Assessment of the Potential Landbank for PAS 100 Compost

Report to

Scottish Government

January 2009

Remade Scotland

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The Caledonian Environment Centre is part of the School of the Built and Natural Environment, Glasgow Caledonian University and is supporting environmental research and policy development in Scotland

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Executive Summary

Remade Scotland, have through this report, assessed landbank availability for potential land application routes for source segregated green waste/combined food and garden waste derived compost produced to PAS 100. For the purposes of this report a landbank is defined as 'stock land with planning permissions but where development has yet to take place'. This report identifies a landbank area which could provide an outlet for around 27,788,000 t/year, primarily in agricultural applications. This assessment does not include existing markets and outlets for MSW derived compost or the potentially significant usage in the domestic gardening market.

However although agriculture has the potential to use significant tonnages of material, due to existing issues surrounding Quality Meat Scotland's (QMS) standards, the currently available agricultural land bank is assessed as being only 25,000 t/yr giving a total available capacity of between 134,250 t/yr and 153,000 t/yr.

With the expansion of green waste derived compost and the move towards recovery of food waste for composting approximately 140,000 of PAS 100 compost could be on the market in the near future of which the current 90,000T is currently being utilised in existing markets.

It is therefore use by Councils in infrastructure development and application to land for roads, parks and gardens along with Brownfield and Derelict & Urban Vacant Land (DUVL) that has the immediate potential to utilise significant tonnages of material.

Potential Landbank	Application Rate (t/ha)	Potential tonnages of PAS 100
Agriculture	30	25,000 - 27,660,000 t/yr
Brownfield/DUVL	125-500	42,500 t/yr
Forestry	125-250	18,750 – 37,500 t/yr
Councils	Unknown	48,000t/yr
Total		**134,250 - 27,788,000t/yr**

There is as yet still only limited specification of PAS 100 compost by Local Authorities and the incorporation of such specifications into Council Sustainable Procurement Practices could make a significant impact on utilisation rates.

A significant amount of Brownfield/DUVL sites also exist in Scotland and Planning Departments play a major role in the development of these by imposing conditions on the developers involved in the projects. Use of PAS 100 material is as yet not widely used for developments as there are no specific requirements set out in planning policy to specify a particular recycled content.

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1. Introduction

Changes in European and UK legislation mean that alternatives to landfill must be found for a range of organic materials. Application to land is a popular option however there are risks and benefits which relate to properties of the soil and land-use. An assessment of the size and availability of landbanks is required to determine how practical it is to apply extra quantities of organic wastes to land across Scotland.

This report seeks to review Council Structure Plans and to provide a summary of landbanks potentially available for source segregated green waste/combined food and garden waste compost in Scotland. The report will highlight barriers to the use of compost on these landbanks and identify areas where policy intervention may be required. The landbanks outlined in this report could also provide an outlet for Publicly Available Standard (PAS) 110 digestate. Currently however there are very few Anaerobic Digestion plants operating in Scotland. Markets for PAS 110 could be assessed at a later date.

There is no set definition for a landbank. In a Council context however a landbank is defined as 'stock land with planning permissions but where development has yet to take place. The landbank can be of land for minerals, housing or any other use' (Planning Portal, 2008). For the purpose of this report a landbank will include areas of agricultural land and field horticulture, forestry, brownfields, infrastructure development (such as transport networks) and Council owned land such as parks and gardens.

2. Background

Scotland has a land area of around 7.8 million hectares of which Agriculture is the dominant land use activity equating to approximately 6.2 million hectares (Scottish Government, 2008a). Approximately 30% of the land area of Scotland is used for arable crops and improved grassland, with a further 17% under woodland. 20% (1.56 million hectares) is protected by various designations such as Sites of Special Scientific Interest (SSSIs), National Parks and Local Nature Reserves (LNRs) (Scottish Natural Heritage, 2008). Scottish Natural Heritage states that less than 3% of Scotland is classed as urban.

According to the Scottish Government (2008b) approximately 25 million tonnes of organic material is applied to an estimated area of approximately 260,000 hectares of land each year; agricultural manures and slurries account for 23 million tonnes; in 2005 non-agricultural waste equated to 1.5 million tonnes and sewage sludge 65,000 tonnes of dry solids. A large number of biodegradable wastes can be applied to land under Waste Management Exemptions. A number of restrictions apply; The Waste Management Licensing Regulations (WMLR) Paragraph 7 states that a maximum of 250 tonnes per hectare of waste derived compost can be spread on land annually provided the treatment results in benefit to agriculture or ecological improvement

and that the land to be treated by the waste does not exceed 50 hectares. Provisions made under Paragraph 9 of the WML exemptions allow for up to 20,000 cubic metres of material to be applied per hectare for land reclamation/improvement; again, a number of restrictions may apply which will be assessed by Scottish Environment Protection Agency (SEPA) on a case by case basis.

Compost has a wide range of biological, chemical and physical properties which can benefit both soil and plant health. It has been proven to:

- Improve soil structure and porosity;
- Improve moisture retention;
- Improve nutrients; and
- Improve yields.

According to a survey carried out in 2005/06 by the Association for Organics Recycling (previously the Composting Association) (2008) agriculture and land restoration are the largest markets in Scotland for compost produced from source segregated wastes; accounting for 24,625 tonnes (26%) and 17,323 tonnes (19%) respectively.

Market Sectors in Scotland

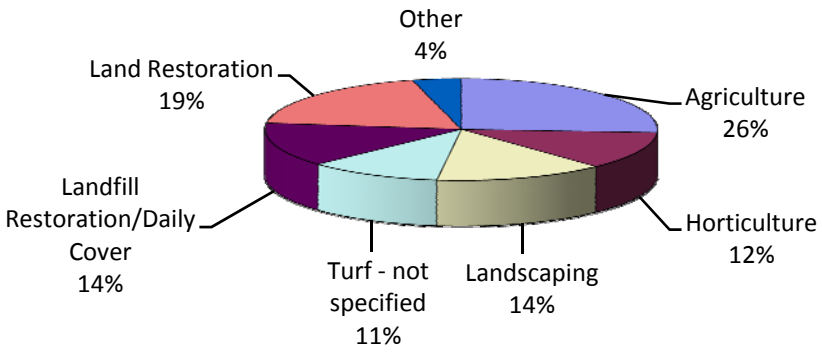

Figure 1 – Market Sectors in Scotland for compost produced from source segregated wastes - Source: AFOR, 2005/06

Over the next few years Councils need to increase the diversion of organic materials from landfill to meet both Landfill Allowance Scheme (LAS) targets and higher recycling targets recently announced by the Scottish Government. Scotland has to reduce the landfilling of BMW to 1.32 million tonnes by 2009/10 and to 0.88 million tonnes by 2012/013. In 2006/07 approximately 1.47 million tonnes of biodegradable municipal waste was landfilled by or on behalf of Councils (SEPA, 2008a). According to figures published by SEPA around 270,000 tonnes of municipal green waste was collected in 2006/07. To further increase the diversion of biodegradable wastes many Councils are considering implementing food waste collections as approximately 600,000 tonnes of food waste is landfilled (based on 18% MSW 2006/07). Food Waste Collection Trials are being funded for one year in Scotland to provide a clear understanding of the effectiveness of different food waste collection systems, both in terms of diverted tonnage from the residual waste stream and the associated economics. Four of the trial areas focus on collection of food waste only and three on combined food and green waste collections. Six of the Councils have rolled out the service and early indications suggest that food waste only collections yield approximately 1.6kg/hh/wk. If fully rolled out across Scotland, food waste recycling has the potential to recover approximately 200,000 t/yr of BMW.

To meet biodiversion targets treatment facilities are required and many of these will need substantial investment. As such a sound business model is required. This model would need to identify feedstocks available and markets (which could potentially include a number of landbanks) for the outputs. Being able to identify potential outlets within specific zones (for example Scottish Enterprise Zones) will help improve confidence of organisations who are looking to construct new facilities or invest in/funding waste treatment facilities.

There are a number of restrictions on the suitability of land for accepting organic materials which are:

- **physical**, such as topography of an area, soil pH, heavy metal concentration, presence of watercourses; and

- **legislative,** such as designation of sites (for example Environmentally Sensitive Areas (ESAs), Sites of Special Scientific Interest (SSSIs), Nitrate Vulnerable Zones (NVZs) and Organically managed farmland).

Quality specifications have been developed which enable waste treatment operators to show that outputs have been processed to a satisfactory level and have reached a standard which will not cause harm to the environment or to human health. Composts which are certified to the British Standards Institution's Publicly Available Specification for composts, PAS 100, will not be regarded by SEPA as waste if the material has a genuine market and is not disposed of (the material becomes a product).

A considerable amount of work has been done by treatment operators to meet the PAS 100 standards and tonnage of this material is increasing year on year. Perception issues play a major role in the use of composts derived from biodegradable waste, primarily due to pathogen content, heavy metal content and physical contaminants. Development of PAS 100 has been carried out to reinforce the safety and quality of composts and as such this report will focus on composts which meet PAS 100.

2.1. Scottish Soils

Scottish soils provide a range of environmental, economic and social benefits which include:

- Providing the basis for agricultural and forestry industries;

- Protecting water from the effects of many pollutants;

- Storing carbon;

- Contributing to biodiversity; and

- Providing a foundation for infrastructure such as buildings and roads (Scottish Government ,2006).

Despite Scotland's soils being in relatively good health it is recognised that there are increasing pressures on these such as soil sealing (development of buildings and infrastructure), soil erosion, organic matter loss and contamination. The Scottish Government (2006) suggests that organic matter levels in Scottish soils may be declining. This, along with climate change, has been identified as the most significant threat to soil functioning. In order to assess the quality and trends in Scotland's soil resource, the Macaulay Institute is currently carrying out an assessment of soils in Scotland to identify if there has been a change in organic matter levels since the last survey.

In 1988 the Macaulay Institute carried out an assessment of land cover in Scotland (figure 2) to illustrate the variety of cover types throughout Scotland.

