AGRICULTURAL AND AGRIBUSINESS STATUS QUO ASSESSMENT: NCWABENI OFF-CHANNEL STORAGE DAM, GUGAMELA AND NCWABENI RIVERS, K CELE TRADITIONAL AUTHORITY AREA 17581 AND ALRED LOCATION NO 6 15846 : MZUMBE LOCAL MUNICIPALITY : UGU DISTRICT MUNICIPALITY : KWAZULU-NATAL : 2012 : FIRST DRAFT

Prepared For :

Nemai Consulting,

P O Box 1673,

Sunninghill,

2157

Prepared By :

J S Phipson

Agribusiness and Environmental Consultant

Cell: 082 944 8462

Tel: 035 340 1940

Email: topcrops@mweb.co.za

P.O. Box 465

Mtunzini

KZN 3867

June 2012

TABLE OF CONTENTS **Pg.**

1.INTRODUCTION

1.1 Project Background

The purpose of this study has been to report on the status quo of agricultural development, vegetation and any other resources that might pertain to agricultural activity occurring within two sites selected as possible areas for the construction of an Off-Channel Storage Dam

This report would then determine to what extent agricultural or agribusiness considerations would impact on site selection.

Site D3A crosses the Gugamela River and its tributaries. Site D2 embraces the Ncwabeni River and its tributaries.

This study was undertaken in late autumn after a summer of good rainfall so agricultural and vegetation conditions were at relatively good levels for the time of the year.

Access to the properties is from the Umtwentweni to St. Faiths road, from either the R 102 or N2.

John Phipson, the author of this assessment has had a lifelong interest in land usage communitydevelopment and nature conservation. He has served on the Natal Provincial Council Nature Conservation Portfolio Committee and was instrumental in the motivation for the establishment of a Chair of Nature Conservation at UKZN. He is a member of the Zululand Indigenous Tree Club and the Custodians of Rare and Endangered Wildflowers. He has worked on many projects, both commercial and community related in the Ugu District Municipality.

The most recent has been an agricultural and agribusiness assessment of the potential for irrigated crop production in the Lovu, Mkomazo and Mpambanyoni River valleys, carried out under the KZN DAEA&RD Technical Assistance and Market Access Programme (TAMAP) earlier this year. .

1.2 Executive Summary

1.2.1 Soils

The predominant soil parent material, a coarse-grained porphorytic granite has weathered down to the Shortlands Soil Form, resulting in this potentially high yielding soil being extensively encountered. Another potentially moderate to high yielding soil, the Oakleaf Soil Form, derived from well weathered alluvium is present in limited areas of the footslopes and valley bottoms.

In the lower footslopes and valley bottoms it is clearly evident that where erosion has led to exposure of the oldest geological formations, Natal Group Sandstone, the result has been the agriculturally inhospitable Dresden Soil Form. This form is characterized by shallow sandy clay loams over hard plinthic rock. When quarried and crushed, this hard plinthite supplies excellent civil construction material.

1.2.2 Topography

The terrain is rugged, broken, steep and inhospitable. On each of the sites there is one gently sloping area of a few ha each.

With the exception of these two small sites, the topography precludes legitimate annual arable crops as the permissible limit is a maximum slope of 12 %. The overwhelming majority of slopes are in excess of 20 to 25 %.

1.2.3 Climate

The climate is hot, dry and hostile to agriculture. High summer temperatures preclude most crops. As is the case for most of the southern KZN coastal river valleys, successful production of most annual arable crops is limited to the cooler months.

1.2.4 Irrigation water

Successful winter crop production would require irrigation. The small size of the two sufficiently level sites does not warrant the cost of installing irrigation systems.

1.2.5 Livestock and Veld

The only livestock seen were a few goats and a few dozen donkeys. The goats, being browsers, were in good condition. The donkeys were in poor condition, probably attributable to the fact that under cover grasses have to compete against hardy acacia, broadleaf and euphorbicaean tree species for nutrients, soil moisture and sunlight. Grass cover is sparse.

No bovines were seen.

1.2.6 Conclusion

There are no compelling agricultural or agribusiness reasons for giving one site preference over the other. Steep slopes in particular, and a hostile climate in general, mitigate against any arable crop activity. The irrigation of small portions of level land on both sites would not be economically viable.

1.2.7 Other Comment

Detail supporting the findings as expressed in the executive summary will either be in the body of the report or attached as annexures.

2. METHODOLOGY : STATUS QUO ASSESSMENT : DESK TOP STUDY

2.1 Soils

2.1.1 Soil Parent Materials

The whole lower Umzimkulu Valley and Oribi Gorge area has a complex and interesting geological history, resulting in a wide range of soil forms and some stunning natural scenery.

On these two sites the predominant parent material is a very coarse-grained porphoritic granite which is an intrusive rock of the Oribi Gorge Suite. Most soils derived from intrusive rock (molten magma that has forced its way through faults in the earth's crust) have a high iron content, which, when weathered turns red, a good rule of thumb indication of fertile soils.

2.1.2 Soil Systems

The two sites fall within the River Valley Soil System of weakly weathered soils.

2.2 Climate

Prior to the site visit soils and climatic data was obtained from the Natural Resources Directorate of KZNDAEA&RD in the form of Bio-Regional Group (BRG) and Bio-Resource Unit (BRU) data and the AGIS AGRIC website supported by the RSA Department of Agriculture.

This was supplemented by information from "Identification & Management of the Soils of the South African Sugar Industry" published by the SASA Experiment Station extracts from "Soil Classification: A Taxonomic System For South Africa : McVicar et al", published by the Institute for Soil, Climate and Water (ISCW), a division of the ARC.

Soil parent material data was extracted from Map 2030, "Port Shepstone", published by the Council for GeoScience, Silverton.

Other sources are referred to in the bibliography.

2.2.1 Climatic Data

KZN agriculture is particularly fortunate in having had two generations of exceptionally dedicated and competent agricultural specialists who have compiled a wealth of localized crop production data unmatched anywhere else in Africa.

This wealth of information has been synthesized into 23 BioResource Groups (BRGs) which in turn have been subdivided into 590 locally detailed BioResource Units (BRUs).

