Uses of compost in regeneration and remediation of brownfield sites in the UK

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Published by:

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March 2006

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Executive Summary

Scope

The following report presents a summary of the findings of a recent study investigating the opportunities for using compost in the regeneration and remediation of brownfield and derelict sites across the UK. Regional Development Agencies (RDAs), Development Agencies in the devolved administrations, and private sector organisations were consulted as part of an exercise to identify sites capable of using compost for landscaping, non-engineered fill, mulch or remedial applications. Organisations were asked to consider sites which could potentially utilise composts in forthcoming projects.

Methodology

Data was collated by using both questionnaire and qualitative methods to determine a range of variables, including the size (ha), end use, development status and timescale for development works. The information gathered was used to determine potential volumes of compost utilisation across the regeneration market, using examples of previous compost use in projects where possible, to estimate potential volumes of compost utilisation.

Findings

Primary research identified a total 5,938 hectares of regeneration land across 67 sites. 3,014 hectares (51%) of land identified falls across the English Regions, which represents around 5% of the total 66,000 hectares of brownfield land identified through the National Brownfield Strategy. Sources of data include Urban Regeneration Companies (URCs), Land Restoration Trust (LRT), and regeneration partnerships, with the majority of information provided through RDA and Development Agency contacts.

The table below illustrates potential use of compost across sites identified for the period 2006-07. The estimates represent potential use of compost in tonnes rather than determined quantities required across sites through specifications or contracts. The figures provide an indication of the potential size of the market for compost use in brownfield restoration.

<table>
<thead>
<tr>
<th>Region</th>
<th>2006</th>
<th>2007</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Midlands</td>
<td>10,650</td>
<td>16,300</td>
<td>26,950</td>
</tr>
<tr>
<td>Yorkshire and Humber</td>
<td>0</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>London</td>
<td>2,010</td>
<td>2,010</td>
<td>4,020</td>
</tr>
<tr>
<td>West Midlands</td>
<td>70</td>
<td>5,320</td>
<td>5,390</td>
</tr>
<tr>
<td>East of England</td>
<td>70</td>
<td>120</td>
<td>190</td>
</tr>
<tr>
<td>South East</td>
<td>380</td>
<td>8,290</td>
<td>8,670</td>
</tr>
<tr>
<td>South West</td>
<td>2,430</td>
<td>2,430</td>
<td>4,860</td>
</tr>
<tr>
<td>North East</td>
<td>3,010</td>
<td>12,950</td>
<td>15,950</td>
</tr>
<tr>
<td>North West</td>
<td>15,720</td>
<td>61,840</td>
<td>77,560</td>
</tr>
<tr>
<td>Wales</td>
<td>910</td>
<td>1,490</td>
<td>2,400</td>
</tr>
<tr>
<td>Scotland</td>
<td>34,280</td>
<td>34,280</td>
<td>68,560</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>0</td>
<td>6,630</td>
<td>6,630</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>69,530</strong></td>
<td><strong>163,660</strong></td>
<td><strong>233,190</strong></td>
</tr>
</tbody>
</table>

Note: Figures have been estimated to the nearest 10 tonnes

Gaps in the research exist for certain regions where those consulted were unable to provide data due to cited reasons including time constraints and commercial sensitivities, for example, in the East of England. The size of the land regeneration market should be considered in light of the extent of the research and these data gaps. It is recommended that further assessment is undertaken to determine the extent of opportunities across such regions.
Timeframes for development have been categorised according to those sites scheduled for development over the next two years, sites scheduled for development over the following three years and sites scheduled beyond this period respectively. Compost use across those sites identified is estimated to be 233,190 tonnes for the period 2006-07, with a further 355,700 tonnes estimated for the period 2008-10. The findings suggest that wider compost use across the regeneration sector could be significant and an important additional market for compost material.

### Potential tonnes of compost use 2008-2010 by region

<table>
<thead>
<tr>
<th>Region</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Midlands</td>
<td>15,800</td>
<td>2,150</td>
<td>2,150</td>
<td>20,100</td>
</tr>
<tr>
<td>Yorkshire and Humber</td>
<td>22,130</td>
<td>17,940</td>
<td>17,940</td>
<td>58,100</td>
</tr>
<tr>
<td>London</td>
<td>2,010</td>
<td>2,010</td>
<td>2,010</td>
<td>6,030</td>
</tr>
<tr>
<td>West Midlands</td>
<td>5,320</td>
<td>13,320</td>
<td>8,070</td>
<td>26,710</td>
</tr>
<tr>
<td>East of England</td>
<td>120</td>
<td>120</td>
<td>70</td>
<td>310</td>
</tr>
<tr>
<td>South East</td>
<td>11,020</td>
<td>5,390</td>
<td>5,020</td>
<td>21,420</td>
</tr>
<tr>
<td>South West</td>
<td>1,930</td>
<td>1,170</td>
<td>730</td>
<td>3,830</td>
</tr>
<tr>
<td>North East</td>
<td>16,110</td>
<td>16,320</td>
<td>16,320</td>
<td>48,750</td>
</tr>
<tr>
<td>North West</td>
<td>47,970</td>
<td>340</td>
<td>340</td>
<td>48,650</td>
</tr>
<tr>
<td>Wales</td>
<td>1,740</td>
<td>1,740</td>
<td>3,990</td>
<td>7,470</td>
</tr>
<tr>
<td>Scotland</td>
<td>34,280</td>
<td>30,120</td>
<td>30,120</td>
<td>94,520</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>6,630</td>
<td>6,630</td>
<td>6,630</td>
<td>19,890</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>165,060</td>
<td>97,250</td>
<td>93,390</td>
<td>355,700</td>
</tr>
</tbody>
</table>

Regions including Wales, the North West, West Midlands, Scotland and the East Midlands all show favourable correlations in terms of the distance between those regeneration sites identified and BSI PAS 100:2005\(^1\) certified compost facilities, suggesting that it would be economically feasible to supply compost to these sites. However other regions show less favourable correlations. This should be considered alongside the fact that the sites identified are not exhaustive, and the study did not map compost facilities yet to join a certification scheme such as BSI PAS 100.

