



silverwoods
WASTE MANAGEMENT LIMITED

**STORAGE TANK REQUIREMENT
REPORT**

CLIENT: J & E Dickinson
DATE: 21/10/2011
PRODUCED BY: Julian Silverwood

1.0 INTRODUCTION

Silverwoods Waste Management Ltd set the industry benchmark in terms of Environmental Compliance. Our attention to detail and understanding of the Environmental Permitting Regulations (England and Wales) 2010, along with the NVZ Regulations ensures that our clients can focus on production, in the knowledge that their wastes are being managed responsibly.

Our services include;

- Management of Dairy Effluents, Wash-waters, DAF Sludge's, Compost and many other sources of both liquid and solid organic wastes.
- Nitrate Vulnerable Zone (NVZ) Compliance.

We have been invited by Mr Dickinson to produce a report assessing the slurry storage requirements at Tyers Hall in preparation for the 1/1/2012 NVZ deadline. The legislation stipulates that all farms within a designated NVZ have to have sufficient storage facilities in place by this date to accommodate up to 6 months of slurry production.

2.0 SLURRY & FYM - CURRENTLY PRODUCED

To date there has been much work completed on assessing the total volume of slurry and FYM produced from Tyers Hall Farm. Martin Pickering has recently updated a report originally produced by ADAS following a site visit by Ian McDonald from the EA. It is important to ensure that there is continuity on the figures reported. We have checked and cross referenced the figures produced by Martin and can confirm they are accurate. The table below summarises both the *Tonnage* of Slurry & FYM produced along with the *Kg of Nitrogen* produced from the farm at the stoking rates detailed below.

Table 1: Summary of Slurry & FYM Volumes

<i>Consultant</i>	<i>Stock Numbers</i>	<i>Volume of Slurry/FYM Produced Over 12 Months</i>	<i>Nitrogen Produced Over 12 Months</i>
Martin Pickering	702 Sows 18 Dry Sows 4 Boars 2129 Weaners 434 Gilts 4425 Fattners 252 Cows 241 Heifers	21,358t	90,405Kg
Silverwoods Ltd	702 Sows 18 Dry Sows 4 Boars 2129 Weaners 434 Gilts 4425 Fattners 252 Cows 241 Heifers*	21,358t	92,537Kg

*It is important to note that the standard Kg/N/yr. produced by a typical 13month+ Heifer is **61kg** and it is on this figure that Silverwoods have based their calculations. It has been suggested however that the EA have given approval for this figure to be reduced due to the smaller size of the Jersey. A figure of **31kg** N/yr/animal has therefore been used in Martin's figures hence the slight difference in the total Nitrogen produced on the farm.

It is also important to note that the stock numbers detailed in the table above have been extracted from the PLANET software package which takes in to account the 'percentage occupancy'. These figures have been previously approved by the EA and have therefore remained unchanged this report.

Samples of slurry have been taken from the following locations;

- Tyers Hall Cow & Pig Slurry
- Tyers Hall Dirty Water
- Tyers Hall FYM
- Woodlaithes Pig Slurry
- Woodlaithes Manure Pad

The full analysis results have been summarised below in Table 2;

Table 2: Summary of Waste Analysis Results

Waste Description	Parameters								
	pH	Total Nitrogen	Ammonium Nitrogen	Calcium	Magnesium	Phosphorus	Potassium	Dry Matter	Total Sulphur
Wood Laithes Pig Slurry	7.8	3.48 g/l	3120 mg/l	176 mg/l	44.0 mg/l	147 mg/l	1310 mg/l	13.7 g/l	177 mg/l
Wood Laithes Manure Pad Tank	8.0	1.87 g/l	1590 mg/l	161 mg/l	31.8 mg/l	67.7 mg/l	1270 mg/l	9.40 g/l	113 mg/l
Tyers Hall FYM Dry Matter	NA	1.80 g/100g	160 mg/kg	12,100 mg/kg	4400 mg/kg	5710 mg/kg	25400 mg/kg	312 g/kg	3930mg/kg
Tyers Hall Slurry	7.4	2.34g/l	1970 mg/l	559 mg/l	144 mg/l	361 mg/l	1260 mg/l	123.4 g/l	110 mg/l
Tyers Hall Dirty Water	6.1	0.23 g/l	177 mg/l	215 mg/l	65.7 mg/l	166 mg/l	230 mg/l	4.20 g/l	31.6 mg/l

