UNITED DOWNS WASTE

AGRICULTURAL LAND CLASSIFICATION SURVEY

CONTENTS

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AGRICULTURAL LAND CLASSIFICATION SURVEY

SUMMARY

1. This report presents the findings of a detailed Agricultural Land Classification (ALC) survey of 10.8 ha of land at United Downs Waste Site, Carharrack. Field survey was based on 11 auger borings and 1 soil profile pit, and was completed in April 1998. During the survey 2 samples were analysed for particle size distribution (PSD).

2. The survey was conducted by the Resource Planning Team of FRCA Western Region on behalf of MAFF in its statutory role in connection with an application to the Minerals Planning Authority under the Town and Country Planning Act, 1990 for an extension to the United Downs Landfill Site.

3. Information on climate, geology and soils, and from previous ALC surveys was considered and is presented in the relevant section. Apart from the published regional ALC map (MAFF, 1977), which shows the site at a reconnaissance scale as Grade 3, the site had not been surveyed previously for MAFF. The current survey uses the Revised Guidelines and Criteria for grading the quality of agricultural land (MAFF, 1988) and supersedes the previously published ALC information.

4. The nearest previous detailed survey was undertaken for a proposed road to link Falmouth to the A30 (ADAS 1992), but being around 1 km distant at the closest point, this is not considered to be relevant to the current survey area.

5. The survey area was also recently surveyed at more than detailed intensity for the environmental assessment of the proposed development of the proposed landfill extension by N A Duncan & Associates, 1997. This survey comprised 29 auger borings and 2 pits and is comprehensively reported in the environmental statement for Country Environmental Services Ltd (Aspinwall & Co December 1997). This survey found mainly Subgrade 3b based on medium clay loam topsoil texture at Wetness Class II or III with some Subgrade 3a where Wetness Class I was found. The current survey for MAFF was intended to validate this survey.

6. At the time of survey land cover was winter cereals in both fields, with mixed woodland adjacent.

7. The distribution of ALC grades is shown on the accompanying 1: 10000 scale ALC map. The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas. Areas are summarised in the Table 1.

Table 1: Distribution of ALC grades: United Downs Waste

Grade	Area (ha)	% Surveyed Area (7.7 ha)
3a	2.0	26
3b	5.7	74
Other land	3.1	
Total site area	10.8	

8. This shows that 26% of the area surveyed was found to be best and most versatile. This was Subgrade 3a limited mainly by restricted workability. The rest of the area was found to be Subgrade 3b limited mainly by wetness.

SOIL RESOURCES

9. The site has been divided into two distinct areas, shown as Soil Units on the attached map of soil resources. This is not a soil stripping map but is intended to illustrate the soil resources available for restoration. Topsoil and subsoil volumes for each Soil Unit are shown in Table 2.

Table 2: Soil Resources: United Downs Waste

Map Unit	Depth, cm	Area, ha	Texture	Stones %	Volume, m^3
Topsoil					
I	0 - 22	2 . 4	MCL	20	5 280
II	0 - 26	5 . 3	MCL	10	13 780
etc					
				Total Topsoil	19 060 m^3
Subsoil					
I	22 - 52	2 . 4	HCL	40	7 200
II	26 - 50	5 . 3	HCL	30	12 720
etc	50 - 120	5 . 3	HCL	20	37 100
				Total Subsoil	57 020 m^3

10. Depths and volumes quoted should be treated with caution due to soil variability. Soil resources may extend below 120cm.

P BARNETT
Resource Planning Team
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1 May 1998

UNITED DOWNS WASTE
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INTRODUCTION

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SUMMARY

7. The distribution of ALC grades is shown on the accompanying 1: 10 000 scale ALC map. The detail of information shown at this scale is appropriate to the intensity of field survey but could be misleading if enlarged or applied to small areas. Areas are summarised in the Table 1.

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CLIMATE

9. Estimates of climatic variables for this site were derived from the published agricultural climate dataset "Climatological Data for Agricultural Land Classification" (Meteorological Office, 1989) using standard interpolation procedures. Data for key points around the site are given in Table 2 below.

10. Since the ALC grade of land is determined by the most limiting factor present, overall climate is considered first because it can have an overriding influence by restricting land to a lower grade despite more favourable site and soil conditions. Parameters used for assessing overall climate are accumulated temperature, a measure of relative warmth and average annual rainfall, a measure of overall wetness. The results shown in Table 2 indicate that there is an overall climatic limitation which limits the land to Grade 2.