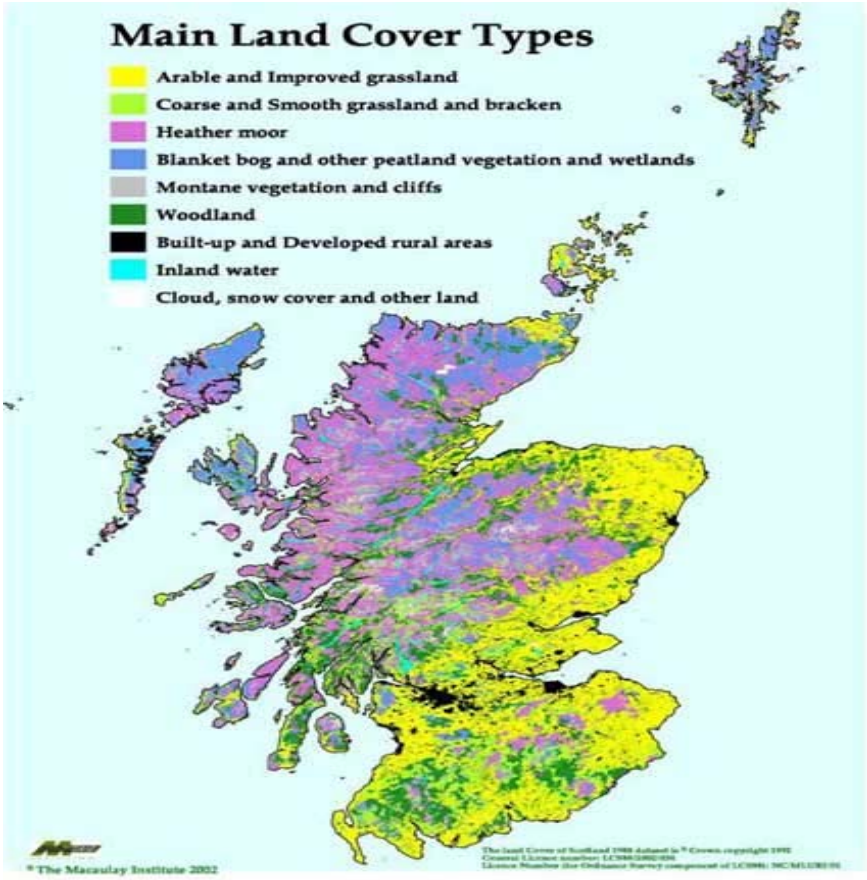

Figure 2 – Scotland's Land Cover - Source: Macaulay Institute

Arable and improved grassland account for the majority of land cover in the east and south of the country whilst heather moor and blanket bog (including other peatland vegetation and wetlands) is prevalent in the north and west. Built-up and developed rural areas make up a small proportion of this land.

2.2. Scottish Policy

The focus of the Scottish Government policy is to 'increase sustainable economic growth' and 'protecting Scotland's soils aligns with and supports the Government purpose of increasing sustainable economic growth' (Scottish Government, 2008c).

Sustainable soil use contributes in particular to the Greener objective (one of 5 Strategic Objectives identified by the Government); of which there are 5 themes:

- Climate Change;
- Sustainable Places;
- People and nature;
- Consumption and production; and

- People and landscape.

A number of existing policies contribute to soil protection; land use and management, pollution, water quality and flooding, planning, conservation and biodiversity and cultural heritage, however there is no soil protection policy which encompasses all of these. The draft Scottish Soil Framework is being developed with the aim of encompassing these various policies and aims to integrate soil protection into relevant policies.

3. Landbanks

3.1. Agriculture

Agriculture accounts for a significant proportion of land-use in Scotland. The majority of soils suitable for arable farming are located in eastern Scotland. Soils in the Southern Uplands support productive pastures and associated dairy industry.

The Macaulay Institute carried out an assessment of the biophysical properties (such as climate, soil properties; depth and stoniness, wetness, erosion risk and slope) which could affect the capability of land for agriculture. A number of classes were developed ranging from 1-7 (one being land which is capable of producing a very wide range of crops and seven being of limited agricultural value).

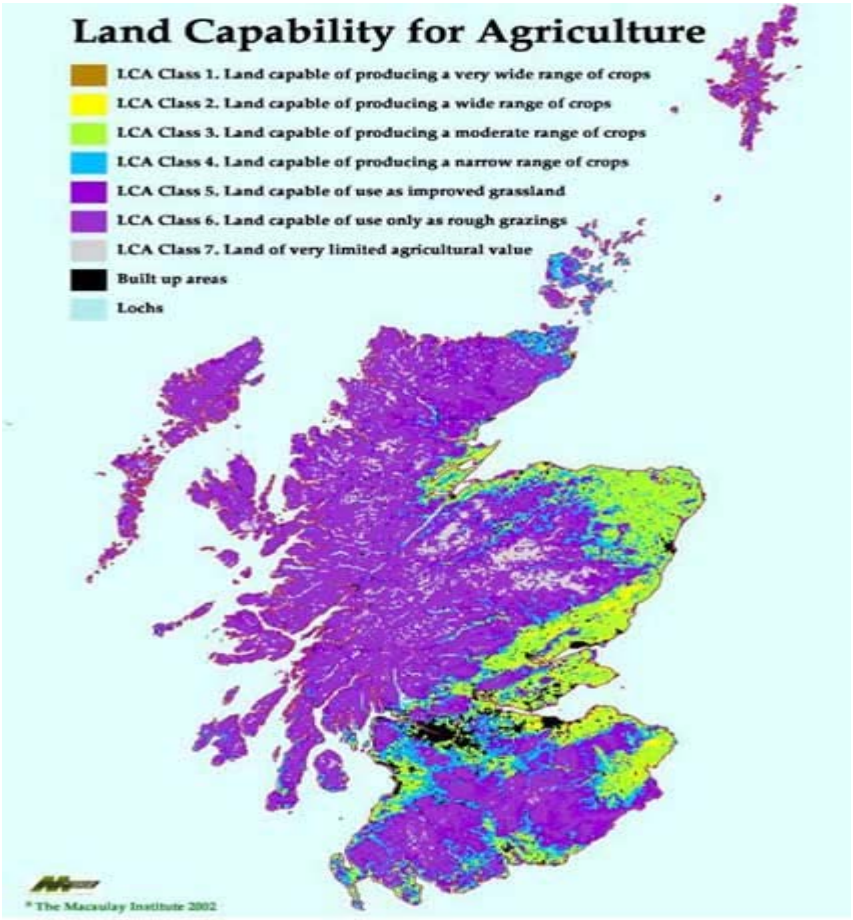

Figure 3 – Land Capability for Agriculture - Source: Macaulay Institute

Based on biophysical properties the majority of land [based on The Integrated Administration and Control System (IACS) Registered land] is defined as LCA Class 6; land capable of use only as rough grazing. The land in the east however is capable of producing a moderate range of crops (LCA Class 3).

Figure 4 shows the main agricultural land-use and how it has changed between 2001 and 2007.

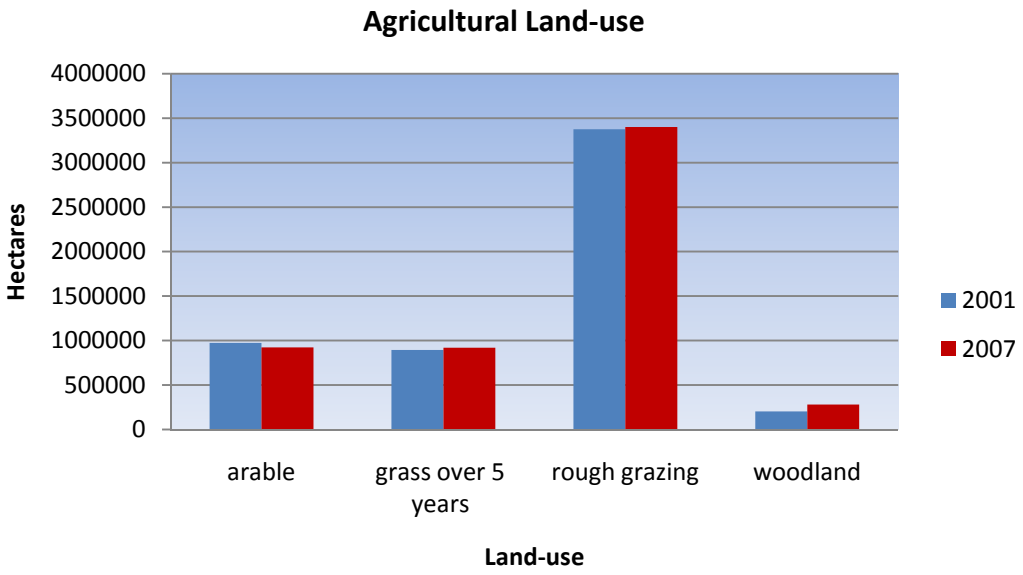

Figure 4 – Agricultural Land-use - Source: Scottish Government, 2007

Figure 4 indicates that rough grazing equates to around 3.4 million hectares. This type of land requires minimum input in terms of management (in comparison to arable farming) and often relies on return of nutrients to the soil by livestock on the land. More intensive arable farming (which equates to 922,000 hectares in Scotland) however can require a significant quantity of nutrients to be applied to land to ensure that soil quality is maintained and individual crop requirements are met. The nutrients required by plants can be classed as major (nitrogen, phosphorus, potassium, magnesium and sulphur); required in relatively large quantities or trace (manganese, copper and boron); only small quantities required. The amount of fertiliser used will depend on the existing soils conditions, quantity of organic manure applied and intended land use. The Fertiliser Recommendations for Agriculture and Horticultural Crops (RB209) (DEFRA, 2006) states that 'a good knowledge of the soil type in each field is essential for making accurate decisions on fertiliser use'.

According to the British Survey of Fertiliser Practice (DEFRA, 2007), arable farming used approximately 148kg/ha total Nitrogen, 34kg/ha Total Phosphate and 47kg/ha Potash (2006/07) whereas grass accounted for approximately 65 kg/ha Total Nitrogen, 14kg/ha Total Phosphate and 18kg/ha Total Potash. There are a range of chemical fertilisers available and, according to Gleadell Agriculture Ltd sales of chemical fertilisers in the UK equates to approximately 11 million tonnes (2% of the world market). Increasing competition from developing countries however, is driving the cost of fertiliser up; in some instances (e.g blended NPK 20.10.10) costs have tripled in the past 12 months from approximately £150 to £450 per tonne.

Figure 5 highlights the increase in fertiliser costs between 2001 and 2007.