2.2.2 BioResource Group (BRG)

The entire site falls into BioResource Group 21(BRG subgroup 21.11) defined as Valley Bushveld

2.2.3 BioResource Unit(BRU)

For all practical purposes the entire site falls into BRU Ta6-Tonjoni, among the implications of which are:

Vegetation

The vegetation primarily consists entirely of Eastern Valley Bushveld (bushland thicket with some forest).

Irrigation Water Resources

One perennial river, the Umzimkulu. This implies that, at times, the Gugumela and Ncwabeni Rivers stop flowing in winter. There are no wetlands.

Soils

53 % 0f the soils are young, 2 % are alluvial, 22 % are well drained.76 % of the soils are shallow. 47 % 0f the gently sloping areas are too rocky to cultivate. Only 6 % of the land is annually arable.

Terrain

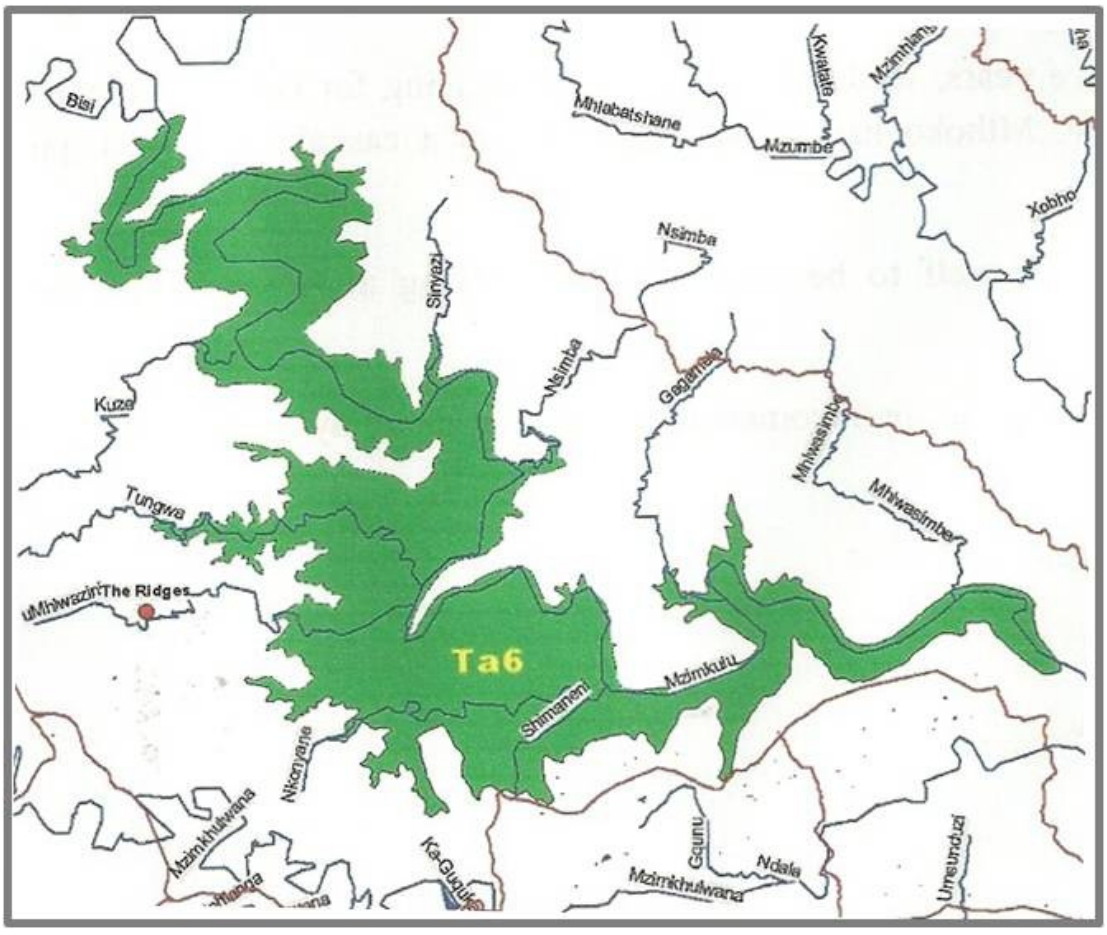
The total area of the BRU, 19 000 ha, varies in altitude from 23 to 721metres above sea level and is predominated by steep slopes (>12 %). There are isolated areas with moderate slopes (5 to 12 %) and no slopes of less than 7 %.

A map of the overall locality of the BRU appears overleaf. A map of that portion of the BRU directly applicable to the study area and a table of climatic data form annexure 1 hereto.

BRU Ta6-Tonjoni

The Gagamela River can be seen in the centre left of the map, flowing into the Umzimkulu River immediately west of the Gibraltar / Camro Estates loop.

The course of the Ncwabeni River is in the ‘horn’ northeast of the Gibraltar / Camro Estatesloop.



3. METHODOLOGY : STATUS QUO ASSESSMENT : SITE VERIFICATION

Preamble

Desktop data was tested against site conditions by means of a drive through and walk through exercise. Where and when encountered, local inhabitants were engaged with in order to obtain their views.

Relevant site data has been photographically recorded. A representative cross section is presented in this report. The rest has been filed for any future reference that may emerge from the development of this project

Although there is an excellent bird's eye view of the site from the Oribi Flats road, the only practical access is from the St. Faith's road.

3.1 Soils

As anticipated the dominant soil form is the Shortlands Soil Form, a potentially fertile, easily managed soil. It has good moisture intake and moisture holding characteristics. The profiles inspected all demonstrated effective rooting depths in excess of one meter. The soil has good drainage characteristics. The only mildly negative feature is the presence of small grit particulates that would be abrasive to implements.

Part of the rule of thumb methodology of soil quality recognition is soil colour. As a general rule red soils are the most productive, followed by brown soils. Third in line are black soils, which though intrinsically fertile are difficult to manage, being like glue when wet and like rock when dry. Grey and pale leached soils are at the bottom of the scale.

The Shortlands soils encountered at site are a deep, rich red colour.

In places the footslopes demonstrated limited areas of shallow topsoil over hard plinthite, giving rise to the Dresden Soil Form. This reddish / purple plinthite was seen in the road bank cuttings and borrow pits.

Outcrops of the oldest parent materials, Natal Group Sandstone, can be seen along the valley bottom. These outcrops are a common feature of South Coast estuaries where erosion has washed down to the original bedrock.