### Specification procedures

Other areas of the study include a review of how far development procedures across public and private sector organisations affect the specification of composts and recycled materials in projects. The research reveals that whilst organisations operating across the sectors differ in structure and make up, all those organisations consulted inevitably use a similar standardised engineering approach to the remediation and restoration of brownfield sites. There is an opportunity within these procedures to specify the use of materials with a recycled content. An illustration of this approach is detailed in Section 4.

### Sustainability

Agencies were also consulted on how far sustainable development policy had a bearing on procurement across the organisation, revealing a wide ranging approach to embracing sustainability as a principle. The majority of organisations revealed softer framework approaches to sustainable procurement and project appraisal processes, with many awaiting the findings of the Sustainable Procurement Task Force, due to publish an Action Plan in 2006. This is expected to shape the way in which public and private sector organisations address sustainability through procurement of services and products, such as composts.

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\(^1\) This is a facility that has been certified by The Composting Association to produce compost according to the requirements in BSI Publicly Available Specification for Composted Materials (BSI PAS100:2005)
Opportunities

The continued emphasis on brownfield land development across the UK opens up a new market for composted materials. Brownfield land areas are increasingly being made available via regional regeneration initiatives, which have the potential to increase demand for composted materials and a diversification of markets that have traditionally been accessed, for instance, by the landscape industry.

Use of compost in situ as soil improver, in landscaping, and within topsoil blends are likely to increase across the brownfield regeneration sector as the technical and commercial benefits continue to be communicated. Documented benefits include nutrient and organic matter addition, structural improvement and water retention capacity, which all assist in increasing the health of poor and over developed soils.

Efforts to develop a Quality Protocol for Compost should also further the development of markets for compost by clarifying the position on the definition of waste and when a waste is considered to be a product in England and Wales. The Protocol is being supported and developed by the Environment Agency (EA), Department for Environment, Food and Rural Affairs (Defra) and WRAP and it is anticipated that this will help to increase user confidence in specifying material across the landscaping, topsoil and land restoration sector.

Barriers

The study also addressed some of the barriers specific to compost use in the regeneration sector. Awareness of availability as a resource, technical knowledge and a lack of confidence, regulatory constraints and suspicions over quality are some of the issues cited by those consulted for failure to specify compost in projects.

The tightening up of legislation concerning contaminated soils through the introduction of Soil Guidance Values (SGVs) also presents challenges for the use of compost across the brownfield sector, with current uncertainty as to how far above a SGV a concentration would have to be in order for risks to be considered as potentially significant. Defra and the EA are considering further guidance with respect to this issue via the SGV Task Force.

Recommendations

Following a detailed examination of the barriers precluding the specification of compost, recommendations for increasing the use of compost include the need for further best practice demonstration projects with widespread dissemination across the contaminated land and brownfield sector.

Long lead-times for site development means it can be difficult for compost producers to prepare or service these markets. WRAP could work to facilitate greater specification of compost at early stages of development processes, working with project managers to source material and match supply with demand.

The role URCs play in terms of leading regeneration initiatives across the UK is acknowledged. Dissemination of Best Practice in terms of the use and procurement of recycled materials in projects should extend to URCs, with WRAP exploring opportunities to engage further with URCs through RDAs, local authorities and other organisations.

CL:AIRE is currently supporting the Soil Guidance Value (SGV) Taskforce with regards to tackling the issues associated with SGVs that are contributing to the uncertainties over the use of recycled materials. Further support could include the provision of advice on this issue amongst the waste industry, since current knowledge amongst compost producers and end users is limited.

Further recommendations include the need to undertake detailed scientific trial data to increase knowledge and understanding of applications for compost in the brownfield land sector.
1 Introduction

1.1 Background

Enviros and CL:AIRE were commissioned by WRAP to undertake research to assess the potential uses for compost in the regeneration and remediation of brownfield sites in the UK. This report describes the methodologies employed and the results obtained from the study, drawing some conclusions on the potential opportunities for compost use across this sector and presents recommendations for further work.

The collection and composting of source segregated organic waste continues to be an important element of the UK’s waste diversion strategy. It will continue to be an important contributor to local authority recycling targets, and the number and types of composting facilities are expected to increase significantly to process this material to meet Landfill Directive Targets and those set in the respective national waste strategies.

Without strong and sustainable markets for compost, further development of the composting industry will be limited. Market development therefore has a key role to play in the long term future of the composting industry with significant efforts already undertaken by compost businesses, WRAP and regional organisations to develop end uses for materials across sectors such as the horticultural, agricultural and landscaping industries. Efforts to explore the market potential for compost in the regeneration sectors have so far been limited. WRAP has commissioned this research to determine whether there is a significant opportunity to utilise compost in brownfield site regeneration and to identify barriers and opportunities which need addressing in order to grow demand in the sector.