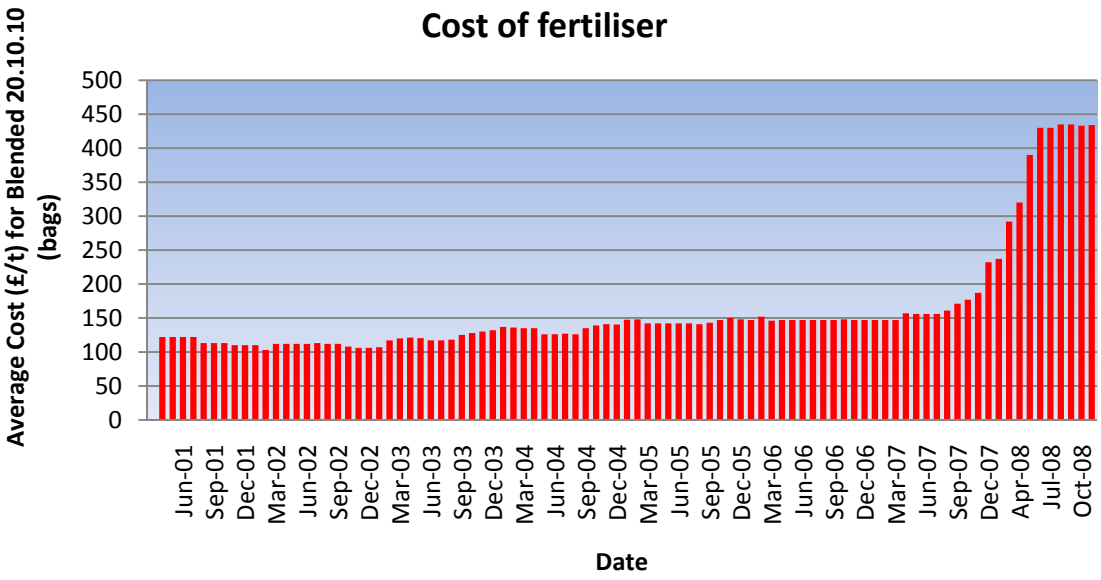

Figure 5 – Cost of fertiliser - Source: Farmbrief

This increase in price could make composts increasingly attractive to farmers both as a slow-release nutrient source and as a soil conditioner. A recent report by WRAP on the benefits of PAS 100 compost to potato crops indicates that, based on the cost of chemical fertilisers in June 2008, the typical fertiliser replacement value of green compost is £7-8/tonne and around £10/tonne for food included compost (based on P_2O_5 and K_2O).

To develop confidence and awareness of PAS 100 composts a number of trials have taken place throughout the UK on a variety of soils and growing a variety of crops. Enviros (2006) carried out a five-year trial which took place over 7 sites (using compost derived from green waste). The following results were obtained.

From a typical analysis, compost contains and applies the following total nutrients in kg/tonne of fresh compost at 30t/ha		
	Kg/t	Total kg/ha
N	8	240
P_2O_5	3	90
K_2O	6	180
MgO	3	90
SO_3	3	90
Organic Matter	200	6000

Table 1 – Nutrients in kg/tonne of fresh compost applied at 30t/ha - Source: Enviros, 2006

The trials highlight that composts improve soil status by providing major nutrients and by increasing the soil organic matter content; 30t/ha fresh compost applies approximately 6 t/ha of organic matter. The trials indicated that the moisture retention, nutrient content and physical structure improved and resulted in an average 7% increase in crop yield.

According to WRAP between 5% and 10% of the total nitrogen provided by compost is released in the first year of application, which means that when applied at a rate of 250kg/ha total N, approximately 12.5kg-25kg/ha of N will be released in year one. Compost made from combined food and green waste tends to have higher nitrogen content.

DEFRA (2008) has carried out research to evaluate the beneficial effects of compost derived from source-separated green and food waste to soil quality and fertility.

Research was carried out during the 2005/06 growing season at 3 field sites using winter wheat as the test crop.

	Gleadthorpe	Boxworth	Rosemaund
Soil Type	Sandy Loam	Clay	Silty Clay Loam
Application rate (t/ha)	26.4	28.9	26.0
Total N (kg/ha)	274	294	266
Total P_2O_5 (kg/ha)	95	99	102
Total K_20	197	205	214

Table 2 – Research Trials - Source: DEFRA, 2008

Compost use in different soils shows several benefits. In sandy soils the compost can help improve soil structure which will help with moisture retention and in clay soils the compost can help aid permeability and improve root establishment. Trials highlight that application of inorganic nitrogen would be required in conjunction with compost to have a positive impact on crop yields.

Legislation/guidelines associated with application of PAS 100 composts to land

The Prevention of Environmental Pollution From Agricultural Activities (PEPFAA) Code is a guidance document produced for farmers which is aimed at reducing the pollution risk through farming activities. The Code provides farmers with comprehensive advice relating to both mandatory and voluntary measures which are aimed at minimising pollution risk to soil and air. In addition PEPFAA indicates which of these must be complied with in order to qualify for the Single Farm Payment. Farmers receiving direct payments are expected to maintain their land in Good Agricultural and Environmental Condition as described in the GAEC Framework for Scotland (2005). The Farm Soils Plan (FSP) is another guidance document which recommends that farmers sample their land once every 5 years for nutrient and heavy metal status. This information would be extremely useful when quantifying agricultural landbank available.

There are a range of mandatory and voluntary measures associated with the agricultural industry:

Agricultural Regulation

- The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003;
- The Water Environment (OIL Storage) (Scotland) Regulations 2006;
- The Waste (Scotland) Regulations 2005;
- Animal By-Products (Scotland) Regulations 2003;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2005;
- Diffuse Pollution Regulations for rural land use; and
- Nitrate Vulnerable Zones Regulations (Scotland) 2008.

Agricultural Guidance

- Prevention of Environmental Pollution From Agricultural Activity (PEPFAA) Code;
- NetRegs;
- Controlled Activities Regulations 2005 – a practical guide;
- Farm Soils Plan;
- Sheep Dipping Code of Practice;
- Guide to Agricultural Waste; and
- Pesticides.

Nitrate Vulnerable Zones

Intensive farming methods have led to greater releases of nitrogen, mainly in the form of Nitrate (Office of Public Sector Information,2008). Nitrate ions are highly mobile and can enter ground water (via leaching) or surface waters (via run-off) which can have a detrimental impact on water quality. According to The Macaulay Institute (2005) nitrate concentrations in surface waters in Scotland are strongly correlated with proportion of arable land in their contributing catchments. The European Nitrates Directive 91/676/EEC requires member states to implement Action Programmes to reduce nitrate loss from agriculture land in areas where levels are, or are likely to be, exceeded.

The amount of nitrogen required depends on soil conditions and crop rotations. Historically however some farmers have been applying excessive quantities of fertilisers which makes nitrogen readily available. In times where there is heavy rainfall and when crops have not been sown this material can be washed into surface waters causing problems such as eutrophication.

Currently 14% of land area in Scotland is designated as NVZ (figure 6). The four NVZs in Scotland are:

- an area of Aberdeenshire, Moray, Banff and Buchan
- an area of Strathmore and Fife
- an area of Lothian and Borders
- Lower Nithsdale

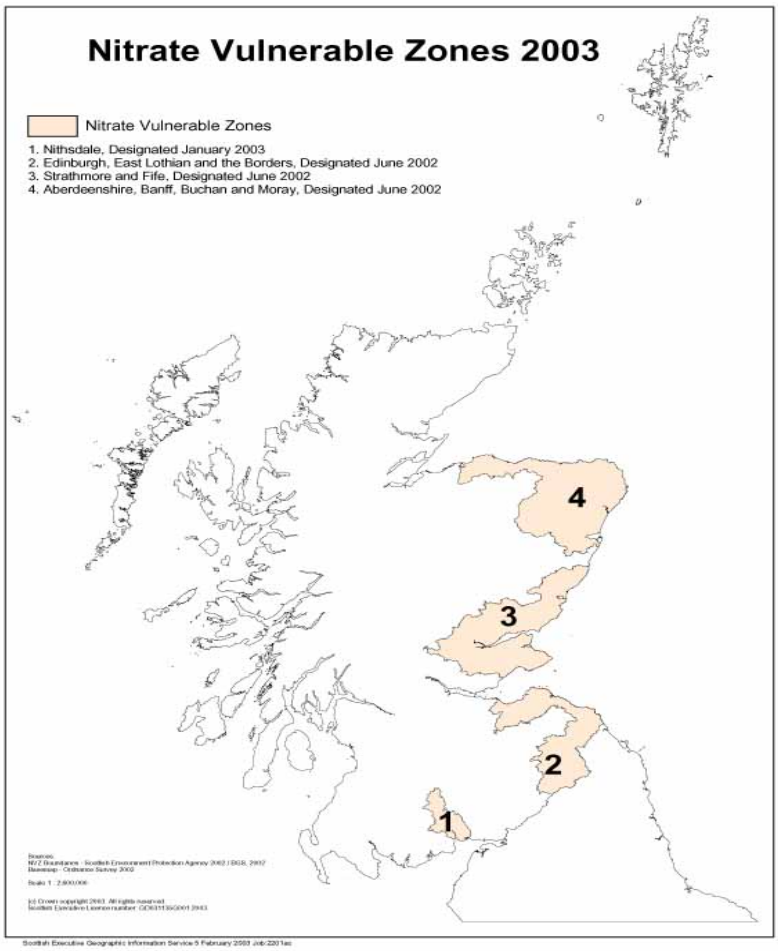

Figure 6 – Nitrate Vulnerable Zones in Scotland - Source: Scottish Government

These areas are located primarily in the east of the country where the majority of arable farming takes place.

Farmers in NVZ Zones are required to keep records of crops grown, livestock numbers and the use of inorganic nitrogen fertilisers and organic manure. In addition a Fertiliser and Manure Plan must be prepared each year. Farmers should work out how many applications it will take before they exceed maximum soil loadings. The Action Programme for Nitrate Vulnerable Zones (Scotland) Regulations (2008), which come into force on 1st January 2009, limits the amount of Nitrogen from livestock manure to an **annual farm limit of 170kg/hectare/year** (Regulation 14) whilst Regulation 15 restricts the amount of Nitrogen from organic manure to an **annual field limit of 250kg/hectare/year**.