The analysis suggests that the samples taken are slightly more 'dilute' than the figures produced in standard nutrient loading tables. Pig Slurry in standard figures contains 3.6 kg/N/t, our analysis suggests a range of 3.5 and 1.8KgN/t. FYM also has a typical N content of 7kgN/t and our analysis suggests 5.6KgN/t. Typical Dairy Slurry based on standard figures contains 3 KgN/t and the analysis above suggests 2.3KgN/t. The Dirty Water is exceptionally 'dilute' and could be applied up to 700t/ha and still comply with the 170KgN/ha loading, however, the maximum application allowed is 250t/ha.

The EA request that Standard Figures are used but there may well be an argument here to suggest that we can apply at a higher application rate which will result in less land being required.

Based on a Nitrogen addition of **170kg/N/ha/yr** the following maximum application rates have been calculated based on the chemical analysis in Table 2;

Table 3: Maximum Applications

Location	Maximum t/ha	Maximum t/acre
Wood Laithes Pig Slurry	44	18
Wood Laithes Manure Pad Tank	90	36
Tyers Hall FYM	28	11
Tyers Hall Slurry	72	29
Tyers Hall Dirty Water	250	100

The NVZ regulations impose a 'N max' limits for crop nitrogen requirements supplied from both manufactured nitrogen and nitrogen from livestock manures. The maximum N limits are currently being controlled by Martin again via the use of the PLANET software package. Julian Thirsk (The Arable Group) takes into account the nitrogen applied in the form of organic wastes and advises on bagged fertiliser use. He ensures that the crops N Max limit is being adhered to in accordance with the table below.

Table 4: N Max Limits

Crop	N Max Limit (Kg N/ha)	Standard Crop Yield (t/ha)
Wheat, autumn or early winter sown	220	8
Wheat, spring sown	180	7
Barley, winter	180	6.5
Barley, spring	150	5.5
OSR	250	3.5
Sugar Beet	120	n/a
Potatoes	270	n/a
Forage maize	150	n/a
Field beans	0	n/a
Peas	0	n/a
Grass	330	n/a

3.0 STORAGE REQUIREMENTS

For the purposes of assessing the NVZ storage requirements we have based our calculations on the annual figure of **(21,358t)** which currently consists of both of Slurry / FYM.

This figure has been broken down in to the two waste streams as follows;

6,036 tonnes of FYM
15,322 tonnes of Slurry (equivalent of 1,392 - 2,500 gallon tanker loads)

The regulations state that FYM can be stored at a suitable, temporary field site provided;

“the manure can be stacked and liquid does not drain from within the stack”

Using the slurry figure of 15,322t, we have calculated the true storage requirements as detailed in Table 5;

Table 5: Storage Required (Slurry Only)

<i>Average Monthly Production</i>	<i>6 Month Storage Requirements</i>
1,276t	7,660t

4.0 STORAGE AVAILABLE

There are a total of 2 stores currently on the farm to contain the Slurry. The main slurry store designated for both the Cattle & Pig slurry has a capacity of **2,036 tonnes or 447,920 gallons** and can be seen in the photograph below. The site visit identified a number of repairs that have been carried out on the side walls of the tank where a number of metal ‘patches’ have been attached to prevent leaks. **This does question the structural integrity of the tank and importantly its future life expectancy.**

Photograph 1: Cow & Pig Slurry Store



At Woodlaites, the underground tanks contain the Pig Slurry and have a capacity of **420t or 92,400 gallons**. The combination of both the main slurry store and this tank provide an immediate storage facility of **2,456t**.