Two relatively level areas of a few ha each were found on the lower footslopes of both the Gugamela and Ncwabeni Rivers. In both these instances well weathered alluvium had resulted in the formation of soils of the Oakleaf Form. These brown soils have a moderate to good yield potential and are easily managed. Although Camro Estates was not visited, it is highly probable that this soil form constiturtes most of the cultivated land on what from a distance appears to be a good irrigated commercial farm.

3.1.1 Land Capability Class (LCC)

Determination of Land Capability Class is the fundamental procedure in determining what can be grown where and at what yield levels.

The following factors are applied in making a Land Capability Class Determination :

Soil texture (clay content)

Slope % of surrounding area

Effective rooting depth

Moisture intake rate

Soil permeability

Soil wetness

Rockiness

Crusting potential

In order to capture these determinants it is necessary to examine soil profiles, often the best method for which is to excavate inspection pits using a TLB machine. GPS co ordinates are recorded for each pit and the pit profiles photographed for future reference.

In this instance there were sufficient already exposed profiles to give sufficient data for the purpose of this exercise. Most areas are currently physically inaccessible to any mechanical equipment.

The data thus acquired is then applied to a flowsheet adapted to RSA conditions from the US Dept of Agriculture standards and utilzed by competent land usage authorities as the basic template for benchmarking soil quality throughout RSA. Land Capability Class is categorized on a scale of I to VIII, so yield potential matrices are easily formulated. Apart from giving an overall yield potential the components of the determination are also useful management tools.

Land Capability Classes (LCC) I to III are suitable for arable crops. LCC IV soils can sometimes be cultivated for annual crops, but under carefully controlled conditions.

Climatic conditions are also a determinant, as is irrigation water availability.In this instance, except for the few ha of footslope soils, the entire area falls into Land Class Capability Classes VII and VIII, suitable for livestock and game only, the most compelling determinant being excessively steep slopes.

3.1.2. Crops Data

Crops data was obtained by observation and by conversation with a few householders.

The D3A dam will inundate less than 2 ha of subsistence farming, most of which is on a 15 % slope. The crops grown are maize, sugar beans and pumpkins. These have been grown as rainfed summer crops. In years when rains are poor, the crop fails.

Other crops grown in the area include sweet potatoes, amadumbe (*Colocasia esculante var. eddoe*) and jugo beans (inhlubu).

As is the case in the study of agricultural potential in the river valleys further north along the KZN coast, crops at these sites are also threatened by grey duiker, bushbuck, bushpigs and porcupines. Mesh fences need to be planted well below ground level.

There is no subsistence agriculture at all on the D2 site.

3.2 Water Resources

Even if there were sufficient level land to allow small irrigation schemes, the only perennial water source, the Umzimkulu River, is too far away to justify the cost.

As indicated in the climate table, winter rainfall is extremely limited, particularly in June and July, which is when it would be most needed

3.2.1 Surface Water

Although the site verification process took place in mid June, water in both the Gugamela and Ncwabeni Rivers was still flowing well. However the limited and scattered bits of land available and the height the water would need to be pumped rule out the use of this asset.

Responses from local inhabitants on the reliability of perennial winter flow were ambiguous.

3.2.2. Groundwater

There was no perceptible evidence of the presence of groundwater such as clear stands of Mthomboti trees or ‘green’ patches in the bush.

3.3 Livestock

The only information gleaned from the desktop study is that, across the BRU as a whole, the livestock carrying capacity is 5.5 ha per large animal (450 kg) unit (AU). This figure is based on a dry matter yield of 3500 kg per ha over a 350 day growing period. This estimate also warns that this carrying capacity can vary widely due to variations in local conditions within the BRU.

(An AU is approximately equivalent to one large ox, 2 donkeys or 10 goats).

The livestock assessment is thus based on personal assessment of veld and vegetation based on own experience.

There are no open grasslands. Whatever grasses are growing in the dominant thicket vegetation are competing against hardy scrub plants for nutrients, soil oxygen, moisture and sunlight.

Most of the thicket vegetation is impenetrable except to small animals such as buck, bushpigs and goats. The few goats seen were in good condition. Being browsers this could be expected.

Donkeys, used mainly for transporting water in counterbalanced 25 litre containers, were small and in poor condition with dull, spiky coats.

No bovines were seen. Comment was that most of the time they live in the bush.

On these two sites the carrying capacity for goats is probably closer to 3 ha per AU and closer to 15 ha per AU for grazers.

Slope and vegetation density preclude any possibility of effective veld management.

The dipping tank on D3A will be inundated.

There are no pastures. Regarding other vegetation, there are no commercial woodlots or plantations.

3.4 Land ownership and administration.

Title to the land is held by the NgonyamaTrust. The Traditional Authority is administered by Inkosi K Cele, whose local representative is Induna Ngwazi. The concept of wall to wall municipal administration has not yet reached this area.

3.5 Persons Interviewed

As far as is practical informal interviews, conducted in isiZulu, followed a conversational pattern, rather than direct questions. Where appropriate, care was taken to explain the purpose of the visit. Care was also taken not to cause any undue alarm or to raise any unrealistic expectations.

Those interviewed included Induna Ngwazi, a well informed and helpful gentleman of the first order, Mrs. Ngwazi (MaNdlovu) whose garden and nearby dipping tank will be inundated if D3A is chosen and Mrs. Ngwazi (MaKhumalo) whose donkeys were loading pairs of 25 litre water containers

4. REALITIES AND RECOMMENDATIONS :

This section of the report completes the status quo verification portion of the assessment. In most instances this phase would be followed by forward recommendations for development of agricultural potential. In this instance the agricultural potential is so limited that there are no recommendations for any agricultural or agribusiness development.

It is clear from this assessment that none of the considerations normally taken into account in assessing a change of land usage or evaluating long term agricultural potential are applicable in this instance.

The only issue is whether there are any agricultural or agribusiness reasons for choosing one site in preference to the other. In the case of site D3A, less than 2 ha of land being illegally cultivated at less than 10 % of yield potential will be inundated. In the case of site D2 no agricultural land will be inundated.

5. BIBLIOGRAPHY AND REFERENCES

This bibliography is limited to publications and papers directly related to items encountered in the study. Extensive background data which provides a background to the conclusions reached in this study is available, if required.