Quality Meat Scotland (QMS) Moratorium

Approximately 10,000 farmers in Scotland are members of Quality Meat Scotland – a quality assurance programme designed to meet consumer expectations relating to quality and sustainability of Scotch Beef and Lamb. In 2007 QMS raised concerns relating to composts produced from green waste and combined food and green waste; in relation to weed toxins and pathogen content. This led to a Moratorium being imposed which related to all composts produced from green or combined

green and food wastes. Following a risk-based assessment however a partial lifting of the moratorium on the use of PAS 100 composts produced from green waste on QMS Assured farms took place. This Interim Green Compost Scheme allows assured farms to plough down approved compost derived from green waste in preparation for combinable crops such as Oil Seed Rape and winter cereals sown for harvest the following year (Quality Meat Scotland, 2008). Work is ongoing to provide QMS with evidence that will allow composts which contained food waste to be applied to land.

Competition – application of non-agricultural waste to agricultural land

There are a number of other non-agricultural organic wastes which are applied to agricultural land; from sewage treatment, paper mills, creameries, distilleries and food processors which could potentially act as competition to PAS 100 composts. A wide range of these wastes can benefit Scottish soils however it is essential that their application to land causes no detrimental damage to surrounding environment or to human health. The majority of these non-agricultural organic wastes are regulated by SEPA and can be applied to land via Waste Management Licence exemption; which has associated cost implications and potential negative perception issues. The WMLR restricts the area of land on a farm that can be treated by non-agricultural wastes to 50 hectares (excluding sewage sludges) under a single exemption.

Sewage sludge can be spread on agricultural land providing the process is carried out in accordance with the Sludge (Use in Agriculture) Regulations 1989 (as amended in 1990). The Regulations are complemented by a Code of Practice (CoP) for Agricultural Use of Sewage Sludge 1996 (this is being revised). According to Scottish Water approximately 50% of Scotland's sludge is recovered to agricultural land. In addition to the current regulations and CoP a voluntary code known as the Safe Sludge Matrix is followed by Scottish Water.

Historically, application of untreated sewage sludge to food crops was undertaken. This was banned from 31st December 1999 and from 31st December 2005 the ban was extended to include non-food crops. The following table indicates the application permitted for both conventionally and enhanced treated sludges.

Crop Group	Untreated Sludges	Conventially* Treated Sludges		Enhanced** Treated Sludges	
Fruit	X	X		✓	10 month harvest interval applies
Salads	X	X (30 month harvest interval applies)		✓	
Vegetables	X	X (12 month harvest interval applies)		✓	
Horticulture	X	X		✓	
Combinable & Animal Feed Crops	X	✓		✓	
Grass & Forage					
-Grazed	X	X	3 week no grazing and harvest interval applies	✓	3 week no grazing and harvest interval applies
-Harvested	X	✓		✓	

* Conventionally treated sludge has been subjected to defined treatment processes and standards that ensure at least 99% of pathogens have been destroyed.

** Enhanced treated sludge will be free from *Salmonella* and will have been treated so as to ensure that 99.9999% pathogens have been destroyed (a 6 log reduction).

Table 3 - Application of sewage sludge to agricultural land - Source: Water UK

In accordance with the Sludge (Use in Agriculture) Regulations 1989 sludge producers are required to;

- Analyse sludge and soil prior to spreading;
- Avoid applying sewage sludge to soils with a pH of less than 5.0;
- Follow all mandatory stock grazing, cropping and harvesting restrictions;
- Maintain detailed records of applications of all sludge to farmland.

Heavy metal content is a parameter which needs to be monitored as elevated levels can have an adverse affect on both human health and on the environment.

Metals in soils and sludges and number of applications to raise a soil to maximum acceptable levels.							
	Zinc	Copper	Nickel	Cadmium	Lead	Mercury	Chromium
Normal Soil Concentration	80	20	25	0.5	20	0.1	50
UK Maximum allowable soil (pH 5.5-6.0)	200	100	60	3	300	1	400
Typical sludge metal concentration	630	300	30	3	270	2.2	5.5
Number of applications to reach limit value	113	160	700	500	553	245	3818

Table 4 – Metals in soils and sludges - Source: SEPA, 1999

According to SEPA (1999) approximately 110 applications of sewage sludge can be applied to a soil with a normal concentration of heavy metals before a maximum limit is reached.

3.2. ALOWANCE Tool

This GIS-based tool has been developed by ADAS to quantify the national capacity of agricultural land in England and Wales to accept organic waste materials. It works on a 10x10km grid resolution and calculates the following:

- Potential agricultural landbank capacity;
- Current farm manure N production;
- Proportion of landbank already taken up by farm manure N loadings; and
- Landbank remaining for non-farm derived organic materials (Nicholson et al, 2008).

Nicholson et al estimates that (out of a theoretical agricultural landbank of 9.1 million hectares) approximately 5.7 million hectares of agricultural land is available to accept organic materials in England and Wales.

ADAS has stated that it is presently enhancing the ALOWANCE tool and work should be completed by 31 March 2009.

A tool which quantifies landbank capacity (including, for example, brownfield sites) in Scotland would be extremely useful at a strategic planning level and also for

organisations such as organic waste treatment facilities looking for markets in the near vicinity of planned/existing facilities.

4. Brownfield Redevelopment

A brownfield site is land that was previously used for any purpose, such as commercial/ industrial, transport or domestic purposes, which is no longer used for that purpose (Sandwell Metropolitan Borough Council, 2008).

The soil in brownfield sites is typically of low quality and in some instances these can be contaminated. According to SEPA there are 14 contaminated land sites in Scotland. The regulator states that:

'the term "contaminated" may take on a different meaning in different circumstances: for example, contaminated land may be land posing a risk, land which has chemicals on it or even land which is suspected to be contaminated'.

SEPA is due to publish a report outlining the State of Contaminated Land in Scotland by the end of 2008.

Every year more brownfield sites are released for development which makes these a good potential market for compost. Certain standards will need to be met which depends on the existing state of the site and on the final end-use of the land. Compost can be used in topsoil manufacture, for landscaping or for bioremediation of contaminated soil.

The main regulatory controls on vacant, derelict or contaminated land in Scotland are through the planning system and a range of environmental regulations: Part IIA of the Environmental Protection Act 1990, Environment Act 1995; and The Contaminated Land (Scotland) Regulations 2000. Planning has control over development of land so this would be a good opportunity to raise awareness of PAS 100 compost in redevelopment as reference could be made to recycled content in soils in planning conditions for specific sites. Councils do generally seek to ensure that soils are fit for their intended purpose and conform to BSI BS 3882: 2007 Specification for Topsoil and requirements for use; however all Councils contacted state that there is no requirement to specify PAS 100 compost and this would be left up to the developers/contractors.

The Scottish Vacant and Derelict Land Survey (SVDLS) 2007 (Scottish Government, 2008c) identifies 10,240 hectares of vacant or derelict land in Scotland (3,830 sites), of which 74% is derelict and 26% is urban vacant (Scottish Government 2008d).

- ***Derelict land*** *is land damaged by development which requires rehabilitation before it can be developed for beneficial use e.g. disused mines and mineral workings*

- ***Vacant land*** *is land which is unused for the purposes for which it is held and is considered an appropriate site for development. E.g. previously used for agriculture*

The figure below shows total Derelict and Urban Vacant Land (DUVL) for each Council in Scotland. The 10 largest sites in Scotland collectively account for 23% of all recorded derelict and urban vacant land. Those 10 sites (all of which are derelict) include the Former Royal Ordinance site at Bishopton, Renfrewshire (708 Acres), Fearn and Fendom Airfields in Highland (collectively 681 hectares) and Ravenscraig East and West sites in North Lanarkshire (271 hectares).

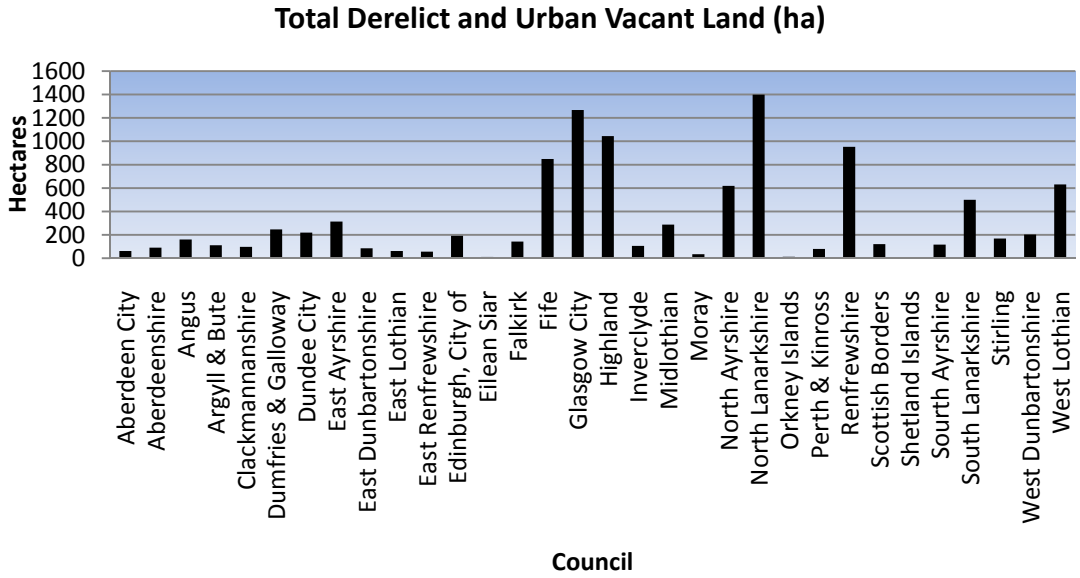

Figure 7 Total Derelict and Urban Vacant Land - Source: Amended from SVDLS, 2007

The largest areas of DUVL are located in the Central Belt, particularly concentrated in North Lanarkshire (14%), Glasgow City (12%) and Renfrewshire (9%) which equates to 1,399 hectares, 1,268 hectares and 952 hectares respectively.

According to the SVDLS an average of 616 hectares of vacant or derelict land is redeveloped annually. The amount of compost which could be used within these developments would depend on the final use and also on the quality of the existing soils.