Table 6 below suggests that **7,660t** is required which results in a shortfall of **5,204t**.

Table 6: Summary of Storage Requirements

<i>Storage Available</i>	<i>Storage Required</i>	<i>Difference</i>
2,456t	7,660t	-5,204 or -1,144,880 gallons

5.0 CONCLUSION

5.1 RECOMMENDATION TO ADDRESS THE SHORTFALL OF STORAGE CAPACITY

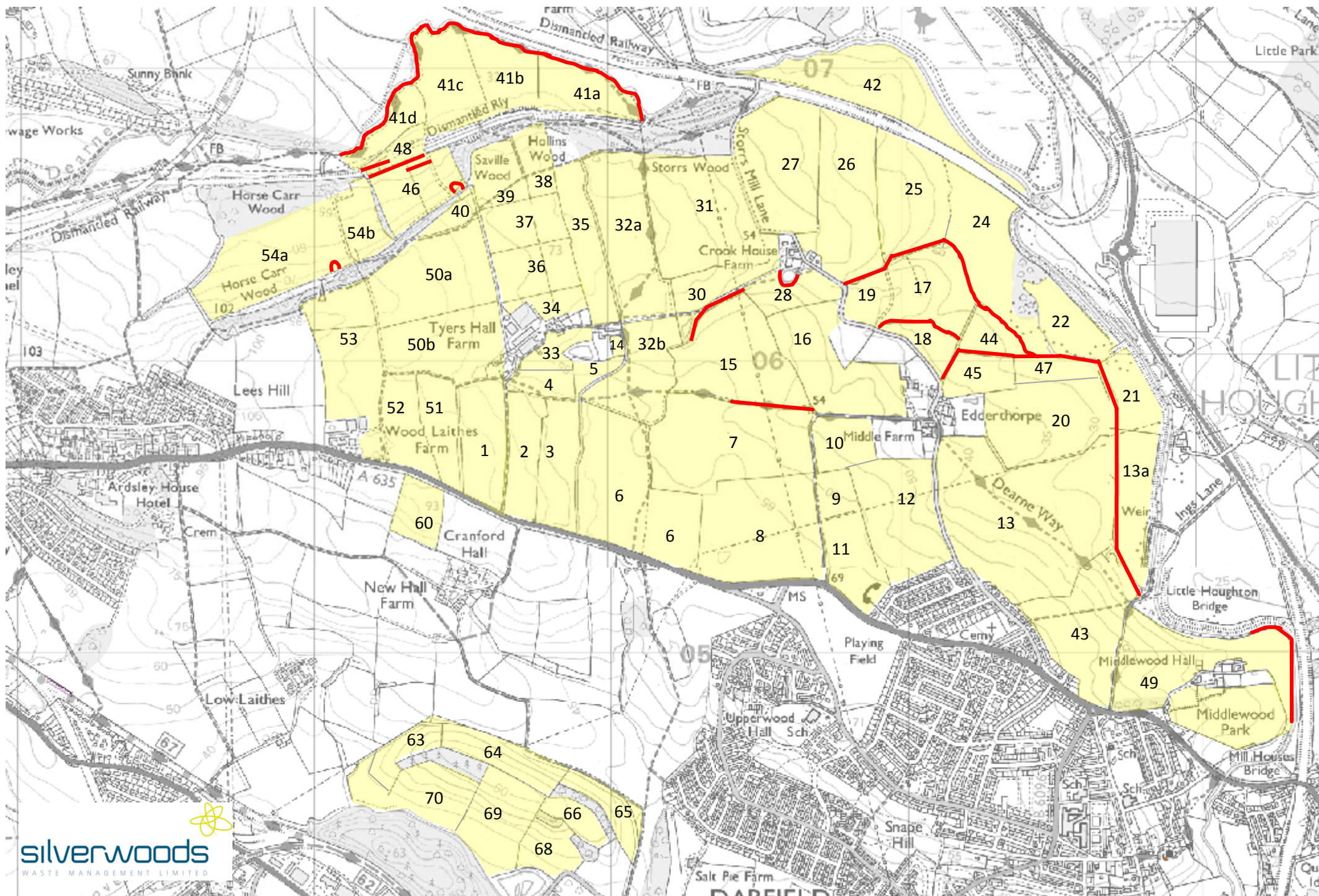
The farm visit combined with the detailed assessment of the volumes of slurry produced from the farm has highlighted the **immediate requirement for additional storage facilities**.