10. Climatic variables also affect ALC grade through interactions with soil conditions. The most important interactive variables are Field Capacity Days (FCD) which are used in assessing soil wetness and potential Moisture Deficits calculated for wheat and potatoes, which are compared with the moisture available in each profile in assessing soil droughtiness limitations. These are described in later sections.

Table 2: Climatic Interpolations: United Downs Waste

Grid Reference		SW741408	SW743408
Altitude (m)		75	65
Accumulated Temperature (day °C)		1565	1576
Average Annual Rainfall (mm)		1191	1183
Overall Climatic Grade		2	2
Field Capacity Days		230	229
Moisture deficit (mm):	Wheat	86	87
	Potatoes	74	76

RELIEF

11. Altitude ranges from 65 metres at the east end of the site to 75 metres in the west with mainly gentle slopes which are not limiting, but with a short bank of stronger slopes in the east of the site which limits this area to Subgrade 3b, although this may not be the primary limitation.

GEOLOGY AND SOILS

12. The underlying geology of the site is shown on the published geology map (BGS, 1990) as Mylor Slate Formation which is entirely consistent with the findings of the current survey. The profiles examined in this survey appeared to be undisturbed although there may have been some superficial spreading of mine waste elsewhere within the survey area.

13. Soils were mapped by the Soil Survey of England and Wales at a reconnaissance scale of 1:250 000 (SSEW, 1983) as Manod Association which is described as well drained fine loamy or fine silty soils over rock. However the current survey found much of the site to be Wetness Class III or even IV with moderate or severe limitation due to wetness. This may be largely induced by the cold wet climate of the area but such soils must be regarded as being at the extreme range of Manod association if it is described as well drained.

AGRICULTURAL LAND CLASSIFICATION

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Subgrade 3a

15. The area shown as Subgrade 3a was found to have medium clay loam topsoil with no evidence of wetness at the two auger borings concerned, which were therefore assessed as Wetness Class I. The primary limitation is restricted workability.

16. Although the current survey contains only 2 borings in the area shown as Subgrade 3a, the survey concluded by N A Duncan in his 1977 survey contains 8 borings in this area which he assessed as Wetness Class I. The boundary shown in the current survey has been drawn to replicate that shown by in the N A Duncan survey.

Subgrade 3b

17. The area shown as Subgrade 3b covers most of the site and was found to be medium clay loam topsoil at Wetness Class III or even IV. At every boring, gleying was evident within 40 cm and at Pit 1 the lower subsoil was assessed by strict interpretation of ALC criteria as slowly permeable, indicating Wetness Class IV, but still Wetness Grade 3b. It

must be said that although Horizon 3 at Pit 1 showed a weakly developed structure which was almost massive and had no visible biopores, such material would not be assessed as slowly permeable on the evidence of auger borings. From the auger borings, it appeared to be friable and generally contained 20 or 30% weathered slate which would enhance this characteristic. However whether Wetness Class III or IV the ALC grade would be the same.

18. The small area of Subgrade 3b within the Subgrade 3a is a short bank primarily limited by gradient.

Conclusion

19. The current survey is largely able to verify the N A Duncan survey of 1997 which was based on twice the density of observations compared to the current survey. There may be some difference of interpretation in the distinction between matrix and mottle colours and the assessment of slowly permeable layers in the subsoil may be debatable, but these characteristics have no effect on ALC grade at this site.

SOIL RESOURCES

20. The site has been divided into two distinct areas, shown as Soil Units on the attached map of soil resources. This is not a soil stripping map but is intended to illustrate the soil resources available for restoration. Topsoil and subsoil volumes for each Soil Unit are shown in Table 2.

Soil Unit I

21. This unit extends to 2.4 ha and comprises the better drained soils on the site, Wetness Class I , which should be somewhat easier to restore.

22. Topsoil was found to be 20-25 cm deep, medium clay loam 10YR42 with around 20% stones, mainly hard quartzite etc.

23. The upper subsoil was found to be heavy clay loam, 10YR63 with around 40% slate stones, extending to 50 or 55 cm and grading into slate parent material which was assessed as over 70% slate rock. The depth to parent material is likely to be variable.

Soil Unit II

24. This unit extends to 5.3 ha and comprises wet gleyed soils with slightly humic topsoils, assessed as Wetness Class III or IV.

25. Topsoil found to be extend to 25 cm, occasionally deeper, medium clay loam 10YR31 with around 10% hard stones. No mottling. Weakly developed coarse subangular blocky, friable and porous. Common fine and very fine roots. Abrupt wavy boundary.