1.2 Context

This research considers the opportunities for compost application across brownfield site regeneration across the UK. The study focuses on the strategies and policies employed by RDAs to return underused, derelict and contaminated sites back into use via regeneration and reclaimation programmes. This research is undertaken at a time when National Brownfield Strategy is being developed by the Governments specialist advisors on brownfield land, English Partnerships (EP) in order to assess the state of England’s brownfield land supply and develop policies to bring forward sites for development across England.

RDAs have been charged with creating a series of brownfield local action plans (BLAPs) aimed at speeding up brownfield delivery with particular reference to the four major growth areas in England of the Thames Gateway, Milton Keynes/South Midlands, London-Stansted-Cambridge and Ashford\(^2\). It is intended that these regional plans will propose methods of making better use of previously developed land (PDL) to deliver regional economic and housing strategies and identify new development opportunities.

WRAP have undertaken development work illustrating the benefits and uses of compost in regeneration projects as a soil conditioner, in landscaping and topsoil manufacture and remediation (i.e. bioremediation of soils). This work shows there are potential synergies between national/regional regeneration and sustainable development strategies and the use of compost in regeneration.

This project considers brownfield and derelict sites across the UK scheduled for reclamation and development where compost specification can be encouraged. The research also targets large land owners of contaminated sites, private industry and utility groups in order to identify areas of brownfield or derelict land which may require compost as part of either reclamation or restoration as part of their business plans or business strategies.

Particular focus has been paid towards:

- Development processes and procedures within each Agency with regards to how and when decisions are made with on the specification of materials such as compost in projects
- Whether Agencies have adopted policies that either encourage or place a commitment on developers to use compost or recycled materials
- The extent to which compost is already used in land regeneration or land remediation projects

\(^2\) No equivalent formalised strategy exists in the devolved administrations for bringing forward brownfield land for redevelopment
Uses of compost in regeneration and remediation of brownfield sites in the UK

- Identification of barriers that are limiting compost use in land regeneration, with suggestions as to how to overcome such issues
- Identifying synergies between WRAP’s own policies and the individual Agencies, together with suggestions for how WRAP can better influence and increase compost use.

Emphasis has been placed upon:

- Land that has been acquired by the RDAs in England, including the equivalent Enterprise Agencies in Wales, Scotland and Northern Ireland
- Sites identified in RDA/Enterprise Agency regeneration strategies and reclamation prospectuses
- Sites where RDAs/Enterprise Agencies are strongly influencing the type of land regeneration
- Large sites owned by utility companies and large industry groups.

The study has identified sites considered by those organisations and individuals consulted to be significant in terms of overall scale of regeneration (hectares), including those sites considered to be particular relevant in terms of potential for using compost in either landscaping, topsoil manufacture or brownfield regeneration. The research provides an indication of the market size for compost in the regeneration and remediation of brownfield land.
2 Methodology

The following section describes those methods undertaken for data collection, with comment also provided on overall response rates to the research.

2.1 Data collection

Data for the study has been obtained in a variety of ways. A questionnaire was developed in order to obtain quantitative data from targeted organisations and industry groups. The questionnaire was developed in conjunction with WRAP and sent out to selected public and private sector organisations across the UK.

A contacts list was developed using CL:AIRE, Enviros and WRAP contacts to target organisations and encourage responses from specific individuals involved in regional/national regeneration projects and policy. Questionnaires were sent out to a range of public and private sector organisations. Respondents were asked to consider a range of issues relevant to the study, including previous experiences of compost use in any application, potential barriers to future specification of composts, and site specification information relating to sites scheduled for development.

Quantitative data such as site information was compiled into a spreadsheet, with grid reference/postcode information used to plot sites across each region. Regeneration sites were mapped in relation to BSI PAS 1003 certified compost facilities using data provided by WRAP. Other qualitative data obtained from consultees has been used to estimate potential volumes of compost use for each site.

To encourage participation, research was also promoted via other forums to encourage responses from various sectors. Background to the research was promoted via regional training events on remediation technologies organised by CL:AIRE and also via the Soil and Groundwater Technology Association (SAGTA) quarterly workshop meeting. To obtain qualitative data, meetings were also scheduled with the English RDAs, Agencies and industry groups. Meetings were held with eight of the English RDAs, Scottish Enterprise, Scottish Executive, and the Welsh Development Agency. In order to improve response rates a number of telephone interviews were conducted where respondents were unable to complete the questionnaire.

2.2 Response rates

Many organisations have struggled to provide data on a number of key areas, such as previous quantities of compost use in projects, site availability and site specific data. Reasons cited by organisations for failure to return questionnaires included a lack of available data, time constraints, the complexity of questions being asked in the survey as well as a perceived lack of relevance to their current business strategy or policy. In such instances limited desk research has been undertaken to identify potential sites across some of the UK regions. Those sites identified as a result of desk research were referenced as such as the source of information.

Of the 19 public sector organisations consulted, five organisations (26%) were able to return completed questionnaires. Face to face meetings, telephone interviews and requests for data via email served to improve overall response rates, resulting in responses from 15 of the 19 public sector organisations consulted (79% overall).

Responses from some of the consulted organisations have been limited, particularly in relation to private sector organisations. Similarly reasons cited by the private sector included time constraints, but also the confidential and sensitive nature of some of the data requested.

Face to face meetings, telephone interviews and email requests also served to obtain feedback from private sector organisations where possible, resulting in feedback from 8 of the 21 private sector organisations consulted (38% overall).