Bibliography : Soils, Crop Production and Grazing

Identification and Management of the Soils of the South African Sugar Industry ; SA Sugar Research Institute.

Soil Classification: A Taxonomic System For South Africa : McVicar et al, ISCW

Guide to Grasses of Southern Africa ;Van Wyk and Van Oudtshoorn ; Briza

Veld Types of South Africa ;Acocks ; Botanic Research Institute

Beginsels van Besproeing ; Chris Barnard ; Agrofert Academy

Water Usage Module ; Pierre Viljoen ; Directorate of Agricultural Engineering ; KZNDAEARD,Cedara

Quality Maintenance Begins at the Design Table ; Awie Marais ; Netafim Irrigation International.

Soil Fertility and Fertilizers ; Havlin et al; Prentice Hall

Soil Science and Management : Plaster : Delmar

Geological Journeys ; Norman and Whitfield; Struik

The Story of Earth and Life : McCarthy and Rubidge ; Struik

Various Industry and Financial Publications

Annexure 1 : Directions to the Sites : Ncwabeni OCS Dam : Narrative

a) Take Exit 51 from the N2 ; Port Shepstone North / St Faiths. Head inland along the St Faiths road.

   Alternatively :

   Take the St.Faiths turn off from the R 102 at Umtwentweni, 5 km north of Port Shepstone.

b) Pass Lindsay's Eggs (on right)

c) Pass Duduzile Senior Primary School (on right)

d) Pass Assisi Clinic (on right)

e) Pass Mehlonyama shops (on left)

f) Pass Mehlonyama Police Station (on right)

g) Turn left off the tarred road onto graveled road signposted D 859 at S 30.56672 and E 30.28448.

h) Ignore two lesser roads (left and half left) at S 30.59270 and E 30.28630. Bear right downwards towards valley below.

i) At S 30.60604, E 30.27454 take right fork.

j) Pass derelict trading store at S 30.61017 and E 30.24546 (on right)

k) Cross causeway over D2 site, Ncwabeni River at S 30.61789 and E 30. 22063

l) Cross causeway over D3A site, Gugamela River at S 30.60609 and E 30.24191

m) Pass Indikini Primary School, S 30.60975, E 30.20924

n) Turn off to Induna Ngwazi's home, S 30 60329, E 30.20770

   If asking directions, specify Induna Ngwazi. Most homesteads are Ngwazi homesteads.

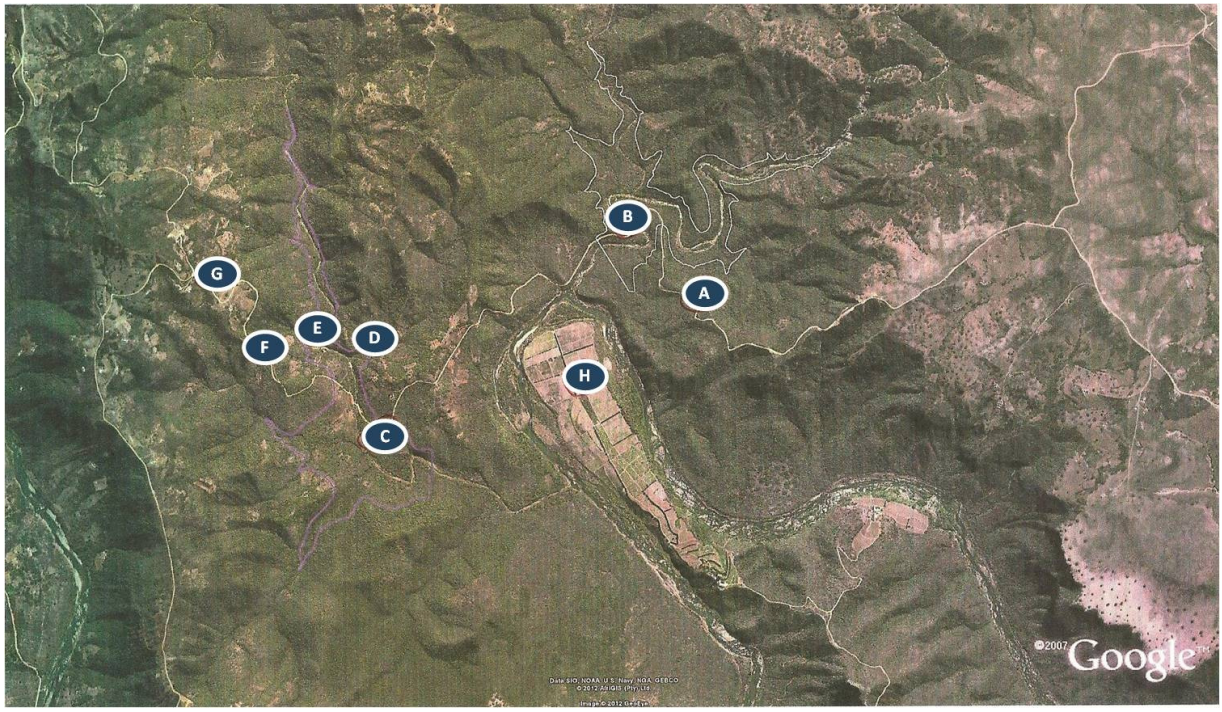

OCS Dam Sites –
Soil Parent Materials
NATAL SOUTH COAST/-
SUIDKUS VAN NATAL
SCALE 1:770 000 SKAAL
Kilometres 0 10 20 30 Kilometer
Copyright © Map Studio
INDIAN OCEAN
INDIESE OSEAAN
PIETERMARITZBURG
DURBAN
The Bluff
KwaZulu
Natal
TRANSKEI
Howick
Hilton
Camperdown
Pinetown
Queensburgh
Westville
Umlazi
Isipingo
Amanzimtoti
Kingsburgh
Umkomaas
Scottburgh
Umzinto
Port Shepstone
Margate
Port Edward
Ixopo
Richmond
Stanger
Tongaat
Verulam
Umhlanga Rocks
Mehlomnyama
Oribi Gorge
Marburg
Hibberdene
Mt. Langford
Ramsgate
Southbroom
Uvongo
Shelly Beach

Annexure 2 : Location of Salient Features : Ncwabeni OCS Dam : Narrative

Feature No.	South Co ordinate	East Co ordinate	Description
A	30.61017	30.24546	Derelict Trading Store
B	30.61789	30.22063	Causeway over Ncwabeni River. Exposed borrow pit face.
C	30.60609	30.24191	Causeway over Gugamela River
D	30.61378	30.22180	Dwelling on steep site. No garden
E	30.61429	30.21799	Dwelling with garden and dipping tank
F	30.61131	30.21282	View onto derelict homes
G	30.60975	30.20924	Indikini Primary School
H			Gibraltar / Camro Estates

Co -ordinates are calibrated in degrees and degree decimals.