26. Upper subsoil was found to be heavy clay loam to around 50 cm, variable in colour but typically 10YR63 with around 30% mixed stones and common distinct fine ochreous mottles. Gleyed. Friable, moderately developed coarse subangular blocky with few small biopores. Few very fine roots. Gradual smooth boundary.

27. Lower subsoil was generally pale with less mottles extending to at least 80 cm. Heavy clay loam or silty clay with 20-30 % slate stones. Few to common distinct medium ochreous mottles. Gleyed. Friable weakly developed coarse angular blocky with very few pores visible. Slowly permeable. No roots seen.

Table 3: Soil Resources: United Downs Waste

Map Unit	Depth, cm	Area, ha	Texture	Stones %	Volume, m^3
Topsoil					
I	0-22	2.4	MCL	20	5 280
II	0-26	5.3	MCL	10	13 780
etc					
				Total Topsoil	19 060 m^3
Subsoil					
I	22-52	2.4	HCL	40	7 200
II	26-50	5.3	HCL	30	12 720
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				Total Subsoil	57 020 m^3

28. Depths and volumes quoted should be treated with caution due to soil variability. Soil resources may extend below 120cm.

RESTORATION

29. Restoration should be to accepted standards of good practice and should include the following.

30. If it is intended to restore any of the land to Subgrade 3a there should be no slowly permeable layer within 80 cm. This would require loose tipping of the entire profile.

31. Subgrade 3b after restoration would be given by Wetness Class IV which would require lose tipping of topsoil only.

32. Surface gradients should be between 2° to assist surface drainage, and 7°, but upto 11° would be acceptable for Subgrade 3b.

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1 May 1998

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APPENDIX I

DESCRIPTION OF GRADES AND SUBGRADES

Grade 1 - excellent quality agricultural land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly include top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2 - very good quality agricultural land

Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.

Grade 3 - good to moderate quality agricultural land

Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a - good quality agricultural land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b - moderate quality agricultural land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass, or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

Grade 4 - poor quality agricultural land

Land with severe limitations which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops (eg cereals and forage crops) the yields of which are variable. In most climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5 - very poor quality agricultural land

Land with very severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

Source: MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land, MAFF Publications, Alnwick.

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Source: MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land, MAFF Publications, Alnwick.

APPENDIX II

DEFINITION OF SOIL WETNESS CLASSES

Soil wetness is classified according to the depth and duration of waterlogging in the soil profile.

Wetness Class I

The soil profile is not wet within 70 cm depth for more than 30 days in most years.

Wetness Class II

The soil profile is wet within 70 cm depth for 31-90 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 90 days, but not wet within 40 cm depth for more than 30 days in most years.

Wetness Class III

The soil profile is wet within 70 cm depth for 91-180 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 180 days, but only wet within 40 cm depth for between 31 and 90 days in most years.

Wetness Class IV

The soil profile is wet within 70 cm depth for more than 180 days but not within 40 cm depth for more than 210 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 40 cm depth for 91-210 days in most years.

Wetness Class V

The soil profile is wet within 40 cm depth for 211-335 days in most years.

Wetness Class VI

The soil profile is wet within 40 cm depth for more than 335 days in most years.

Notes: The number of days specified is not necessarily a continuous period.

'In most years' is defined as more than 10 out of 20 years.

Source: Hodgson, J M (Ed) (1997) Soil Survey Field Handbook. Soil Survey Technical Monograph No 5, Silsoe.

APPENDIX III

ABBREVIATIONS AND TERMS USED IN SURVEY DATA

Soil pit and auger boring information collected during ALC survey is held on a computer database and is reproduced in this report. Terms used and abbreviations are set out below. These conform to definitions contained in the Soil Survey Field Handbook (Hodgson, 1997).

1. Terms used on computer database, in order of occurrence.

GRID REF: National 100 km grid square and 8 figure grid reference.

LAND USE: At the time of survey

WHT:	Wheat	**SBT:**	Sugar Beet	**HTH:**	Heathland
BAR:	Barley	**BRA:**	Brassicas	**BOG:**	Bog or Marsh
OAT:	Oats	**FCD:**	Fodder Crops	**DCW:**	Deciduous Wood
CER:	Cereals	**FRT:**	Soft and Top Fruit	**CFW:**	Coniferous Woodland
MZE:	Maize	**HRT:**	Horticultural Crops	**PLO:**	Ploughed
OSR:	Oilseed Rape	**LEY:**	Ley Grass	**FLW:**	Fallow (inc. Set aside)
POT:	Potatoes	**PGR:**	Permanent Pasture	**SAS:**	Set Aside (where known)
LIN:	Linseed	**RGR:**	Rough Grazing	**OTH:**	Other
BEN:	Field Beans	**SCR:**	Scrub		

GRDNT: Gradient as estimated or measured by hand-held optical clinometer.