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3 This is a facility that has been certified by The Composting Association to produce compost according to the requirements in BSI Publicly Available Specification for Composted Materials (BSI PAS100:2005)
3 Brownfield development strategies and plans

The following section outlines the role of national and regional organisations in UK regeneration strategy, including English Partnerships (EP) and the English RDAs in developing regional and national brownfield plans and policy. Background to regeneration and brownfield strategy across the devolved administrations are also provided. Key findings of the National Brownfield Strategy together with the emerging Brownfield Local Action Plans which are currently being developed by English RDAs and supported by EP are also discussed. Brownfield and derelict land policy is also summarised for the devolved administrations, including current developments driving the regeneration agenda across Scotland, Northern Ireland and Wales.

3.1 English Partnerships (EP)

EP are the national regeneration agency supporting the Government to encourage sustainable growth across England. EP work in partnership with other Agencies including the Housing Corporation, the English RDAs, local government and the private sector. EP are also a key delivery body for the Government's Sustainable Communities programme which addresses housing shortages, homes for key workers, affordable housing and the problems of land abandonment and decay.

EP have five core business areas, which include:

- Developing its portfolio of strategic sites
- Acting as the government’s specialist advisor on brownfield land
- Ensuring that surplus public sector assets are used to support wider Government objectives, especially those contained in the Sustainable Communities Plan
- Helping to create communities where people can afford to live and want to live
- Supporting the urban renaissance by improving the quality of our towns and cities.

RDAs act as the delivery agents for EP, and are responsible for the wider economic strategy in each region through the Regional Economic Strategy. EP engage with the RDAs by providing a focused programme of support to deliver brownfield regeneration, housing targets and job creation. In particular EP are instrumental in providing a higher level focus and experience in delivery for particular strategic sites and programmes. EP are currently driving the programme of renewal for the most deprived areas of the country typically in the North and the housing targets in growth areas typically in the south.

EPs work is translated into the following priority work programme areas:

- Sustainable growth across the four “growth areas” of the ‘South East,’ including Milton Keynes, the London-Stansted-Cambridge M11 corridor, Thames Gateway and Ashford;
- The National Coalfields Programme
- National Brownfield Strategy
- Development of strategic brownfield sites or ‘hardcore brownfield land’ in, or adjacent to, priority areas or in areas of housing pressure or low demand and housing abandonment
- The 20% most deprived wards in the country, as defined by ODPM and currently adopted for a number of measures, such as the recent residential stamp duty exemptions.

Further work programmes include support to the English RDAs in developing brownfield action plans (BLAPs), discussed along with other work areas in detail below.

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4 ODPM website 2006
3.2 National Brownfield Strategy

National Brownfield Strategy continues to develop under the direction of EP and The Office of the Deputy Prime Minister (ODPM). Rationale for the study included the large amount of land remaining underutilised across the UK, with continuing social change resulting in the need for an additional 2.4 million new homes over the next two decades. EP produced ‘Towards a National Brownfield Strategy’ in 2003 to assess the state of England’s brownfield land supply. The report contains a series of recommendations as the basis for developing a comprehensive National Brownfield Strategy across England.

The Strategy has highlighted how a huge potential exists to reuse brownfield land to meet government housing growth targets, while reducing the pressure to develop on our countryside. As much as a third of the 66,000 hectares of brownfield land identified in the National Land Use Database (NLUD) has been identified by EP as readily available for development, significantly contributing towards government targets for developing 60 per cent of housing on brownfield land.

Key findings of the study include:

- Nearly one-third of the brownfield or previously developed land (PDL) identified is contained within the key growth regions (i.e. Greater London, South East and East of England).
- Only one-sixth of the total ‘hardcore’ PDL (i.e. land that has been vacant or derelict for nine years or more) is to be found in these growth regions, suggesting fewer barriers to the long-term regeneration of brownfield land.
- The target of achieving 60 per cent, or more, of new homes on brownfield land should continue to be achievable in the foreseeable future.

EP predict that the pace and uptake of PDL needs to be increased by around 1,000 ha per annum if public policy objectives are to be met. Modelling of relevant policy targets revealed a requirement for some 7,700 ha per annum of PDL to be available for a range of hard end uses (i.e. for built development rather than open space end uses).

The study found how neither the public or private sectors have had the incentives to tackle ‘hardcore’ PDL sites that make up a significant proportion of the total stock of identifiable PDL. Of the total stock, some 16,523 ha of PDL has remained derelict or vacant for more than nine years.

The National brownfield strategy will continue to develop using an improved evidence base via NLUD and through best practice research with pilot projects in a number of targeted geographic areas. Details of these together with the emergence of local plans are described below.

3.3 Pilot Projects

Pilot projects are being developed across a number of the English regions to assist the development of national and regional strategy. It is anticipated that the pilots will identify and assess any potential hurdles that inhibit the reuse of brownfield sites, but also success stories that can be replicated elsewhere. Led by EP, the pilots will examine the feasibility of hard and soft end uses and create strategic partnerships involving local authorities, private sector and community organisations.

Projects will be led through Local Brownfield Partnerships (LBPs) that have been developed to undertake a strategic approach to return identified sites back into use. Fourteen pilot areas have been identified including Barking & Dagenham, Barrow in Furness, Bradford, Bristol, Dudley, Easington, Ipswich, Kerrier, Manchester, Mansfield, Milton Keynes, Portsmouth, Sheffield and Tower Hamlets. Work programmes in each pilot area commenced midway through 2005, with findings due to be published in early 2006.

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6  EP (2005)
3.4 Brownfield Local Action Plans (BLAPs)

BLAPs are the regional approach proposed to tackle brownfield land as recommended in English Partnerships 2003 report[7]. BLAPs are intended to guide action at regional level and identify strategic development opportunities for returning former brownfield sites back into use.