Annexure 2 : Location of Salient Features : Ncwabeni OCS Dam : Map



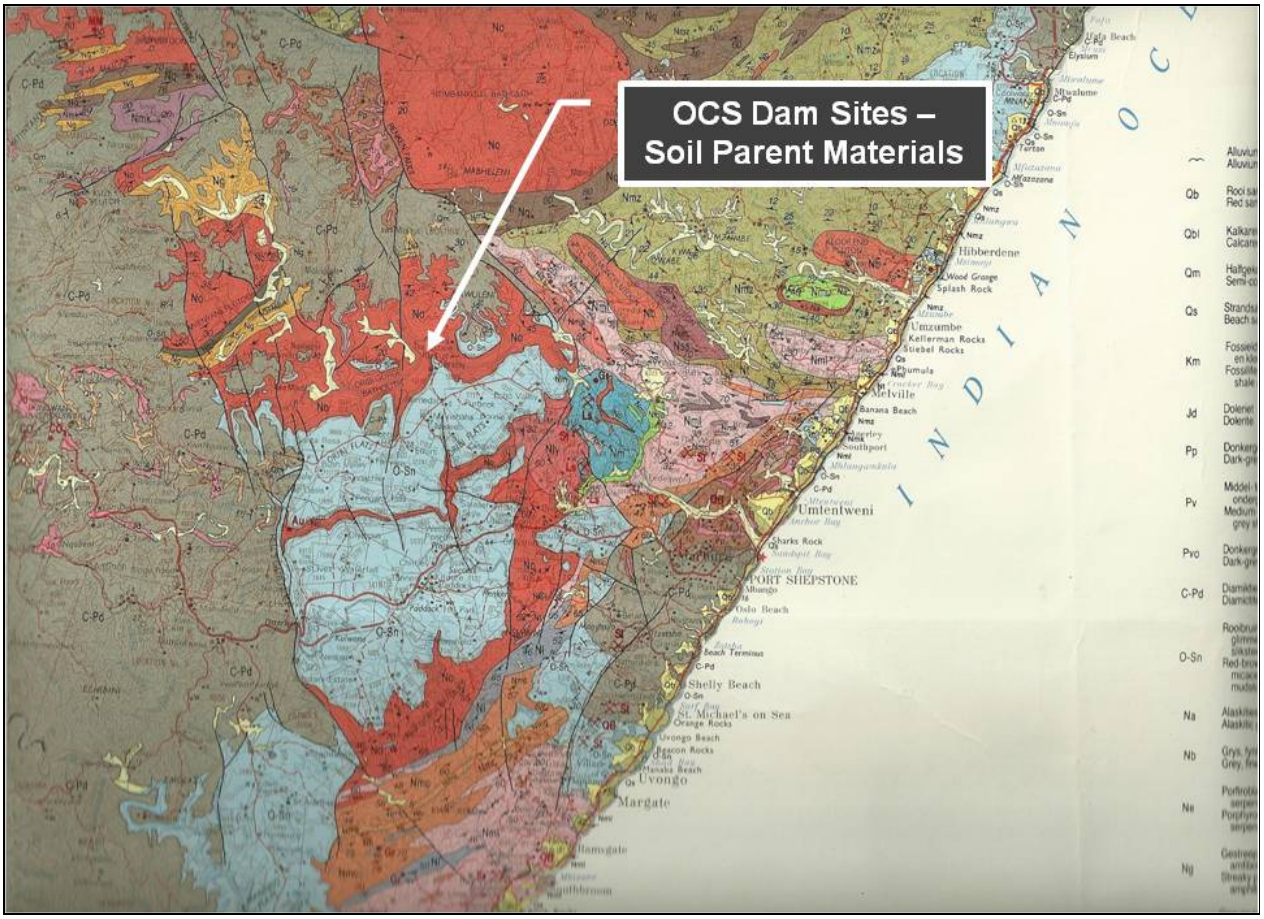
Annexure 3 : Soil Parent Materials : Ncwabeni OCS Dam : Narrative

The Sienna colouring, coded ‘No’, represents the coarse grained porphorific granite from which the predominant Shortlands red soils have evolved.

The blue O-Sn coding represents the Natal Group Sandstone, the oldest parent material in this area. It is this material that is responsible for the weathered hard plinthite formation under the topsoil that results in the Dresden Soil Form. In its unweathered form Natal Group Sandstone is represented by the large rocks present in the valley bottoms and riverbeds.

The grey/brown C-Pd coding represents Dwyka Tillite formed from the mud that settled on the bottom of the Karroo Lake, which lake once covered this area, 300 million years ago. This is a difficult soil to manage, hard when dry and sticky when wet.