GLEY, SPL: Depth in centimetres to gleying or slowly permeable layer.

AP (WHEAT/POTS): Crop-adjusted available water capacity.

MB (WHEAT/POTS): Moisture Balance. (Crop adjusted AP - crop potential MD)

DRT: Best grade according to soil droughtiness.

If any of the following factors are considered significant, 'Y' will be entered in the relevant column.

MREL:	Microrelief limitation	**FLOOD:**	Flood risk	**EROSN:**	Soil erosion risk
EXP:	Exposure limitation	**FROST:**	Frost prone	**DIST:**	Disturbed land
CHEM:	Chemical limitation				

LIMIT: The main limitation to land quality: The following abbreviations are used.

OC:	Overall Climate	**AE:**	Aspect	**EX:**	Exposure
FR:	Frost Risk	**GR:**	Gradient	**MR:**	Microrelief

FL:	Flood Risk	**TX:**	Topsoil Texture	**DP:**	Soil Depth
CH:	Chemical	**WE:**	Wetness	**WK:**	Workability
DR:	Drought	**ER:**	Erosion Risk	**WD:**	Soil Wetness/Droughtiness
ST:	Topsoil Stoniness				

TEXTURE: Soil texture classes are denoted by the following abbreviations:-

S:	Sand	**LS:**	Loamy Sand	**SL:**	Sandy Loam
SZL:	Sandy Silt Loam	**CL:**	Clay Loam	**ZCL**	Silty Clay Loam
ZL:	Silt Loam	**SCL:**	Sandy Clay Loam	**C:**	Clay
SC:	Sandy clay	**ZC:**	Silty clay	**OL:**	Organic Loam
P:	Peat	**SP:**	Sandy Peat	**LP:**	Loamy Peat
PL:	Peaty Loam	**PS:**	Peaty Sand	**MZ:**	Marine Light Silts

For the sand, loamy sand, sandy loam and sandy silt loam classes, the predominant size of sand fraction will be indicated by the use of the following prefixes:-

F: Fine (more than 66% of the sand less than 0.2mm)
M: Medium (less than 66% fine sand and less than 33% coarse sand)
C: Coarse (more than 33% of the sand larger than 0.6mm)

The clay loam and silty clay loam classes will be sub-divided according to the clay content: **M:** Medium (< 27% clay) **H:** heavy (27 - 35% clay)

MOTTLE COL: Mottle colour using Munsell notation.

MOTTLE ABUN: Mottle abundance, expressed as a percentage of the matrix or surface described.

F: few <2% **C:** common 2 - 20% **M:** many 20 - 40% **VM:** very many 40%+

MOTTLE CONT: Mottle contrast

F: faint - indistinct mottles, evident only on close inspection
D: distinct - mottles are readily seen
P: Prominent - mottling is conspicuous and one of the outstanding features of the horizon.

PED. COL: Ped face colour using Munsell notation.

GLEY: If the soil horizon is gleyed a 'Y' will appear in this column. If slightly gleyed, an 'S' will appear.

STONE LITH: Stone Lithology - One of the following is used.

HR:	All hard rocks and stones	**SLST:**	Soft oolitic or dolimitic limestone

CH:	Chalk	**FSST:**	Soft, fine grained sandstone
ZR:	Soft, argillaceous, or silty rocks	**GH:**	Gravel with non-porous (hard) stones
MSST:	Soft, medium grained sandstone	**GS:**	Gravel with porous (soft) stones
SI:	Soft weathered igneous or metamorphic rock		

Stone contents are given in % by volume for sizes >2cm, >6cm and total stone >2mm.

STRUCT: The degree of development, size and shape of soil peds are described using the following notation

Degree of development	**WA:**	Weakly developed Adherent	**WK:**	Weakly developed
	MD:	Moderately developed	**ST:**	Strongly developed
Ped size	**F:**	Fine	**M:**	Medium
	C:	Coarse	**VC:**	Very coarse
Ped Shape	**S:**	Single grain	**M:**	Massive
	GR:	Granular	**AB:**	Angular blocky
	SAB:	Sub-angular blocky	**PR:**	Prismatic
	PL:	Platy		

CONSIST: Soil consistence is described using the following notation:

L:	Loose	**VF:**	Very Friable	**FR:**	Friable	**FM:**	Firm
VM:	Very firm	**EM:**	Extremely firm			**EH:**	Extremely Hard

SUBS STR: Subsoil structural condition recorded for the purpose of calculating profile droughtiness: **G:** Good **M:** Moderate **P:** Poor

POR: Soil porosity. If a soil horizon has poor porosity with less than 0.5% biopores >0.5mm, a 'Y' will appear in this column.