Local plans are currently under development via partnerships and stakeholders such as regional and local government, which collectively will classify and identify brownfield land using available data for each area. Regional summaries of PDL are available via NLUD together with other sources and database information[8]. The plans will enable stakeholders to understand best uses for brownfield sites based on strategic and regional need. BLAPs are intended to complement existing national strategy and pilot projects, but also address local barriers that have previously inhibited brownfield redevelopment and engage local communities.

Redevelopment of large areas of brownfield land will continue to be undertaken largely by the private sector, with a significant proportion of projects taking place with little direct involvement from public bodies and government agencies, except as their role as regulator and enforcing legal permissions[9]. It is expected that the development of BLAPs will increase direct involvement with private industry.

The North West Development Agency (NWDA) and East of England Development Agency (EEDA) have been the first to develop BLAPs, with lessons learnt from these initial regional plans incorporated into other BLAPs currently being developed by Advantage West Midlands (AWM), East Midlands Development Agency, One North East and Yorkshire Forward. The status of each of the BLAPs being developed by RDAs across England varies, although each of the regions are progressing with individual plans aimed at bringing brownfield land back into use.

3.5 National Coalfields Programme

Also directed by EP, the National Coalfields Programme includes the management of over 100 former colliery sites in partnership with RDAs, Coalfields Communities Campaign, Coalfields Regeneration Trust, CL:AIRE and other key local and private-sector partners. Since its development in 1996 the Programme has achieved reclamation of over 1,658 hectares of brownfield land, building over 1,000 homes and developing over 686,000 square metres of commercial office space across former sites.

The Programme is on course to achieving new uses for around 4,000 hectares of coalfield land, with 8,000 new homes and 2 million square metres of commercial space and a significant creation of public open space across the English regions. Priority sites continue to come forward, with sites periodically added to the Programme nationally. Full details of other sites and their partners are available via the EP website[10].

EP are supporting the restoration of sites under the Coalfield Programme in partnership with RDAs and local authorities across each region. Since many of these sites are characterised by poor, sometimes thin soils, this presents significant opportunities for use of composts as ameliorants and conditioners.

[10] www.englishpartnerships.co.uk
4 Development procedures

The following section includes the outcome of discussions with consultees on their development procedures for site regeneration and/or remediation. Limited data was attained from the private sector, with those consulted citing time restrictions, difficulties in responding to the questions answered and commercial sensitivities as reasons for a lack of response to the survey. Through individual consultation however, development processes were discussed with RDAs, Agencies and private industry to confirm the procedures by which land remediation and regeneration projects are enacted.

4.1 Public and private sector site engineering procedure

RDAs were asked to consider their development procedures with regards the various stages of remediation and site restoration. In doing so organisations were asked to consider:

- The processes by which brownfield sites come forward for development;
- Development processes and procedures by which sites are remediated/regulated;
- At what stage of the development process would the opportunity arise to influence material specification.

Despite differing remits of public sector organisations and industry, consultation confirmed that the development procedures undertaken for remediation and regeneration of brownfield sites are broadly very similar. All RDAs and Agencies consulted follow the standard engineering procurement contract for site remediation works, with the private industry following the same standardised approach. Figure 1 illustrates the standard stages of development for a site owner (i.e. an RDA or for private sector).

The following points are typical with regards to site remediation procedure:

- The method by which a site is remediated will be based on a site specific investigation, remediation objectives, timescales, site constraints and budgets available for overall treatment works.
- Whilst each development is site specific, it will ultimately be the consultants used by the organisation who usually decide and set the specifications for remediation strategy and material use.
- A Principal Consultant will be appointed by RDAs/Agencies for large scale remediation and/or regeneration projects and will work closely with the relevant Agency as the client representative to develop reclamation/remediation strategy.
- Whilst the Principal Consultant will also take responsibility for deciding reclamation and/or remediation strategy, RDAs/Agencies (as the client) will be consulted and have influence over how site works go forward. The Principal Consultant will also be responsible for writing specifications. Where sustainable or green procurement policies exist, this may influence specifications, however technical requirements to ensure fit for purpose, together with cost and availability of resources will normally have priority.
- One of the most appropriate points of intervention to encourage compost use is through RDAs at the reclamation stage. RDAs will often act as agents for EP; therefore there are potential opportunities for EP to encourage compost specification in projects.
- Sub contractual elements including final site restoration and landscaping will also normally be directed by consultants. In the majority of cases RDAs will be contracting these services out.
- Specifications are designed in response to individual project needs to suit often unique circumstances, therefore there is no general assumption or rule for all contracts promoting one particular type of material use.
Specification of materials will normally be determined during the reclamation and/or remediation design phase and informed following site investigation works (see Figure 1). Final end use of the site will also influence material specification. Typically master plans will determine as to whether importation of fill and landscaping materials will be required following site remediation works.

Opportunities for compost specification in brownfield restoration are often determined by whether an organisation undertakes remediation following initial site investigation or whether they choose to sell a site in its existing condition. A number of those organisations consulted revealed that it is common practice to sell contaminated sites with full information following initial site investigations. Developers procuring such sites will then take on site reclamation, which will be carried out as part of remediation. Any specification of materials will normally be determined by those taking ownership of such sites.

The ability to influence this process is complicated further by the fact that due to a number of sensitivities, the process of selling sites on to developers is often undertaken with limited knowledge or involvement by outside parties.\(^{11}\)

\(^{11}\) Under Part IIA of the Environmental Protection Act 1990 the EA will be consulted to ensure appropriate remediation of a site takes place. Clients or client representatives (consultants) will, however ultimately decide their own remediation strategy, with input from the EA or Local Authorities to ensure regulation is upheld.
4.2 Conclusions

Development procedures for the remediation of brownfield sites undertaken by public and private sector organisations are similar in that a standardised engineering approach is followed. The approach to reclamation and/or remediation will normally include the procurement of a client representative or a Principal Consultant, and it is common for private sector organisations to have such capabilities in-house.