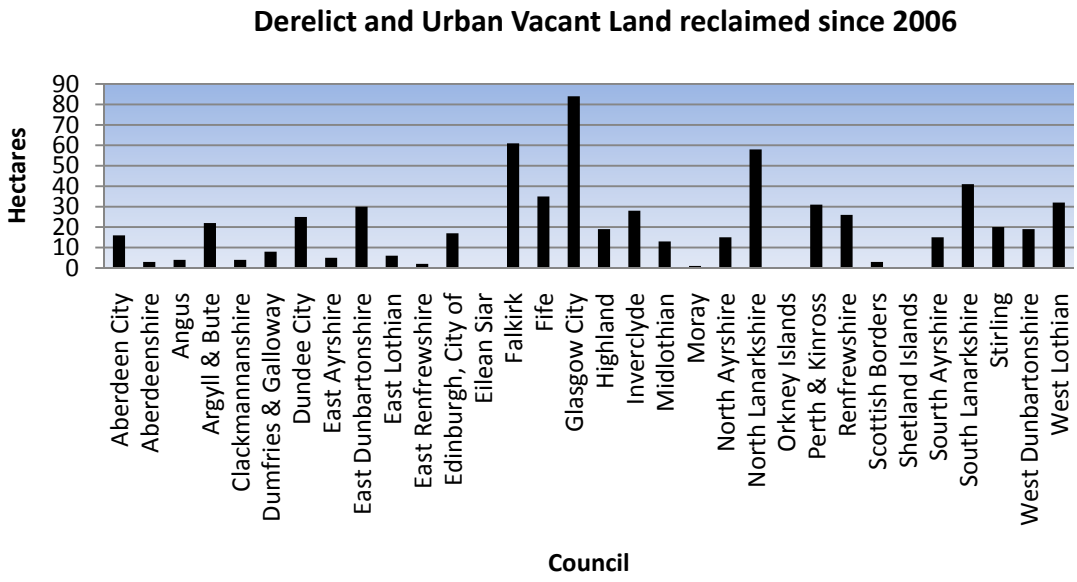

Figure 8 – Derelict and Urban Vacant Land reclaimed since previous study - Source: Amended from SVDLS, 2007

A total of 642 hectares was reclaimed since the last SVDLS which took place in 2006. The largest area of DUVL reclaimed was within Glasgow City Council which equated to 84 hectares (13%), closely followed by Falkirk Council and North Lanarkshire Council at 61 hectares (9%) and 58 hectares (9%) respectively.

A number of new sites have been identified since the previous SVDLS report. The following figure shows new sites within each Council area.

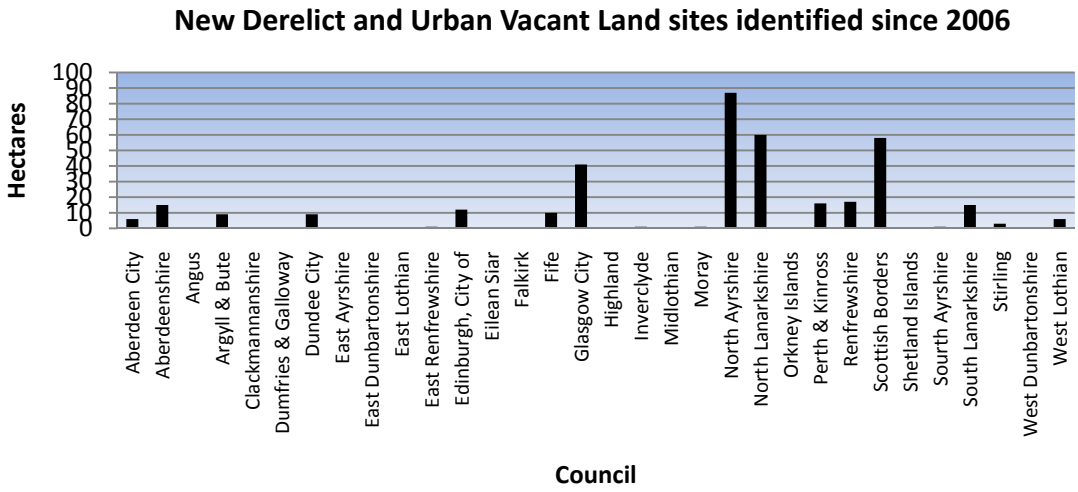

Figure 9 – New Derelict and Urban Vacant Land sites identified since previous study - Source: Amended from SVDLS, 2007

A total of 369 hectares of DUVL was identified since 2006. Councils which contain the largest area of new sites are North Ayrshire (24%), North Lanarkshire (16%) and the Scottish Borders (16%) which equate to 87 hectares, 60 hectares and 58 hectares respectively.

The quantity of PAS 100 compost used in Scotland in 2006/07 as a soil conditioner and landscaping purposes was approximately 65,000 tonnes (SEPA, 2008a). A report by WRAP (2006) estimated a potential for 34,280 tonnes of compost to be used in the regeneration of brownfield sites in Scotland in 2006. The remaining 30,000 tonnes could potentially have been used in agriculture or in smaller scale landscaping projects.

Current Trailblazer projects taking place in Scotland, which are managed by WRAP to raise both the awareness and benefits of PAS 100 compost, are due to utilise approximately 30,000 tonnes of compost. These projects focus on a range of end-use applications; from woodlands to residential. The Specification for Topsoil BS3882 is being re-drafted to further increase the use of recycled organic materials. WRAP has developed a toolkit which identifies the different blends of soil and compost required for individual sites to achieve BS3882 for topsoil.

Examples of projects which are currently running in Scotland are:

Ravenscraig, Lanarkshire

This 450 hectare site was previously a steel works which closed in 1992. Redevelopment of this site will include retail and sports facilities and residential properties. PAS 100 compost is being used along with steel furnace slag and glacial drift to produce a soil which is capable of supporting plant growth. Utilising existing on-site materials has meant that developers have avoided the disposal and environment costs of removing the material from the site.

Polkemmet,

This site was previously an open cast mine which covered an area of approximately 470 hectares. The site will be redeveloped into 2 golf courses, leisure facilities and housing. The soil will consist of a mix of PAS 100 compost and colliery waste. This project will utilise 17,000 tonnes of compost over 120 hectares. According to WRAP the trial led to significant cost savings by using locally produced compost instead of buying topsoil (saving of approximately £10/tonne), in addition to reduced maintenance costs.

Cost savings of more than 50% have been shown in other redevelopment projects when making use of existing soils by mixing them with PAS 100 compost instead of pursuing a common practice which involves importing of topsoil.

Preferred or Intended Use of DUVL

As part of the survey carried out for the SVDLS report Councils were asked to provide preferred uses of DUVL as outlined in the Council Local Plans. The figure below shows a number of potential applications for DUVL.

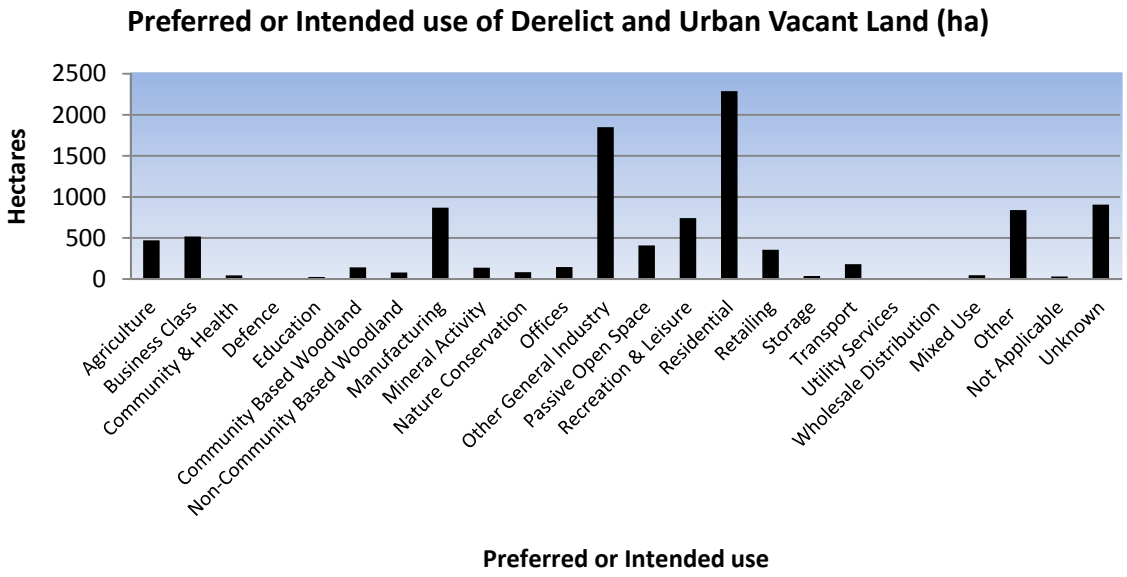

Figure 10 – Preferred or Intended use of Derelict and Urban Vacant Land - Source: Amended from SVDLS, 2007

The preferred options were residential (20%) and other general industry (18%). A significant area (18%) was placed into the 'other, not applicable and unknown' category.

Knowing the preferred or intended use of DUVL could potentially allow a rough calculation of compost usage for each application.

WRAP (2006) provides indicative figures for compost used per hectare in development of brownfield sites for specific applications.

Use	End Use Opportunities	Green Area %	Compost Rate t/ha	Compost Tonnes
Woodland	In-situ soil improvement/mulch	100	250	250
Golf Course	Top dressing/landscaping	100	125	125
Parks	In-situ soil improvement/landscaping	100	250	250
Mixed Development	Topsoil manufacture/landscaping/in-situ soil improvement	20	250	50
Urban Housing	Landscaping	25	250	52.5
Rural Housing	Landscaping	40	250	100
Urban shops/sports complex	Landscaping	5	250	12.5

Large colliery regeneration	In-situ soil improvement/landscaping/topsoil manufacture/bioremediation	100	500	500

Table 5 – Compost Utilisation in a range of applications - Source: Amended from WRAP, 2006

In an attempt to quantify the amount of compost which could potentially be used in sites which were indicated by Councils as being a preferred or intended use it has been necessary to categorise these into one of the eight end-use applications as seen above. The following table shows potential compost utilisation however this is a rough guide and the usage will be influenced by existing regulations and site conditions, future end-use and competition from other organic materials.