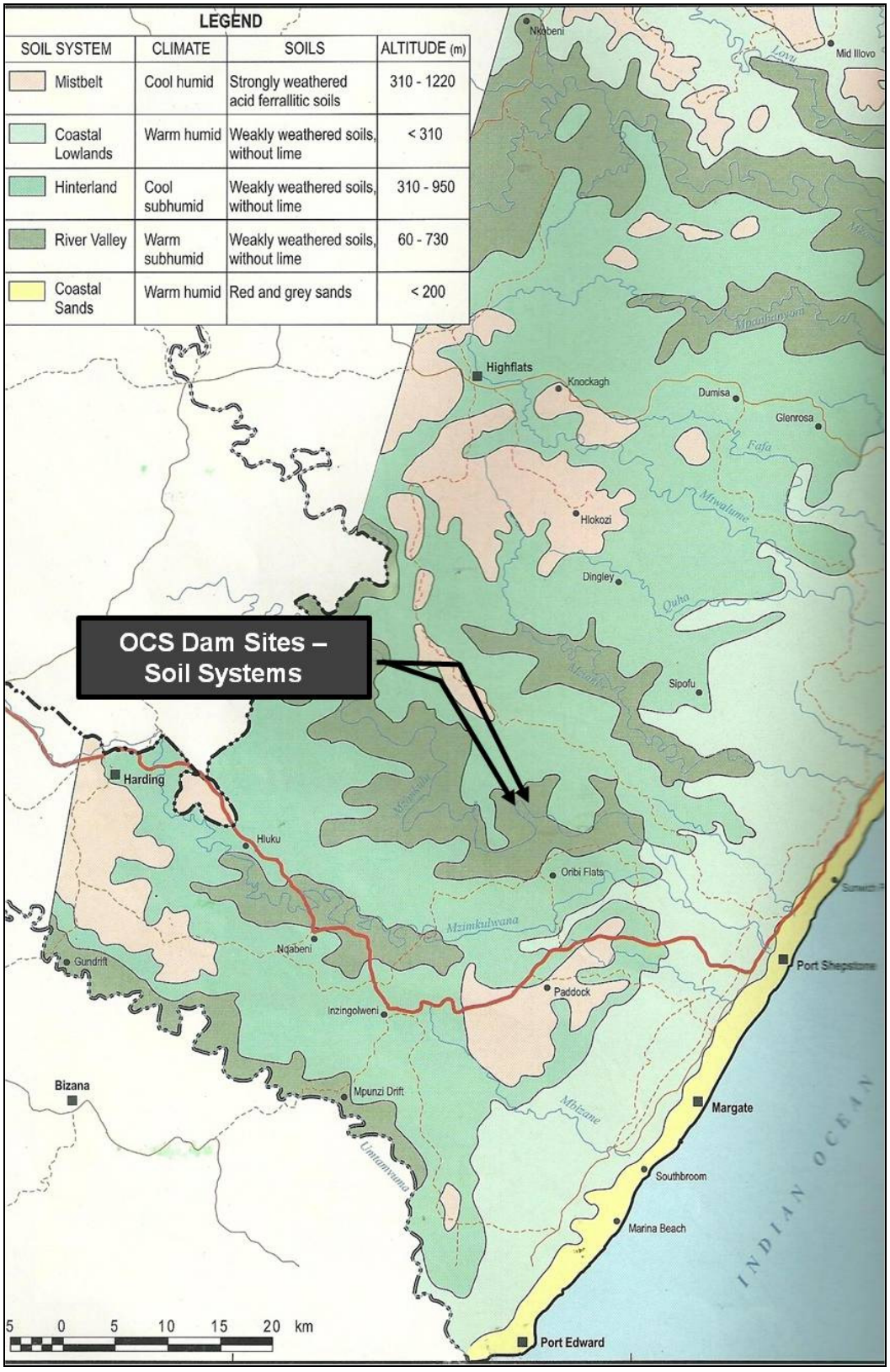
Annexure 3 : Soil Parent Materials : Ncwabeni OCS Dam : Map



Annexure 4 : Soil Systems : KZN Lower South Coast : Ncwabeni OCS Dam : Narrative

It can be clearly seen that the sites lie within the warm, subhumid River Valley Soil System, made up mainly of weakly weathered soils.

The 'Gibraltar Loop' on which the nearby Camro Estates is situated is probably covered by weakly weathered alluvial soils, similar to those on the few low lying alluvial level areas on D3A and D2.


LEGEND
SOIL SYSTEM | CLIMATE | SOILS | ALTITUDE (m)
Mistbelt | Cool humid | Strongly weathered acid ferrallitic soils | 310 - 1220
Coastal Lowlands | Warm humid | Weakly weathered soils, without lime | < 310
Hinterland | Cool subhumid | Weakly weathered soils, without lime | 310 - 950
River Valley | Warm subhumid | Weakly weathered soils, without lime | 60 - 730
Coastal Sands | Warm humid | Red and grey sands | < 200
OCS Dam Sites – Soil Systems
Nkabeni
Mid Illovo
Highflats
Knockagh
Dumisa
Glenrosa
Hlokozi
Dingley
Sipofu
Harding
Hluku
Oribi Flats
Nqabeni
Gundrift
Inzingolweni
Paddock
Port Shepstone
Bizana
Mpunzi Drift
Margate
Southbroom
Marina Beach
Port Edward
INDIAN OCEAN
5 0 5 10 15 20 km

Annexure 5 : Soil Profiles : Ncwabeni OCS Dam : Narrative

The soil formations of the Ncwabeni sites are straightforward. The valley bottoms are derived from Natal Group Sandstone, the oldest formation in the area. Over the millennia natural erosion and weathering have worked down to this level. The unweathered sandstone rocks are clearly visible in the river beds and adjoining banks.

Where there is relatively level ground on the footslopes the weathering of alluvium has led to the formation of two isolated small areas comprised of the Oakleaf Soil Form. Within the rest of the area that will be inundated, by far the most predominant soil form is the wide expanse of the distinctly red Shortlands Soil Form.

Soil profiles were noted and photographed at 12 points, details of which are available on request.

Other soil forms become apparent on the midslopes and scarp lying above the inundated area.

Deep, red Shortlands Soil Form, the predominant soil form in the study area.

Weathered Natal Group Sandstone has resulted in shallow soils of The Dresden Form

Annexure 6 : Irrigation Water : Ncwabeni OCS Dam : Narrative

It is difficult for those who do not regularly work with irrigation systems to grasp the amount of water required for crop production. In this climate peak demand during the winter production period will often reach 50 000 litres per ha, per day. This is equivalent to 5 000 buckets of water per day. Any irrigation weirs built across these two streams would be pumped dry within a few hours. Added to this, the area of land available for irrigation is so small that the cost of establishing an irrigation scheme could not be justified.

Water flowing in the small volumes in the Ncwabeni River (above) and the Gugamela River (below) in mid June could dry up in August, when it is most needed.