To encourage the use of compost in projects WRAP should seek to influence projects at the stage where specifications are being written and where tenders for contracted works are being drawn up by consultants/client representatives. Opportunities for influencing projects should also be explored at earlier stages through corporate policy commitments and through drives towards sustainable procurement.

One of the most appropriate points of intervention to encourage compost use is through RDAs at the reclamation stage. RDAs will often act as agents for EP; therefore there is also the opportunity for EP to encourage compost specification in projects.

WRAP should continue to engage with Sustainability Managers in public sector organisations to support procurement policy and ensure individual Project and Technical Managers are able to access information relating to technical specifications, source materials and identify best practice case studies.

Engaging with private sector land owners is difficult given the sensitivities concerning the remediation of contaminated sites. Influence through Environmental Management Systems, Environmental Policies or Sustainable Procurement Policies may be possible, however overriding priorities to limit liability will normally preside in project design.

Consultants employed by private sector land owners will however be open to receiving information on performance of composts, potential cost benefits and other product information. WRAP could explore options for engaging with the contaminated land industry through groups such as SAGTA, the Association of Geotechnical and Geoenvirenmental Specialists (AGS) and other industry associations to encourage awareness and use of compost in projects.
5 Sustainable procurement policy

Summary of findings

Agencies were consulted as to how far internal policies influence contractors or developers in specifying either composts or other products with recycled content in development projects. Findings revealed that the extent to which Agencies encourage use of recycled materials varies considerably. Popular approaches include a ‘softer’ tack whereby developers are encouraged to embrace a range of issues around sustainability in project design, such as energy conservation, waste minimisation and recycling.

Despite varying formal and informal approaches to project appraisal, sustainability is a key consideration in all of those Agencies consulted. However the extent to which recycled content products transpire into projects is less clear, with limited quantifiable data available.

Some of those Agencies consulted suggested how the specification of products such as PAS 100 or equivalent standardised products could potentially be written into contracts to ensure its use in projects. Whereas others consultees had reservations, citing concerns such as dissuading contractors at the tendering stage and liability issues.

Incidences where contractors are obliged to use recycled materials in projects are fairly limited, with some of those individuals consulted awaiting the findings of the Sustainable Procurement Task Force. The Task Force are due to release an action plan in 2006, aimed at bringing about a step-change in sustainable procurement practices in the UK.

Conclusions

Sustainability is a key consideration in all of those Agencies consulted. It is anticipated the findings of the Sustainable Procurement Task Force will recommend actions for translating sustainability policies into procurement practice, allowing organisations to go further with recycled content in projects and sustainable design.

Through current sustainability policy, Agencies are encouraging developers and contractors to consider sustainability through frameworks and guidance, however decision making processes could be guided further by ensuring specifiers are able to access to information concerning product availability, technical performance and cost comparisons with competing products.

RDAs/Development Agencies are able to ensure projects adopt a sustainable approach and thus encourage the specification of recycled content in design and master planning. WRAP could facilitate this process through the provision of product information and the development of commonplace sustainability guideline criteria.

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12 Sustainable Development Commission (2005)
6 Potential applications for compost on brownfield sites

Despite examples of compost use across the regeneration sector, limited reliable data currently exists on national use in this market. The Compost Association reported the volume of composted materials produced in the UK in 2003/04, and their associated end uses, shown in Table 1. The majority of product (60%) is used as a soil conditioner, however this continues to be predominantly used for agricultural end use, with 6% utilised in topsoil manufacture.

A 2001 ODPM report\(^{13}\) identified 231,000 tonnes of green compost used as soil improvers in the landscaping and retail markets, however it is unclear what volume constituted use in reclamation and restoration works.

<table>
<thead>
<tr>
<th>Product</th>
<th>Quantity (‘000 tonnes)</th>
<th>Percentage of total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mulch</td>
<td>188</td>
<td>16</td>
</tr>
<tr>
<td>Soil Conditioner</td>
<td>722</td>
<td>60</td>
</tr>
<tr>
<td>Growing media component</td>
<td>102</td>
<td>9</td>
</tr>
<tr>
<td>Turf dressing</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Topsoil component</td>
<td>68</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>94</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>1,189</td>
<td>100</td>
</tr>
</tbody>
</table>

Other studies\(^{14}\) estimate the market for compost in restoration at several millions of tonnes per annum, suggesting a ‘general restoration’ market potentially capable of utilising 1,000,000 tonnes per annum, referencing Stockley Park regeneration as an indicator (100,000 cubic metres used as part of restoration works). Landfill restoration markets are estimated to be capable of taking a further 5,000,000 tonnes per annum as part of requirements to create topsoil for completion works. Landfill restoration is typically covered using poor quality materials, often leading to further restoration requirements at later stages. Composts have a potential role in ensuring quality restoration works.

In assessing a range of potentially viable end markets for lower grade MBT materials, the Juniper MBT Guide Report\(^{15}\) highlighted brownfield regeneration sites as an attractive usage option capable of taking significant quantities of organic material. No figures are provided as a market estimate for low value compost applications in remediation, however the study does estimate how some 80,000 hectares could benefit from application of lower grade ‘composts’ as part of remediation at the time of writing. Wider uses for compost for regeneration works are long standing, with good examples demonstrating its capacity as an ameliorant, in topsoil manufacture and in remediation.