Preferred or intended use for DUVL	Potential Compost Utilisation (tonnes)
Agriculture	118,250
Business Class	25,950
Community & Health	11,500
Education	1,300
Community Based Woodland	35,750
Non-community Based Woodland	20,250
Manufacturing	43,450
Mineral Activity	69,500
Nature Conservation	21,000
Offices	7,400
Other General Industry	92,450
Passive Open Spaces	102,750
Recreation & Leisure	92,875
Residential	185,819
Retailing	4,475
Storage	1,900
Transport	9,150

Utility Services	400
Wholesale Distribution	450
Mixed Use	2,350
Total	**846,969**

Table 6- Potential Compost Utilisation

Potential compost utilisation equates to approximately 850,000 tonnes. If development continued to re-instate 600 hectares per year then approximately 42,500 tonnes/annum PAS 100 compost could be utilised. This figure excludes sites classed as 'other, unknown and not applicable' meaning that there is potential to increase the quantity of compost used. This figure also depends on the availability of sites. Some sites may not be suitable for development in the short to medium term for a number of reasons; either use is undetermined or it is uneconomic.

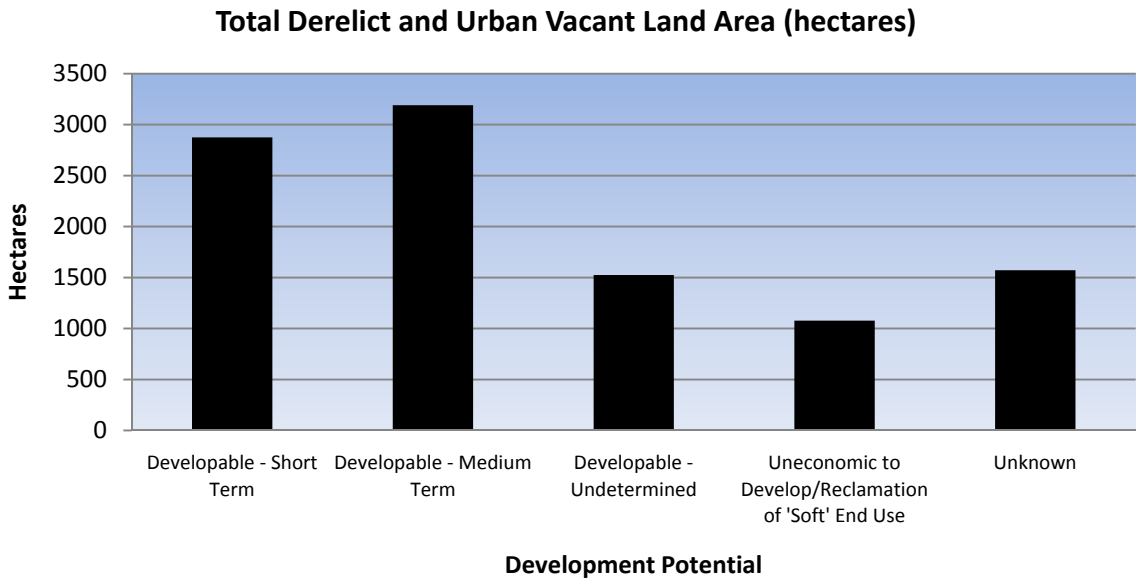

Figure 11 - shows development potential of DUVL in Scotland - Source: Amended from SVDLS, 2007

Land area available for short-term development equates to 2875 hectares (28%), medium term to 3191 hectares (31%) and 4174 hectares (41%) is of undetermined, uneconomic or unknown potential. Therefore land restoration could be a suitable market for PAS 100 compost in the short to medium term. Further work needs to be done to address DUVL classed as 'undetermined, uneconomic or unknown'.

Vacant and Derelict Land Fund

The Vacant and Derelict Land Fund (VDLF) 2004-2006 was set up in response to a review which highlighted that long term vacant and derelict land was not being put to better use. The Scottish Executive invested £20 million in 3 Councils; Dundee City, Glasgow City and North Lanarkshire and to date 68 hectares of formerly derelict and

urban vacant land has been reclaimed with the VDLF making either a partial of full contribution. South Lanarkshire was included in the fund in 2006/07.

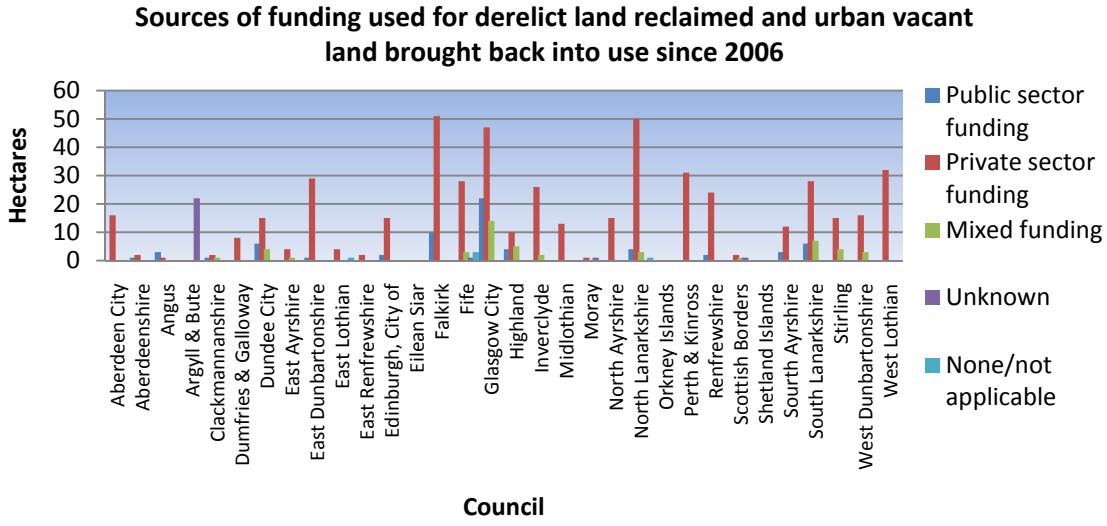

Figure 12 - Sources of funding used for Derelict and Urban Vacant Land brought back into use since previous survey -Source: Amended from SVDLS, 2007

Approximately 88% of funding used for derelict land reclaimed and urban vacant land brought back into use comes from the private sector whilst 10% comes from the public sector. The current economic climate may have a negative impact on funding available from the private sector.

Competition

Scottish Water indicates that approximately 33,000 tonnes dry solids (ds) of sewage sludge was used for land reclamation purposes in 2006/07. Sewage sludge use on non-agricultural land is exempt from licensing if the activity meets the requirements in Regulation 17 and 18 of the Waste Management Licensing Regs (WMLR) 1994, as amended. According to the Scotland & Northern Ireland forum for Environmental Research (2008) there is currently no Code of Practice (CoP) or published guidance on the use of sludge composts and biowastes for land restoration.

5. Council Structure Plans

Achieving development which avoids harming the long-term needs of people, the economy or the environment is known as sustainable development (Scottish Government). The planning system plays a major role in sustainable development by controlling changes in both land-use and building design.

Planning legislation in Scotland takes the form of The Town and Country Planning Act (Scotland) 1997 amended by The Planning etc. (Scotland) Act 2006.

Planning policies support:

- re-using vacant, derelict and previously-developed land;
- re-using buildings that make local areas attractive;
- making sure it is possible to get to existing and new developments by foot, cycle and public transport, as well as by car;
- conserving important historic areas and buildings; and
- protecting areas that are important for recreation or wildlife (Scottish Government).

The White Paper Modernising the Planning System, published in June 2005 proposed the creation of local development plans which would cover the whole of Scotland, as well as strategic development plans which would cover the four largest city regions around Aberdeen, Dundee, Edinburgh and Glasgow.

The development plan is a fundamental part of every Council's planning system and consists of two parts; a structure plan which take a long-term view of development and a local plan which contains more detailed policies and relate to smaller areas. Decisions on planning applications are based around these plans and control the level and location for developments.

In addition to the Development Plan, Councils also produce Supplementary Planning Guidance (SPG) to assist with aspects of planning policy and other matters covered by the planning authority. Supplementary guidance is used to support statutory development plans but it is not an alternative.

A review of all Structure Plans was undertaken to establish future plans for developments (Table 1) and in addition the potential for compost use in these developments was assessed. All Councils have indicated how many houses are proposed over a set period of time and many have highlighted future developments in infrastructure (such as new roads and upgrades to existing roads), recreation and retail.

Structure Plans	Housing	Infrastructure	Tourism/Recreation	Retail
Edinburgh and Lothians (2001-2015)	70,200	✓	✓	*
North East Scotland (2006-2015)	13,720	✓	*	✓
Highland (2007-2017)	12,600	✓	*	✓
Moray (2006-2017)	2730	✓	*	✓
Clackmannanshire & Stirling (2002-2017)	5,062	✓	✓	✓
Falkirk (2001-2020)	11,000	✓	✓	✓
Fife (2006-2026)	35,200	✓	*	*
Dundee & Angus (2001-2016)	12,730	✓	✓	✓
Perth & Kinross (2003-2020)	9,780	✓	✓	*
Argyll & Bute(2002-2012)	2,177	*	*	*
Shetland Islands(2006-2011)	540	*	*	*
Orkney Islands(2000-2010)	700	*	*	*
Western Isles	**	✓	*	*
Glasgow & The Clyde Valley (2004-2018)	113,100	✓	✓	
Ayrshire (2005-2025)	37,200	✓	*	✓
Dumfries & Galloway (2004-2009)	2,605	✓	✓	*
Borders (1999-2011)	6,313	✓	✓	*
Total	335,657			

*No precise development plans mentioned in the structural plan
** Addressed in Local Plan

Table 7 – Structure Plans

The Structure Plans highlight the total number of households proposed within Scotland from 2001-2026. The structure plans also indicate that a number of retail, infrastructure and recreation developments will be considered within the Council catchment area. All Councils were contacted to request information relating to area of land developed for major developments in an attempt to quantify potential compost use for specific types of major developments within each Council area. A number of responses were received stating that this would be a time consuming

process for the Councils to carry out (since the majority did not have this information readily available on their systems) and as such the majority of Councils were unable to provide any useable information.