The installation of a new slurry store is required to comply with the NVZ regulations. Not only will a new store provide the necessary storage facilities it will also lead to significant environmental benefits.

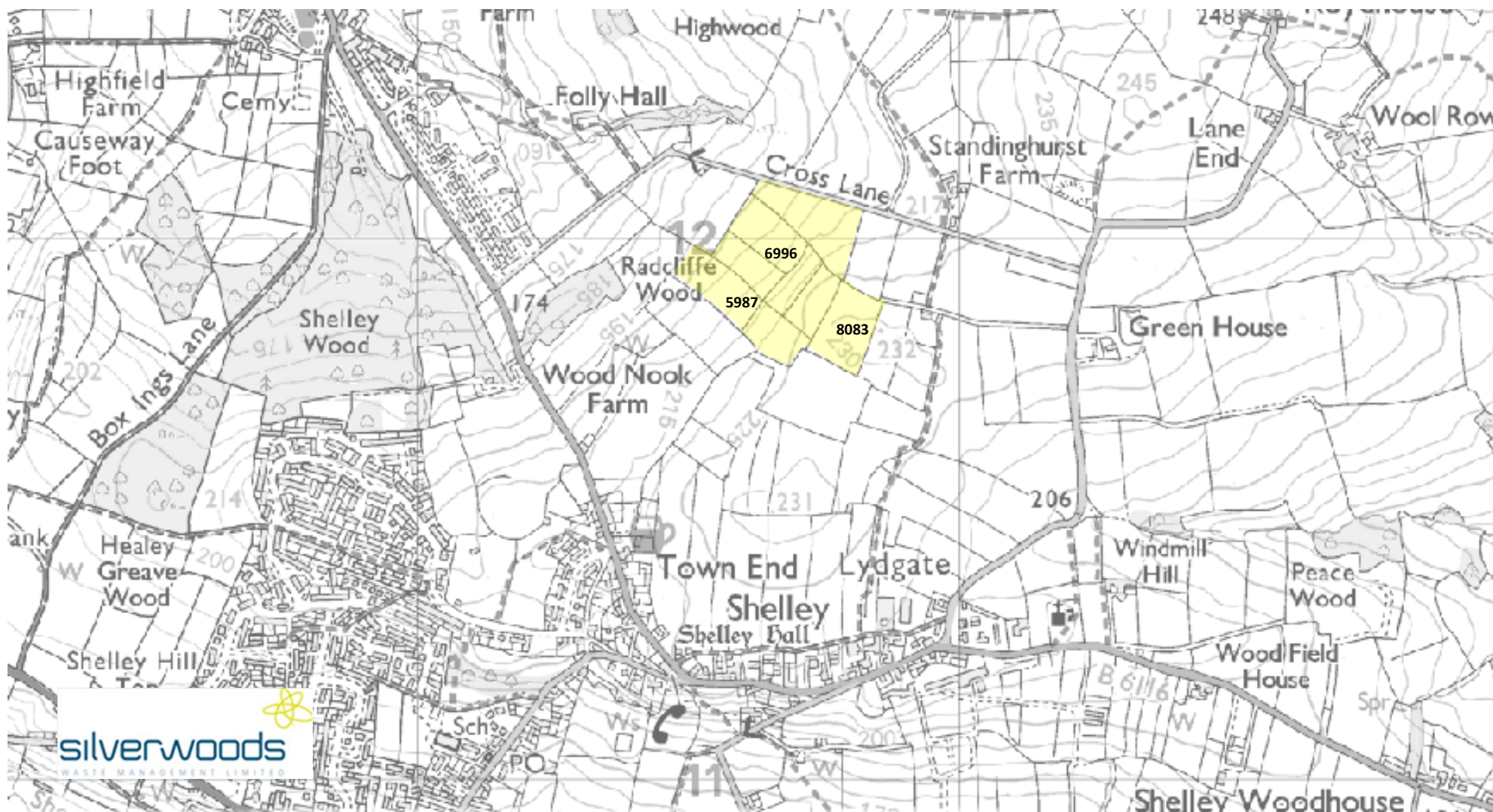
Applications of slurry can be tailored specifically to crop nutrient requirements and weather conditions. Bagged fertiliser is currently purchased and the volume currently reduced used could be reduced significantly if slurry could be applied in a timely manner. With fertiliser prices continuing to rise, the benefits associated with obtaining and improving the utilisation of the nutrients supplied by the slurry could be used to off-set the cost of installation.