The following case studies have been identified where compost has been utilised as part of the regeneration or restoration of brownfield land.

6.1 Markham Colliery

The Markham Willows project is an integral part of the wider Markham Vale regeneration initiative in Derbyshire. The 320 hectare site is centred on the site of the former Markham Colliery. The project has and continues to demonstrate best practice in colliery reclamation and restoration, with works being undertaken on the North and South Tips of the former colliery.

Initial activity has seen the introduction of an eventual area of 60 hectares of short rotation coppicing and ‘regular biodegradable matter’ to restore soils and provide structure across the site, providing beneficial use of garden waste...
compost and sewage sludge to stabilise and contain site contaminants within the former colliery spoil. Restoration works across the site include a number of activities, including the establishment of short rotation coppice for use as a harvested fuel, the use of biodegradable materials to provide nutrients and humic substances, production of wood fuel for use at the Markham Vale development and the opportunity for the creation of a community company to manage and support the project.

Sewage sludge was used for the formation of a new topsoil horizon in the initial 15 Ha ‘reference plot’, while leaving the existing spoil heap surface in situ. Subsequent applications of compost on the remaining 45 ha as a mulch will provide additional organic matter and is forecast to provide the humic conditions necessary for improved growth of the willow crop. An assumed mix of 1:1 compost: sewage sludge will be applied, which will be mixed into the top 15 centimetre surface layer using a disc cultivator\textsuperscript{16}.

Trials undertaken by AEA Technology plc have shown how compost addition to the topsoil/sewage sludge mix further enhances the establishment and growth of willow. Compost has also been shown to be suitable as a weed suppressor, retaining moisture and building structure in soils.

The large area available at Markham provides the opportunity for the production of compost on site, with project partners exploring the potential for developing an open windrow facility to supply the short rotation coppice as a main user of output materials. Cost modelling undertaken by AEA Technology plc suggests operational costs could be covered by gate fees, considering a 6,000 tonne/year facility. Coppice rotation could take an estimated 250 tonnes per hectare, with ‘top up’ requirements providing a potential long term market for finished product.

6.2 **Tilmanstone Colliery**

Compost was specified as part of final landscaping and restoration works for the former Tilmanstone Colliery. SEEDA required rapid remediation and reclamion of the site for industrial uses. The overall development area was some 12 hectares of colliery shale tip. 15,000 cubic metres of compost were sourced from local supplier, E Q Waste Management of St Albans, by civil engineering contractor Nuttall Hynes.

Topsoil was then mixed on site to Tom La Dell Landscape Architect’s specification of seven to eight per cent organic matter by weight, with shale up to 20mm in diameter and up to 25 per cent local subsoil. The first batches were mixed in a barrel screen with later batches mixed with a 360 degree excavator. Nutrient levels were also tested in the finished product to ensure BS 3882 standard availability. Resulting blends included 15 per cent compost by weight.

A woodland belt was planted, together with building surrounds, with an additional 3 hectares provided with grassed down areas for those plots of land awaiting development.

The topsoil organic matter level was high enough so that when landscape contractor English Landscapes carried out planting no compost was needed. This reduced the costs of the planting and improving plant establishment, as the soil was easier to work around the roots of plants. The topsoil was used in areas for mass planting of native trees and shrubs on 1:2 slopes; ornamental tree and shrub planting at the site entrance; small scale planting around the office building and for lawns and meadows. It was spread 400 mm deep on planted areas and 200 mm deep on grass areas\textsuperscript{17}.

6.3 **Chorley Royal Ordnance Site**

The Mersey Forest in NW England, which is the largest of the Community Forests, is already half way toward achieving its target of increasing tree cover from 4% to 15%, with more than 25% of the existing tree planting taken place on brownfield land. This proportion is likely to increase in the future\textsuperscript{18}. In partnership with Liverpool John Moores University and the Clean Merseyside Centre and WRAP, a number of brownfield sites across the region continue to benefit from the addition of compost to restore soil quality, develop woodlands and grasslands, encouraging ecology development.

One of the larger sites that has benefited from compost addition is the former Royal Ordnance site. Having stripped, screened and disposed of contaminated topsoil from the site a shortage for landscaping was acknowledged. Unsuitable geotechnical material comprising a sand/loam was extracted from within the site during development. Rather than dispose of this material to landfill, composted green waste was incorporated at a ratio of 2:1 soil to compost by volume to produce a suitable mix for landscaping a new access road which will service a business development. Any additional mixed material was used as part of an area landscaped for recreational open space.

\textsuperscript{17} WRAP (2005) Compost helps to create sustainable topsoil on brownfield site. www.wrap.org.uk/organics
Cost comparisons for two proposed options for landscaping the site are illustrated in Table 2, which indicate how reductions in costs were made possible through the use of compost. Blending composts with existing site materials provided a 54% cost saving over the option of purchasing topsoil and transportation over potentially long distances.