5.1. Estimation of Landbank from Housing, Retail and Recreation

The structure plans evaluation of 335,657 homes over 25 years equates to 13,426 new homes per year. Consultation with the *Chartered Institute of Housing* and *Homes for Scotland* identified that 24,744 new homes were built in 2007. However the Scottish Government target is to increase the number of new homes built each year to 35,000 by 2015. The industry faces a number of key barriers to delivery of new homes including:

- The shortfall of land available through the planning system leading to high demand for supply and fuelling house price inflation;
- Underinvestment in water and drainage infrastructure; and
- The recent financial crisis restricting lending and borrowing.

Given the conflicting pressures of demand for new homes with the barriers it is estimated that the annual home building figure will remain at around 25,000 per year.

Assuming a typical new build house plot footprint is 35m^2 and assuming an equivalent land size for garden preparation/remediation/landscaping after building, would provide 866,040m^2 of land for remediation. Using the application rate in Table 6 of 250 t/ha this would result in 21,750t/year. However not all new homes are built on new sites and not all new homes are individual houses. Little data is available for the distribution of housing types being developed between individual houses and high rise developments. There is also limited information available on the sitting of new build whether on brownfield or greenfield sites

However a telephone conversation with *Homes for Scotland* suggests Scotland's current capacity for high-rise developments (both market demand, site availability and high monetary investment in a difficult financial climate) may be limited. Indications are that in Scotland that perhaps as much as 80% of new homes are built on brownfield sites.

Assuming therefore in the most extreme case that all new homes were individual houses but that 80% were already accounted for in the DUVL calculation then only 20% of 21,750 tonnes or 4,330 tonnes would be additional to the 185,819 tonnes estimated in Table 7.

There may be the potential to utilise compost in new housing developments but without specific details of individual house building plans therefore the estimates in table 7 will be used. Similarly it is difficult to undertake an additional estimate of potential land remediation in commercial developments.

5.2. Modernisation of the Planning System

According to the Planning Performance Statistics Report 2004-2007 (2008e) structure plans were an average of 5.1 years old as of 30th July 2007. 70% of local plans are more than 5 years old and around 20% over 15 years old. However under the new modernised system Councils will be required to update development plans every 5 years.

The planning system will play its part in promoting sustainable development by:

- Promoting the use of Strategic Environmental Assessments (SEAs) when drawing up plans
- Drawing up development plans which meet wider environmental obligations. The UK Government, the Welsh Assembly and the Northern Ireland Office have signed up to a UK Strategic Framework for Sustainable Development which involves each administration working towards shared principles and priorities.
- Making it easier for local people to participate in the decision-making process; and
- promoting high quality design in all new development. (Scottish Government, 2005a)

National Planning Framework

The National Planning Framework (NPF) will be the mechanism used to provide a strategy for the sustainable development of Scotland. The NPF is intended to complement high level documents such as The Framework for Economic Development in Scotland and Smart, Successful Scotland and to reflect the priorities, actions and targets for sustainable development. The NPF will introduce a new hierarchy for planning - which allows the system to deal with different types of developments in different ways - it is envisaged that the NPF will help to facilitate the delivery of investment needed to meet many of the environmental targets. Under the new hierarchy for planning, proposed developments will be processed and scrutinised depending upon whether they raise issues of national, major, local or minor importance.

Source: Scottish Government, 2005

5.3. Infrastructure

According to Scottish Government (2005b) urbanisation led to approximately 1,400 hectares of agricultural land being given over to roads, housing or industry in 2002-2003.

Transport Scotland (TS) is responsible for Scotland's trunk roads which equates to 3500kms (6%) and 3000km of track and the additional 94% (some 56,000km) are maintained by Councils. Roads pass though an abundance of landscapes (urban and rural). TS and Councils need to maintain soft verges and slopes (soft estate) associated with roads under their control. This soft estate can be relatively wide (over 100m at some motorway junctions according to TS).

TS stated that it is committed to placing issues of climate change, environmental quality and protection of the natural and cultural heritage at the centre of its management, planning and delivery. It has a number of elements which address environmental issues;

- Scottish Transport Appraisal Guidance (STAG);
- Trunk Road Biodiversity Action Plan;
- Landscape Design and Management Policy;
- Sustainability Scoping Review; and
- Landslide Study.

The Landscape Design and Management Policy for TS supports the wise use of resources and the exploring of alternative approaches. However compost is not generally used within landscape schemes and TS only permit a limited amount of fertiliser if deemed necessary by the designers. A theme of the landscape and design and maintenance policy is the support of natural characteristics which requires planting schemes to utilise existing soils to create local conditions. The soil used to recreate these conditions may however be affected during handling which can have a detrimental effect on soil quality and can, in turn, lead to erosion problems. According to Anthony et al., 2005, approximately 30,000 tonnes of sediment losses to surface waters was from roads. Compost usage in soft estate could help to improve the structure of the soil, improve moisture retention, improve the organic matter content and provide slow-release of nutrients into the soil in what can be a rather inhospitable environment.

Use of compost in overseas projects highlights the benefits of green waste compost in roadside embankments (Nova Scotia Department of Transportation and Infrastructure Renewal, 2000) ;

- Erosion control for slopes and embankments;
- Improvement in organic matter content; and

- Improvement survival rate after seeding and planting.

A number of new roads and road upgrades have been mentioned in the Council Structure Plans. According to the SVDLS the preferred or intended use of 183 hectares of DUVL was for transport. If assuming 20% green area (classed as a mixed development) then a potential 9,150 tonnes of compost could be used.

TS has issued a programme of works for Scottish Motorways and Trunk Roads which outlines start dates for network developments. The Scottish Motorways and Trunk Road Programme indicates that work will start:

- on 15 roads in 2008/09;
- on 13 roads in 2009/10; and
- on 7 roads in 2010/11.

One particularly well known and large development is the completion of the M74 motorway. According to a study carried out for the Trunk Road Authority (TRA) the new 8km road will occupy 77 hectares of land consisting of commercial properties, derelict/unused land and some residential properties of open space (woodland, grassland). Although the motorway will occupy approximately 36 hectares of existing semi-natural habitats, 27 hectares of new planting will be carried out (equates to approximately 3.40 hectares soft estate/kilometre). There is the potential to use PAS 100 compost in this development. The quality of soils would need to be taken into account but potentially the M74 development could utilise approximately 7,000 tonnes of compost (based on 250 tonnes/hectare). In addition sustainable urban drainage systems (SUDS) would be created to remove pollutants from road run-off. In the correct situation compost can also be used in SUDS systems.

A survey, carried out for TS to assess potential carbon sequestration, identified 4,247 hectares of roadside soft estate. For the purpose of this report Remade Scotland has calculated that the area of roadside soft estate available per kilometre equates to approximately 1.20 hectares/kilometre. The potential for use of PAS 100 compost on existing soft estate would depend on which area of soft estate needed improvement and the application required. According to landscaping organisations surveyed by Remade Scotland (2007) compost application rate can vary from 4.5-18 tonnes/hectare.

Councils maintain a larger proportion of roads in Scotland which means that there is the potential to utilise greater quantities of compost. The area of verges, slopes and embankments available within each Council is currently difficult to quantify. Again, application of PAS 100 compost would depend on area which needed improving and the application required.

5.4. Forestry/Woodland

According to Forestry Commission (2008a) the area of woodland in Scotland equates to over 1.3 million hectares: 539,000 hectares (35%) is owned by the Forestry Commisssion (FC) and the remainder is under public, private or personal ownership.

The FC delivers forestry policy of Scotland, ensuring that the land is managed in a sustainable manner. Management of woodland areas is extremely important as some preparation techniques can be very intrusive. Thinning and harvesting trees, preparing ground for planting and building access roads disturb the soil which can potentially lead to sediment being washed into watercourses. According to Anthony et al., 2005 soil losses to surface waters equates to approximately 13,000 tonnes per year from forestry activities. Release of nutrients from the soil can lead to similar pollution problems to these seen in agriculture. These issues are addressed at a high level within the UK Forestry Standard. In addition, the recently revised Forest and Soils Guidelines suggest a number of management options such as cultivation, drainage and thinning regimes that are aimed at maintaining and enhancing soil organic matter levels.

The Scottish Forestry Strategy (SFS) is currently being revised and amongst the many aims is one to address soil, water and air quality. This will include publishing guidelines for new Forests and Soils and also the implementation of Scottish Soils Strategy Recommendations. In addition SFS aims to establish new woodlands on soils with low current levels of organic matter to enhance carbon sequestration. In 2007-2008 4200 hectares of new planting and 12600 hectares of restocking took place (Forestry Commission, 2008b). No new planting took place in FC land. However an objective of the SFS is to increase Scotland's forests and woodlands from 17% to 25% by 2050; which would involve planting approximately 15,000 hectares of new woodlands per year. If assuming that 1% of this area required an input of nutrients/organic matter (and that owners of the land were willing to specify PAS 100 compost) then between 18,750-37,500 tonnes of compost could potentially be used each year for development of new woodland (on the basis that between 125-250 tonnes/hectare is applied).

The Forestry Commission has published an Information Note to help foresters and companies trading in sludge, compost and other organic waste products to make informed decisions about the use of sludge and compost on forest land. The document highlights that application and incorporation methodologies for organic wastes are very dependant on a range of factors; the type of waste, the life-stage of the forest in which the waste is to be applied and the equipment available to the contractor who undertakes the task.

The FC states that application of compost to planting areas is not common place. In the past the FC has used applications of inorganic fertiliser on many of the less fertile sites, but states it is currently trying to reduce the use of these wherever possible. Much of the land which is made available for forestry is of medium to poor nutrient status. There have been some limited trials of sewage sludge spread on forest land, but as the process requires flat trafficable land it is not a viable option

for most of the UK forest estate. The FC states that it attempts to minimise the input costs for ground preparation, planting, fertilising with the expectation that the final crop will give a medium level return.

In 2007/08 100% of all new plantings were undertake by Non-FC land. These organisations may have a different view in terms of applying composts. Availability of material in specific regions and costs would play a role in whether or not the material is used.

6. Sustainable Procurement Procedures

As recycling targets increase and public and private sector organisations collect more materials for recycling there will be an increasing need for more robust markets for the materials.