Annexure 7 : Climatalogical Data : BRU Ta6-Tonjoni : Ncwabeni OCS Dam

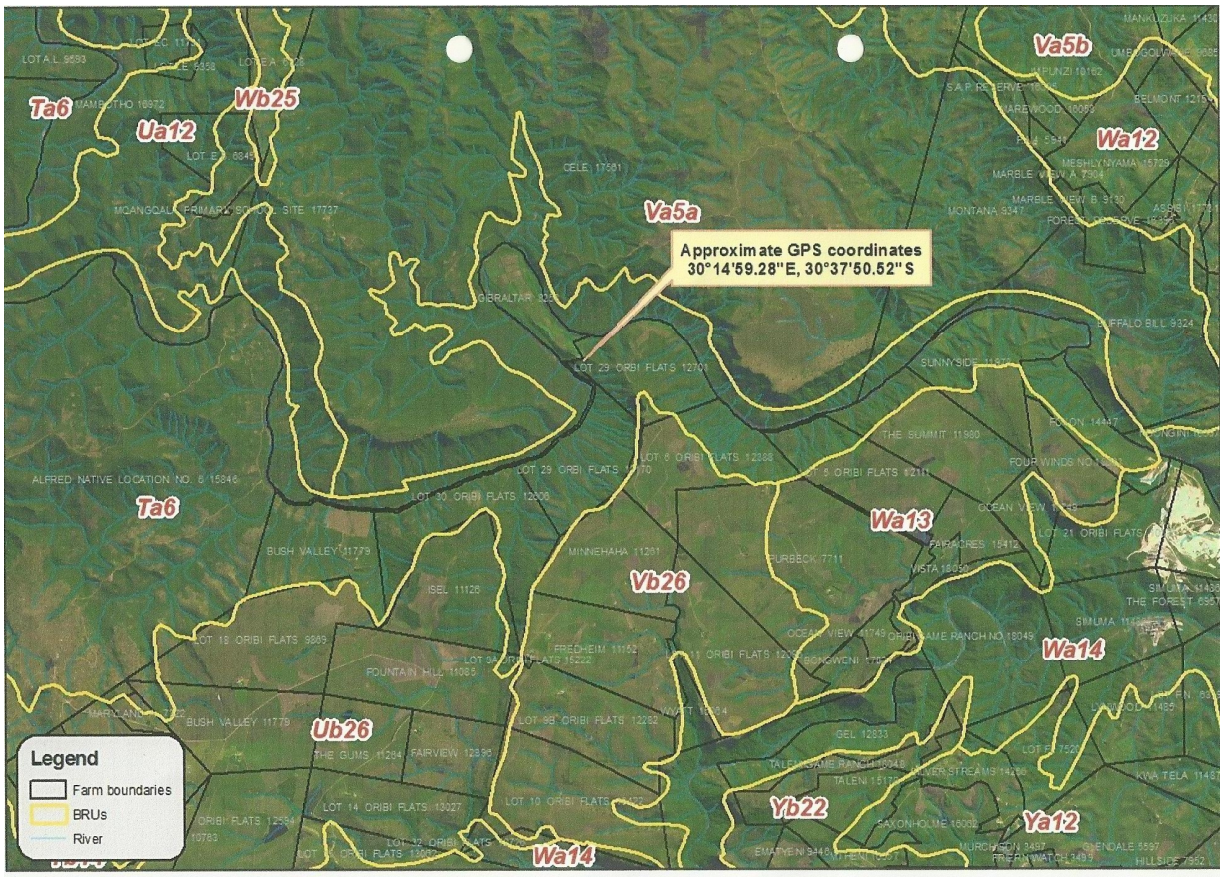
	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rainfall(mm)													
Mean	687	86	89	82	37	28	12	23	25	47	75	91	92
Temp (Deg C)													
Mean	19	22	22	22	20	18	16	16	17	18	18	20	21
Min	15	18	19	18	16	13	11	11	12	13	14	16	17
Max	24	26	26	26	25	23	21	22	22	22	22	23	25
Heat Units													
(Base 10)		372	347	363	306	257	183	189	214	234	251	285	341
Chill Units		0	0	0	0	0	0	0	0	0	0	0	0
Evaporation													
APan (mm)	1634	170	150	149	118	102	96	101	119	132	153	164	180

Frost Severity : Nil

Note the low rainfall (88 mm) between May and August.

The diagram overleaf clearly demarcates the locality and extent of BRU Ta-6

The ‘Gibraltar Loop’ is clearly visible at top centre



agriculture & environmental affairs Department of Agriculture & Environmental Affairs PROVINCE OF KWAZULU-NATAL	Prepared by : Dumisani Mashele Natural Resources Macro Planning Date: 12/06/2012	N 1:88 888	CLIENT John Phipson Agribusiness Consultant	TITLE Umzimkulu River Valley MAP NUMBER 2012/TOPCROPS-2

Annexure 8 : Slope and Vegetation : Ncwabeni OCS Dam : Narrative

Both photographs overleaf clearly illustrate the steep slopes and dense forest vegetation and impenetrable scrub occurring in both river valleys.

It is also evident that where there are open areas the grass is heavily overgrazed.

The Ncwabeni Valley (D2 site)above and the GugamelaValley (D3A site) below.

Annexure 9 : Land Capability Class (LCC) Determination Flow Sheet : Ncwabeni OCS Dam : Narrative

The use of this flowsheet is a useful management tool, not only in determining the type of use for which land can be employed, but also as an indication of the level of management required and the yields that can be achieved.

The most important determinants are

- Slope Class and %
- Topsoil Texture (Clay %)
- Effective Rooting Depth
- Permeability Class of Upper Subsoil

These factors are then entered into a matrix. Secondary considerations are then added, which considerations leave the class unaffected, can move the class up a notch or two or move it down a notch or two.

These considerations include availability of irrigation water, wetness, permeability of topsoil, rockiness and soil surface crusting.

The determinants used in this classification can all be field observed or field measured.

