares of wine grapes and 6.3 hectares of dryland perennial pastures. The wine grapes are bush vines that are not currently under irrigation, although the vineyards appear to have had irrigation infrastructure in the past. The vineyards are not in particularly good condition (see figure 5).

Parts of the site are invaded by alien wattle. The adjoining land along the north western boundary is used for vegetable production by small scale farmers.

5. Assessment of the suitability of the soil conditions for a graveyard

Graveyard suitability is assessed in terms of the following three factors:

1. Excavatability
2. Side wall stability
3. Occurrence of a water table

The digger (TLB) was able to fairly easily excavate all test pits to a depth of > 1.5 metres. The presence of the hardpan made excavation in those patches slightly difficult, but the

digger was still able to get through the hardpan. For hand excavation, both the hardpan, and to a lesser extent, the dense underlying clay, would present something of a challenge.

Side wall stability appeared to be adequate in all test pits.

As already discussed in section 2, the less permeable underlying clay, across the whole site, leads to periodic saturation and lateral drainage of water above the clay layer. It is preferable for graveyard sites to have no water table, including perched ones, within the excavation depth. However soil conditions with no water table are fairly rare in the Western Cape.

6. Conclusions

The aim of this investigation was to characterise the different soil types and consequent agricultural potential across the site in order to provide the required information to assess the impact of a loss of this land for agricultural production.

The soils are rated medium to high agricultural suitability, but have several limitations, most importantly low water holding capacity and the occurrence of shallow soils in places across the site. Parts of the site are suitable for wine production, but other parts of it are marginal. Only 17% of the site is used for cultivated crops.

The loss of this land for agriculture, depending on what parts of it are lost, does have agricultural impact in that arable lands, suitable for crop production may be lost. The site includes areas of only medium agricultural potential, whose loss would have a lower agricultural impact than loss of the medium-high and high potential parts.

Appendix 1: Structure of soil code and explanation of symbols

The code used indicates the soil classification as well as other characteristics of the soil. Soil forms are the first level of division in the South African soil classification system. Soil forms are further divided into different families. All soil forms are given a South African place name. Families are given a four digit number. Soils are divided into forms based on the sequence of diagnostic soil horizons in the soil profile.

This is not a comprehensive explanation of the code but explains the most important points:

Column 3 Numbers indicate the depth of the transition between horizons in order of increasing depth and according to the categories given below. Following all the horizons, the depth of a stone content is given if applicable.

Number in code	Depth below surface (cm)
1	0 - 15
2	15 - 25
3	25 - 35
4	35 - 45
5	45 - 55
6	55 - 75
7	75 - 95
8	95 - 115
9	115 - 135
0	135 - 155

Column 4 Two letter abbreviation of soil form name followed by four digit indication of soil family.

Column 5 Where a profile is a transition between 2 different soil forms - two letter abbreviation of the transition soil form name.

Columns 6 - 8 Lower case letters indicating the occurrence of additional horizons underlying the diagnostic horizons, if applicable.

Column 9 - 10 Combined letter and number code indicating course fraction content and stone size of subsoil horizons, if applicable. f = fine gravel, g = course gravel, k = stones, r = rocks. The number for each class is the volume fraction out of 10. The sum of the numbers gives the total course fraction content.

Column 11 Course fraction content of topsoil horizon indicated in the same way as above.

Column 12 Sand grade f = fine and me = medium and co = course and clay content of topsoil horizons according to the following categories:

number	Clay percentage
1	0 - 5
2	5 - 10
3	10 - 15
4	15 - 20
5	20 - 35

Column 13 A number between 1 and 9 indicating wetness class based on the depth at which saturation occurs in the profile and the length of time for which the soil remains saturated. All wetness classes of 6 and higher may require drainage. A 0 indicates that no wetness is present in the profile.

Column 14 The rating out of 10 of the vineyard vigour potential, using the rating system that is used by Western Cape soil scientists.

Column 15 The soil map unit into which the soil profile has been categorised.

Appendix 2: Table of soil profile data

Test pit no.	Soil depth (cm)	Soil description code											Suitability rating
		Depth codes	Family	Transition form	Subsoil properties					Topsoil properties		Drain	
								CF	CF	CF	texture		
1	100	386	Kd2000		gc			f5g3		f1	co1	3/6	5.0
2	120	397	Pn2100		vp			f5g2		f1	co1	3	6.8
3	70	363	Km1110	Es	vp			f5g2		f1	co1	3/6	5.2
4	40	242	Km1110		vp			f5g2		f1	co1	3/6	4.3
5	100	3686	Vf2110		vp			f5g3		f1	co1	3/6	6.3
6	130	494	Km2110		vp			f3g5		f1	co1	3/4	6.2
7	30	3703	Dr2000		hp2/3	gs	vp	f3g5		f1	co1	3/4	5.2
8	120	494	Km2110		vp			f3g3		f1	co1	3/4	6.2
9	40	242	Km1110		vp			f3g3		f1	co1	3/4	4.5
10	60	363	Km1110		vp			f3g3		f1	co1	3/4	5.2
11	60	363	Km1110		vp			f2g1		f1	co1	3/6	5.0
12	120	397	Pn2100		vp			f5g2		f1	co1	3	6.8
13	150	404	Pn2100		vp			f2g2		f1	co1	2	6.8
14	70	363	Km2110	Pn	vp			f2g2		f1	co1	3/4	5.6
15	30	3	Dr2000		hp2/3			f2g5		f1	co1	3/6	4.2
16	50	252	Km2110		vp			f3g4		f2	co1	3/6	4.9
17	90	3737	Gc2100		hp2			f2	f2g5	f1	co1	3/4	6.2
18	90	3737	Gc2100		hp2			f2	f2g5	f1	co1	3/4	6.2
19	90	3737	Gc2100		hp2			f2	f2g5	f1	co1	3/4	6.2
20	80	373	Km1110		vp			f4g4		f2	co1	3/4	5.6
21	40	242	Km1110		vp			f5g2		f1	co1	3/6	4.3
22	40	4	Dr2000		hp2/3			f2g5		f1	co1	3/6	5.0

Test pit no.	Soil depth (cm)	Soil description code											Suitability rating
		Depth codes	Family	Tran-sition form	Subsoil properties					Topsoil properties		Drain	
								CF	CF	CF	texture		
23	90	363	Wa1000		hp2/3			f2g5		f1	co1	3/6	5.5
24	50	252	Km2110		vp			f3g4		f2	co1	3/6	4.9
25	>150	363	Vf2120		ne			f2g1		f1	co1	3	6.8