Currently the only requirement placed on public bodies which relates to specification of recyclate in contracts is voluntary (which relates to paper and construction). Some Councils are attempting to increase the use of materials with recycled content e.g, Glasgow City Council has recently asked for accredited operators to tender for a 3 year contract supplying PAS 100 compost for it's parks and gardens. The Council is responsible for the upkeep of 19 parks which equate to a combined area of 965 hectares. According to Urban Parks Forum, 2001 10,323 hectares of parks (classed as National Historical Importance, Local Importance and Recreational Open Space) existed across 26 Scottish Councils.

All Councils in Scotland were contacted to find out:

- Which departments utilise compost; and
- If house-holders are encouraged to utilise green waste compost by Councils

38% of Local Authorities have used composted materials in parks and gardens and roads however this is on an ad-hoc basis. 28% of Local Authorities make compost available to householders however some do not actively promote the service.

Specification of PAS 100 compost seems to be related to confidence and awareness of the material. Work carried out by Remade Scotland (2005) estimated that across eight Councils in the Glasgow and Clyde Valley Region approximately 10,800 tonnes (based on 0.6m^3/t) of compost could potentially be used. A similar survey was carried out on five Councils in the East of Scotland (Remade, 2007). This estimated that 9,000 – 10,800 tonnes of compost could potentially be used. This equates to approximately 20,000 tonnes across 13 Councils (around 1,500 tonnes per Council). If applied to all Councils across Scotland then Councils have the potential to utilise 48,000 tonnes of compost annually.

In the majority of Councils procurement responsibility is devolved which means that individual departments order their own materials. Following publication of The

McClelland Report in 2006 the Scottish Government implemented a Procurement Reform Programme. Two of the aims are to:

- facilitate cross sector collaboration to avoid duplication of effort, maximise potential gains from collaboration, enable the sharing of experience and information and to ensure that common suppliers and markets are managed effectively; and

- encourage suppliers to build effective and mutually beneficial relationships with the Scottish Public Sector

A number of departments within Councils have the potential to utilise PAS 100 compost such as Roads, Parks & Gardens, Cemeteries and Regeneration Departments. Sharing of experience which relates to trials of PAS 100 compost and costs should be encouraged between departments to both raise the profile of the material within the Council and also to help achieve best value.

In January 2008 the Scottish Government outlined plans for a Zero Waste Scotland, which included consulting on a range of legislative measures to implement zero waste. One of the measures proposed is:

"To encourage recycling by taking powers to enable the Scottish Government to place a duty on Public Bodies and businesses to specify a minimum percentage of material made from recyclate in procurement contracts"

The consultation received many responses from the public and private sector and a summary of the responses have been taken into consideration for the drafting of the Climate Change Bill.

7. Discussion

In 2006/07 approximately 272,000 tonnes green waste was collected by or on behalf of Councils and 90,000 tonnes of PAS 100 composts were produced. Around a quarter of Councils make this compost available to householders and a slightly higher number state that the material is used by parks & gardens and roads (although this is on an ad-hoc basis).

Thirteen treatment operators are certified PAS 100 producers and together are certified to produce 59,060 tonnes. In addition to these 13 plants, 9 operators are working towards PAS 100 (applied status) and are undergoing certification to produce 82,260 tonnes. If all plants were producing PAS 100 material then certified maximum tonnage could theoretically equal 141,320 tonnes. Landbanks available for PAS 100 compost (or alternative products which contain recycled content such as digestates) will also require to be assessed and developed.

Agriculture

The agricultural market could prove to be a significant user of PAS 100 compost providing farmers, quality assurance bodies and regulators are content with the

outcome of risk assessments carried out on the materials. According to AFOR (2006) approximately 25,000 tonnes of source-segregated compost (not necessarily meeting PAS 100) was used in agriculture in 2005/06. However without such restrictions agricultural applications could potentially absorb 27,660,000 tonnes.

PAS 100 compost has proved to be of benefit to agricultural land due to the addition of essential nutrients and organic matter however it's use depends on soil conditions and application. Compost can also be attractive in terms of fertiliser replacement value and crop yields. As to be expected, there will be a significant amount of competition from other biodegradable materials.

Brownfield

Use of PAS 100 compost in brownfield sites could be increased if awareness of the benefits in terms of costs and soil quality is realised. A significant amount of DUVL exists in Scotland however only around half of this land has the potential to be developed in the short to medium term. Planning departments play a major role in the development of these sites by imposing conditions on the developers involved in the projects. Use of PAS 100 material is not widely used for developments as there are no specific requirements set out in planning policy to specify a particular recycled content.

One planning department stated that:

'whilst a relevant matter in terms of sustainable development, there is currently no policy basis for us to impose planning conditions on the make-up of soils on redevelopment sites. The soil composition would be a matter for the developer of a site to specify. It is hoped that this may be a matter which it would be appropriate to address through the replacement local plan policy'

Some Councils have stated that they do have supplementary guidance or sustainable design guides in place (non statutory requirements) which state that there should be no reliance on unsustainable procedures or resources such as peat ameliorates and that developers should retain, protect and re-use the soil on site where practicable. In addition Councils may state that soils must conform to BSI BS 3882:2007 Specification for Topsoil and requirements for use.

Geotechnical properties need to be considered when applying compost to brownfield site prior to redevelopment. Soils which are high in organic matter are usually unsuitable for most engineering processes. Soil improvement is not necessarily the same as ground improvement, from an engineering viewpoint, as high organic content may make the ground difficult to stabilise and make it unsuitable for the types of loads imposed by buildings or infrastructure, due to the long term settlement and continual compression which is characteristic of the organic matter. In this respect, PAS 100 compost is suggested for landscaping purposes (including topsoil manufacture) alone.

Infrastructure

Council Structure Plans have indicated where road developments may take place. Transport Scotland is responsible for 6% of the road network and Councils are responsible for 94%. These organisations manage a considerable amount of soft estate in the form of verges and slopes. Effective management is essential since roads account for 13,000 tonnes of soil loss to surface waters. Any new roads or upgrades to roads will have to comply with conditions set by the planning department. Landscaping policy does exist for highway networks, however very little information exists relating to compost specifications and recycled content. 183 hectares of DUVL has been identified for transport development. This could potentially account for approximately 9150 tonnes of PAS 100 compost. This figure does not include compost utilised by the sector for ongoing maintenance of soft estate.

Forestry

The Forestry Commission, which owns approximately 35% of woodland area, prefer a minimum input medium output approach in terms of the management of the land. The Commission has previously applied fertilisers to land with little difference in final yields. It can be difficult to apply fertilisers to forestry land due to access and spreading issues. The best opportunities available for compost in forestry are for new plantings and, according to plans set out in the SFS, approximately 15,000 hectares of new plantings will take place throughout Scotland. If the FC can be convinced of the benefits of PAS 100 composts in terms of costs and improving soil structure then perhaps this could be a potential outlet for the materials. This would also help meet objectives outlined in the SFS with regards to protecting water, air and soil. In addition to the FC a large amount of land is owned by a range of public and private bodies. Work is required to engage with these owners to raise awareness of PAS 100 compost.

8. Conclusion & Recommendations

The role of the Scottish Soil Framework Directive is to bring protection of soils in line with current EU legislation which exists to protect nature, air and water. A significant amount of change is taking place in terms of legislation: e.g Planning etc Scotland Act 2006; Public Procurement Reform Programme and NVZ Regulations. It is now time to implement strategies to protect Scottish Soils. There is a need for Councils to lead by example as they are responsible for significant areas of land and are responsible for controlling development in catchment areas. In addition they have a number of environmental targets which need to be met such as the Landfill Allowance Scheme (LAS) Targets.

This report has identified a number of potential landbanks for PAS 100 compost which are outlined in the table below.

Potential Landbank	Application Rate (t/ha)	Potential tonnages of PAS 100
Agriculture	30	25,000 - 27,660,000 t/yr*
Brownfield/DUVL	125-500	42,500 t/yr**
Forestry	125-250	18,750 – 37,500 t/yr
Councils	Unknown	48,000t/yr

*Based on maximum area of arable agricultural land (excludes reduction in potential agricultural landbank available due to competition from other organic and inorganic materials). Total potential tonnages could be reduced if lowering the application rate (t/ha) to take account of compost produced from garden and food waste.

**Includes tonnage figure for infrastructure identified in Council Structure Plans.

Table 8 – Summary of selected landbanks and potential use of PAS 100 compost

Agriculture is by far the largest potential available landbank for PAS 100 compost (and potentially PAS 110). There are however a number of obstacles which will require to be addressed before application to this landbank is readily accepted. Approximately 140,000 tonnes of PAS 100 compost could be on the market in the near future.

To cope with the volumes of organic materials being diverted from landfill further treatment infrastructure is required which will result in an increase in the organic outputs entering the market.

Recommendations

A number of landbanks are potentially available for PAS 100 compost however a number of data gaps exist. More work is required to improve data collection and to raise awareness of this material. This work would include:

- Working with Councils to help meet wider environmental objectives by integrating soil protection into relevant policy such as planning and sustainable procurement.
    - Quantifying land area available within individual Council areas which could act as a landbank for PAS 100 compost. Information relating to the area of ground associated with parks and gardens, recreational ground, vacant and derelict land and roads departments should be readily accessible.
    - Councils should consider implementing take-back schemes for householders thus improving awareness of the material.

- Raising the profile of PAS 100 compost for a variety of applications by carrying out trials. This could involve working with Councils (roads departments, regeneration departments, parks and gardens) and other public bodies which own historical park and gardens to highlight the benefits of the material.

- Develop brands – such as Scottish Water's Pod or Forth Resource Management Ltd's Green Goddess. Going beyond baseline information and providing further information on nutrients and by creating blends.

- Gathering information from Farm Management Plans which would help to build an overall picture (on a farm by farm basis) of soil quality and quantity of inorganic and organic fertiliser used.

- Engaging with forestry/woodland and landscaping organisations to publicise the benefits of PAS 100 compost and also to assess application methods.

- Development of a tool which quantifies potential landbanks and pinpoints treatment facilities/suppliers of PAS 100 compost. It is not economic to move material significant distances for agriculture and land restoration. This will be particularly useful for planners, regulators, investors and commercial organisations.

- Addressing application methods for PAS 100. Application problems are particularly common in the forestry industry.

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