Appendix 2

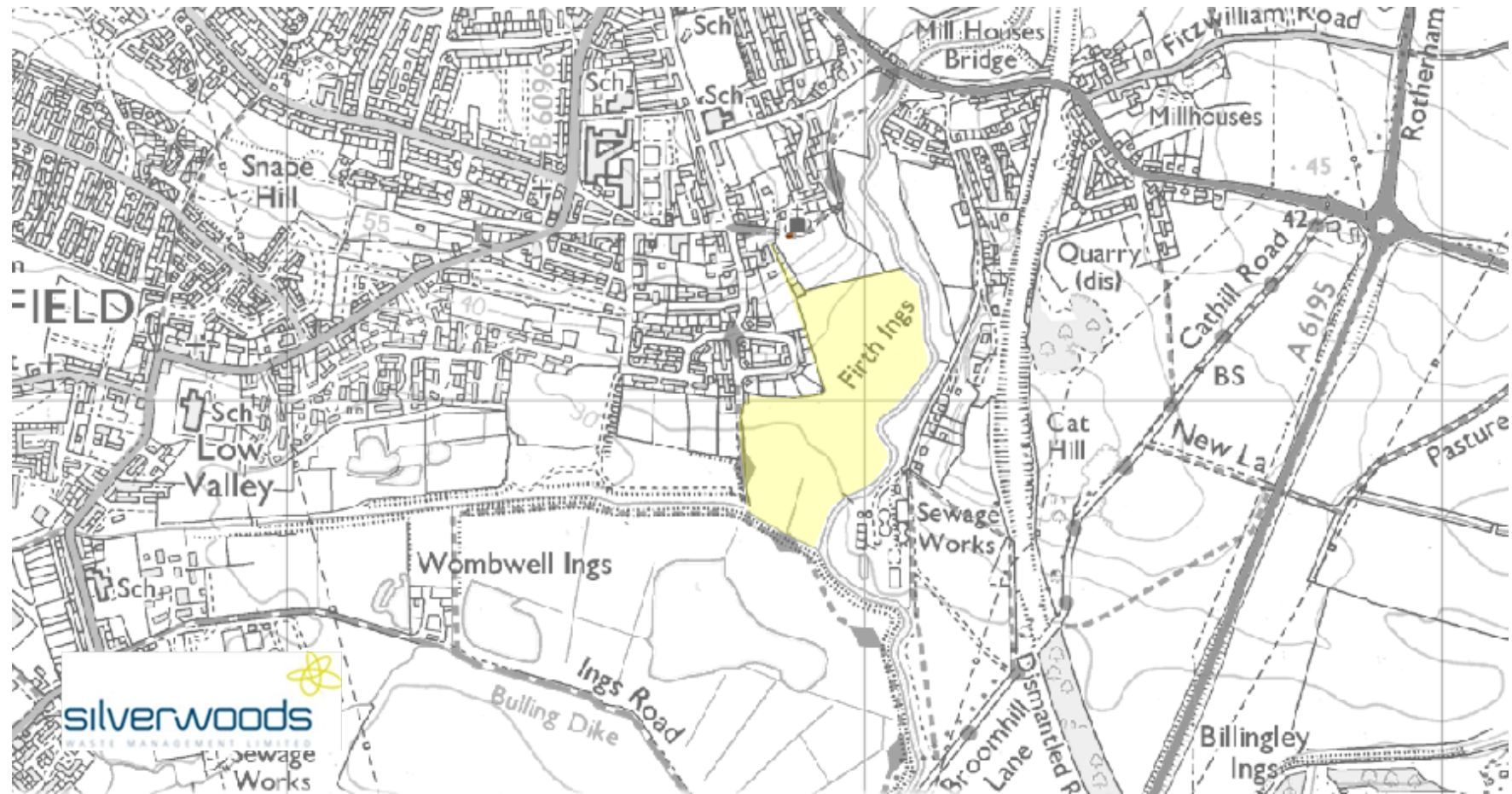
NVZ Pollution Risk Assessment



Shelley



Land off Church Street



Field No	Field Name	RPA Field No	Field Size (Ha)	Spreadable Area (ha)	Crop	Guideline Max Application (t)	
						FYM	Slurry
1	17 Acre	5873	6.23	6.19	Temp Grass	186	297
2	12 Acre	7169	4.85	4.82	Perm Grass	145	231
3	Site	8467	5.80	5.93	Perm Grass	178	285
4	Bank	7893	1.99	1.96	Perm Grass	59	94
5	Triangle		1.14	1.14	Perm Grass	34	55
6	Garage	0655	15.09	15.09	W Wheat	453	724
7	Reseed	4172	15.08	15.08	OS Rape	452	724
8	Garden C	5342	14.20	13.99	W Wheat	420	672
9	Priestcroft	7755	2.05	1.99	W Barley	60	96
10	Priestcroft	8072	3.56	3.61	W Barley	108	173
11	Priestcroft	8233	5.26	5.27	W Barley	158	253
12	Belbrook	0148	10.13	10.00	W Barley	300	480
13	65 Acre	4246	26.31	26.28	W Wheat	788	1261
13a	Bottom 65 Acre	7951	5.49	5.27	W Barley	158	253
14	Paddock	0305	0.31	0.31	Perm Grass	9	15
15	29 Acre	4249	11.59	11.68	OS Rape	350	561
16	Bean Field		11.14	11.14	W Wheat	334	535
17	Cover Crop	0924	7.44	6.91	W Barley	207	332
18	Next to Muck	1007	2.28	2.28	OS Rape	68	109
19	Small Spring Wheat		2.33	2.33	Fodder Beet	70	112
20	Lucerne	5080	10.70	10.62	W Barley	319	510
21	RH River	7787	3.77	3.81	W Barley	114	183
22	LH River		4.45	4.45	W Barley	134	214
24	Blackland	3034	9.31	9.28	W Barley	278	445
25	Spring Wheat	0455	8.87	8.90	W Wheat	267	427
26	Crookhouse Maize 1	8155	11.16	11.28	W Wheat	338	541