IMP: If the profile is impenetrable to rooting a 'Y' will appear in this column at the appropriate horizon.

SPL: Slowly permeable layer. If the soil horizon is slowly permeable a 'Y' will appear in this column.

CALC: If the soil horizon is calcareous with naturally occurring calcium carbonate exceeding 1% a 'Y' will appear this column.

2. Additional terms and abbreviations used mainly in soil pit descriptions.

STONE ASSESSMENT:

VIS:	Visual	**S:**	Sieve	**D:**	Displacement

MOTTLE SIZE:

EF:	Extremely fine <1mm	**M:**	Medium 5-15mm
VF:	Very fine 1-2mm>	**C:**	Coarse >15mm
F:	Fine 2-5mm		

MOTTLE COLOUR: May be described by Munsell notation or as ochreous (OM) or grey (GM).

ROOT CHANNELS: In topsoil the presence of 'rusty root channels' should also be noted.

MANGANESE CONCRETIONS: Assessed by volume

N:	None		**M:**	Many	20-40%
F:	Few	<2%	**VM:**	Very Many	>40%
C:	Common	2-20%			

POROSITY:

P: Poor - less than 0.5% biopores at least 0.5mm in diameter
G: Good - more than 0.5% biopores at least 0.5mm in diameter

ROOT ABUNDANCE:

The number of roots per $100cm^2$:		Very Fine and Fine	Medium and Coarse
F:	Few	1-10	1 or 2
C:	Common	10.25	2 - 5
M:	Many	25-200	>5
A:	Abundant	>200	

ROOT SIZE

VF:	Very fine	<1mm	**M:**	Medium	2 - 5mm
F:	Fine	1-2mm	**C:**	Coarse	>5mm

HORIZON BOUNDARY DISTINCTNESS:

Sharp:	<0.5cm	**Gradual:**	6 - 13cm
Abrupt:	0.5 - 2.5cm	**Diffuse:**	>13cm
Clear:	2.5 - 6cm		

HORIZON BOUNDARY FORM: Smooth, wavy, irregular or broken.*
* See Soil Survey Field Handbook (Hodgson, 1997) for details.

SITE NAME	PROFILE NO.	SLOPE AND ASPECT	LAND USE		PARENT MATERIAL
United Downs Waste	Pit 1 (Asp 11/6)	3° N	Cer	Av Rainfall: 1183 mm ATO: 1576 day °C	Mylor Slate
JOB NO.	DATE	GRID REFERENCE	DESCRIBED BY	FC Days: 229 Climatic Grade: 2 Exposure Grade: 1	PSD SAMPLES TAKEN
53.98	15.4.98	SW 74084083	PB		TS 0-25 cm composite (S35: Z47: C18%)

Horizon No.	Lowest Av. Depth (cm)	Texture	Matrix (Ped Face) Colours	Stoniness: Size,Type, and Field Method	Mottling Abundance, Contrast, Size and Colour	Mangan Concs	Structure: Ped Development Size and Shape	Consistence	Structural Condition	Pores (Fissures)	Roots: Abundance and Size	Calcium Carbonate Content	Horizon Boundary: Distinctness and form
1	24	MCL	10YR31	10%HR (vis)	0	0	WKCSAB	FR	-	G	CF,VF	-	Abrupt Wavy
2	50	HCL	10YR62,32	30% HR(vis)	CDF, MO 5YR58	0	MDCSAB	FR	M	P(low)	FVF	-	Grad Smooth
3	80+	HCL/ZC	2.5Y71,81	20% HR (vis)	CDMO 10YR66	0	WKCAB	FR	M	P	0	-	

Profile Gleyed From: 24 cm

Slowly Permeable Horizon From: 50 cm

Wetness Class: IV

Wetness Grade: 3b

Available Water Wheat: 126 mm

Potatoes: 95 mm

Moisture Deficit Wheat: 87 mm

Potatoes: 75 mm

Moisture Balance Wheat: +39 mm

Potatoes: +20 mm

Droughtiness Grade: 1 (Calculated to 120 cm)

Final ALC Grade: 3b

Main Limiting Factor(s): We

Remarks: H3 Strictly SPL because of structure and porosity (biopores), but lacked the appearance of a typical SPL. If not SPL, profile would be W. C. III.