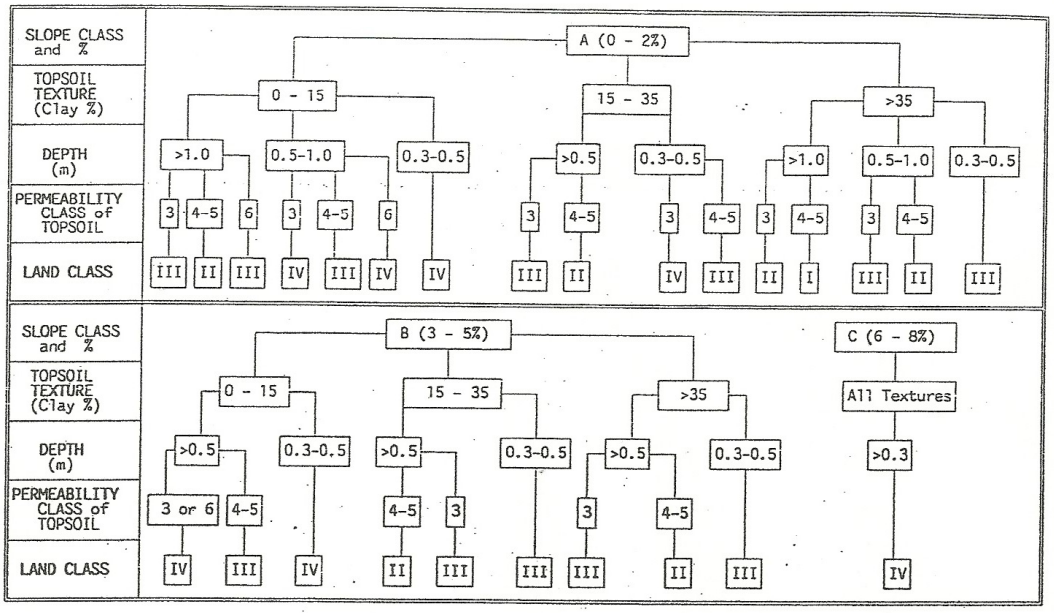
Land Capability Class is determined on a scale of I to VIII. Less than 2 % of RSA soils fall into LCC I.

Most arable land is LCC II and III. LCC VII is for livestock and game, LCC VIII for game only.

CAPABILITY CLASS DETERMINATION GUIDELINE for BRGs:

Dry Zululand Thornveld (20), Valley Bushveld (21), Lowveld (22), Sandy Bushveld (23) (Average annual rainfall 587-830 mm)

Use the following flow chart to determine the land capability classes for land to be cropped in the above Bioresource Groups.



PERMEABILITY CLASS DESCRIPTION*			
Class	Rate (seconds)	Description	Texture
7	<1	Extremely rapid	Gravel and Coarse Sand. 0 to 10 % clay.
6	1-3	Rapid	5% to 10% clay.
5	4-8	Good	> 10% clay.
4	9-20	Slightly restricted	
3	21-40	Restricted	Strong structure, grey colours, mottles. > 35% clay.
2	41-60	Severely restricted	Strong structure, weathered rock. > 35% clay.
1	>60	Impermeable	Rock and very strong structure. > 35% clay.

* If roots can penetrate the subsoil, test permeability of upper subsoil.
If roots cannot penetrate the subsoil, test the permeability of the mid-topsoil.
Dark structured clay topsoil (vertic & melanic) with a Class 2 permeability should be assessed in the chart as if it has a Class 3 permeability. If permeability is Class 7, downgrade to Land Class IV.

Now refer to the opposite page to make adjustments for wetness, rockiness, crusting or permeability.

USE THE FOLLOWING LAND CHARACTERISTICS TO MODIFY THE LAND CLASS OBTAINED OPPOSITE, IF NECESSARY: The land capability class determined using the "flow chart" cannot be upgraded through consideration of wetness, rockiness, surface crusting or permeability classes given below, but it may be downgraded as indicated.

WETNESS		
Class	Definition	Land Class
W0	Well drained - no grey colour with mottling within 1.5 m of the surface. Grey colour without mottling is acceptable.	No change
W1	There is no evidence of wetness within the top 0.5 m. Occasionally wet - grey colours and mottling begin between 0.5 m and 1.5 m from the surface.	Downgrade Class I to Class II, otherwise no change
W2	Temporarily wet during the wet season. No mottling in the top 0.2 m but grey colours and mottling occur between 0.2 m and 0.5 m from the surface. Included are: soils with G horizons (highly gleyed and often clayey) at depths deeper than 0.5 m; soils with an E horizon overlying a B horizon with a strong structure; soils with an E horizon over G horizons where the depth to the G horizon is more than 0.5 m.	Downgrade to Class IV
W3	Periodically wet. Mottling occurs in the top 0.2 m, and includes soils with a heavily gleyed or G horizon at a depth of less than 0.5 m. Found in bottomlands.	Downgrade to Class Va
W4	Semi-permanently / permanently wet at or above soil surface throughout the wet season. Usually an organic topsoil or an undrained vlei. Found in bottomlands.	Downgrade to Class Vb

PERMEABILITY	
Permeability Class	Adjustment to be made
1 - 2	If in sub-soil, rooting is likely to be limited: Use the permeability of the topsoil in the flow chart. If this is the permeability of the topsoil, then the topsoil is probably a dark structured clay, in which case a permeability Class 3 can be used in the flow chart.
3 - 5	Classify as indicated in the flow chart.
6	Topsoil should have < 15% clay - use the flow chart.
7	Downgrade Land Classes I to III to Land Class IV.

ROCKINESS		
Class	Definition	Land Class
R0	No rockiness	No change
R1	2 - 10% rockiness	Downgrade Classes I to II, otherwise no change
R2	10 - 20% rockiness	Downgrade Classes I to II, otherwise no change
R3	20 - 30% rockiness	Downgrade to Class IV
R4	> 30% rockiness	Downgrade Classes I, II, III & IV to Class VI

SOIL SURFACE CRUSTING		
Class	Definition	Land Class
t0	No surface crusting when dry	No change
t1	Slight surface crusting when dry	Downgrade Class I to Class II, otherwise no change
t2	Unfavourable surface crusting when dry	Downgrade Classes I & II to Class III, otherwise no change

NB **Any land not meeting the minimum requirements shown is considered non-arable (Class V, VI, VII or VIII).**
Non-arable land in BRGs 2, 4, 6, 9, 12, 14, 15, 16, 17, 18 & 19 includes:

* all land with W3, W4 or R4,
* all land with slope exceeding 20%,
* land with slope 13-20%, if clay < 15% or depth < 0.4m,
* land with slope 8-12% and clay > 15%, if depth < 0.25m,
* land with slope 8-12% and clay < 15%, if depth < 0.5m, and
* land with slope 0-7%, if depth < 0.25m.

20 March 1996