27	Maize 2	5964	1.72	11.79	Maize	354	566
28	Pond Crookhouse	6223	3.39	3.28	Perm Grass	98	157
30	Bin	4032	7.80	7.80	W Wheat	234	374
31	Pylon	3156	9.05	9.20	W Wheat	276	442
32a	Long	1218	6.5	9.83	Perm Grass	295	472
32b	Long		7.09	7.09	Perm Grass	213	340
33	Pond T.Hall	8104	2.09	2.05	Perm Grass	62	98
34	1 st Pad	8419	1.74	1.61	Perm Grass	48	77
35	Long	9146	6.5	6.50	Temp Grass	195	312
36	2 nd Pad	7531	4.91	4.34	Perm Grass	130	208
37	3 rd & 4 th Pad	7147	4.39	4.41	Perm Grass	132	212
38	Tip	7667	2.36	2.36	Perm Grass	71	113
39	6 th & 7 th Pad	6264	3.56	3.53	Perm Grass	106	169
40	Wood Top		1.25	1.25	Perm Grass	38	60
41a	Bottoms	9196	4.80	4.63	W Barley	139	222
41b	Bottoms	6699	4.76	4.81	W Barley	144	231
41c	Bottoms	4596	6.34	6.37	W Barley	191	306
41d	Bottoms	2376	3.15	3.18	W Barley	95	153
42	Braithwaites	8997	11.68	9.42	OS Rape	283	452
43	Darfield		10.71	10.71	W Barley	321	514
44	AgBag	3109	2.59	1.74	Fodder Beet	52	84
45	AgBag	2797	2.80	2.81	W Barley	84	135
46	Woodfields	3660	5.53	5.44	Perm Grass	163	261
47	N to AgBag	5496	2.47	2.44	W Wheat	73	117
48	Lagoon		3.15	3.15	Perm Grass	95	151
49	Middlewood		16.91	16.91	W Wheat	507	812
50a	RH 50 Acre	4029	10.14	10.82	Perm Grass	325	519
50b	LH 50 Acre	4505	9.18	8.55	Perm Grass	257	410
51	Clover	4377	3.95	3.95	OS Rape	119	190
52	Woodlaithes	3080	5.18	5.18	Temp Grass	155	249
53	Transmitter	1302	9.21	9.21	Temp Grass	276	442
54a	Outcrop	8735	12.94	12.94	Perm Grass	388	

RPA Field	Field Size (ha)	Spreadable Area	Crop	Guideline Max Application (t)	
				FYM	Slurry
3099	3.26	3.26	Perm Grass	97.8	153.22
2122	1.39	1.39	Perm Grass	41.7	65.33
2507	0.55	0.55	Perm Grass	16.5	25.85
2610	0.59	0.59	Perm Grass	17.7	27.73
3016	1.47	1.47	Perm Grass	44.1	69.09
3137	0.65	0.65	Perm Grass	19.5	30.55
3427	1.69	1.69	Perm Grass	50.7	79.43
3740	0.28	0.28	Perm Grass	8.4	13.16
3912	0.18	0.18	Perm Grass	5.4	8.46
4249	0.53	0.53	Perm Grass	15.9	24.91
4735	1.13	1.13	Perm Grass	33.9	53.11
4858	0.56	0.56	Perm Grass	16.8	26.32
5340	1.26	1.26	Perm Grass	37.8	59.22
5669	0.62	0.62	Perm Grass	18.6	29.14
5914	0.82	0.82	Perm Grass	24.6	38.54
5923	0.13	0.13	Perm Grass	3.9	6.11
5944	2.29	2.29	Perm Grass	68.7	107.63
6029	0.58	0.58	Perm Grass	17.4	27.26
6254	1.88	1.88	Perm Grass	56.4	88.36
6410	0.31	0.31	Perm Grass	9.3	14.57
6459	1.15	1.15	Perm Grass	34.5	54.05
6766	1.4	1.4	Perm Grass	42	65.8
6821	0.49	0.49	Perm Grass	14.7	23.03
6875	1.04	1.04	Perm Grass	31.2	48.88
7107	0.53	0.53	Perm Grass	15.9	24.91
7329	0.63	0.63	Perm Grass	18.9	29.61
7926	1.82	1.82	Perm Grass	54.6	85.54
6996	4.77	4.77	Perm Grass	143.1	224.19
5987	2.09	2.09	Perm Grass	62.7	98.23
8083	1.34	1.34	Perm Grass	40.2	62.98
			TOTAL	1062.9	1665.21