### Table 2: Comparative cost options for Chorley Royal Ordnance (Source: WRAP 2006)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost £</th>
<th>Activity</th>
<th>Cost £</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1 - Creation of soil using in situ subsoils and recycled compost</strong></td>
<td></td>
<td><strong>Option 2 - Import 14,000 tonnes top soil and dispose of subsoil</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Product Cost</strong></td>
<td></td>
<td><strong>Product Cost</strong></td>
<td></td>
</tr>
<tr>
<td>7036 tonnes PAS 100 28mm compost @ £7/tonne including delivery</td>
<td>49,252</td>
<td>Approx. 7000 tonnes unsuitable geotechnical material ‘dig and dumped’ @ £8/tonne</td>
<td>56,000</td>
</tr>
<tr>
<td>Approx. 7036 tonnes subsoil used to ‘make’ soil</td>
<td>0</td>
<td>Approx. 7000 tonnes subsoil hauled to landfill @ estimated £3/tonne</td>
<td>21,000</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Import 14000 tonnes topsoil. Price varies significantly depending on availability and quality. Estimated at £8/tonne including delivery.</td>
<td>112,000</td>
</tr>
<tr>
<td><strong>Handling Costs</strong></td>
<td></td>
<td><strong>Handling Costs</strong></td>
<td></td>
</tr>
<tr>
<td>360 + driver 641.5 hours @ £25/hour</td>
<td>16,581.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bucket + driver 280.5 hours @ £30/hour</td>
<td>86,37.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dump truck 5 hours @ £0/hour</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervision 461 hours @ £10/hour</td>
<td>4,610</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tractor/Trailer 416.5 hours @ £17/hour</td>
<td>7,080.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36,909.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL Costs to date for manufactured top soil ready for use in landscaping</strong></td>
<td>86,161.50</td>
<td><strong>Total costs for imported topsoil ready for use and subsoil disposal</strong></td>
<td>189,000</td>
</tr>
<tr>
<td><strong>Total cost per tonne of made soil (14072 tonnes of ‘made’ soil in total)</strong></td>
<td>6.12</td>
<td><strong>Total cost per tonne of topsoil (14000 tonnes estimate)</strong></td>
<td>13.5</td>
</tr>
</tbody>
</table>

### 6.4 Colchester Gasworks

Whilst examples of compost use in bioremediation are few in the UK, some research and development work have been trialled. A former gasworks site at The Hythe Quay, Colchester was being redeveloped for a housing and commercial development by Barratt Eastern Counties Ltd.

Remade Essex undertook trials with remediation contractors Knight Environmental, demonstrating compost use in degradation of hydrocarbons at a former gasworks in Colchester. The bioremediation area covered 1.2 hectares and treated 8,500 cubic metres of contaminated soil, using 750 tonnes of compost mulch from the Rainham Eco-industrial site, screened to <40 mm. Excavated soils which were contaminated by hydrocarbons from the gasworks were screened and mixed with mulch, in the ratio 1 mulch to 6 soil, plus the addition of a quantity of a granular bionutrient formulation.

Original contaminant levels of 150,000 mg/kg TPH and 30-40,000 PAH were recorded across the site, with target levels to be reached for soil treated on site set at <30,000 mg/kg TPH and <10,000 mg/kg PAH. Any site materials which had higher TPH and PAH above this threshold (most heavily contaminated) was removed from the site and was disposed of via landfill. Final testing revealed recorded levels to 1-2,000 mg/kg TPH and 250-500 mg/kg PAH, resulting in treatment of between 60 -70% of contaminated soils on site. The project demonstrated considerable savings on landfill disposal costs through treating soils with composts of around £50 per tonne. Disposal costs have risen significantly since, with disposal costs for similar materials currently around £150 per tonne.19

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19 Remade Essex case study available at http://www.remadeessex.org.uk/pageDetail.asp?articleID=84
6.5 Concluding remarks

The above projects have demonstrated some practical uses for compost in regeneration. Compost materials has been shown to have positive benefits when used as a mulch material in landscaping, as an input material to enrich topsoils, and also as an input material in bioremediation of contaminated soils. The projects identified have demonstrated how compost can increase humus and often stabilise contaminants, supply nutrients for plant growth and suppress undesirable weed growth. Manufacturing composts with existing sub soils has also demonstrated how significant cost savings can be made.

The case studies illustrate how source segregated compost is often blended with other sources of organic material such as sludges. Product blends of compost and biosolids are often desirable since compost is high in available potassium and biosolids are normally high in available nitrogen. However products meeting horticultural parameters such as those set out in *BSI PAS 100:2005 - Specification for composted materials* will often be more desirable to specifiers since specifications reduce risk in projects.

Perceptions of sludge as a waste coupled with potential odour issues may also mean source segregated compost is the preferred product. PAS 100 certified sites are still in limited numbers however, across some UK regions. Transport logistics are cost prohibitive to many brownfield regeneration sites, therefore sourcing organic materials from a range of sources will continue to be common practice for Project Managers.
7 Potential compost use in brownfield regeneration

The following section describes the approach to assessing the potential opportunities that exist for using compost in regeneration across those sites identified as part of the study. Site identified are broken down by region, with some assessment on data quality, highlighting where gaps in the research exist. Methods by which compost use projections have been calculated are also included, together with project examples on which the modelling tool was developed and assumptions were based upon. Estimates projections for compost use across those sites identified are provided for the periods 2006-07 and 2008-10.

Primary research with project contacts identified a total 5,938 hectares of regeneration land across 67 sites, details of which are displayed in the tables and illustrations below. 3,014 hectares (51%) of land identified falls across the English Regions, and represents around 5% of the total 66,000 hectares of brownfield land identified through the National Brownfield Strategy. Table 3 illustrates the number of sites identified as a result of the study together with the total areas (ha).

Regeneration site information has been provided through the contact organisations consulted. The majority of information was provided through RDA and Development Agency contacts, with additional information supplied by URCs, LRT and regeneration partnerships. Information is based upon both qualitative feedback via questionnaires and meetings with consultees where individuals felt there were potential opportunities for specifying compost in projects (either landscaping, topsoil manufacturing or bioremediation).

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Sites</th>
<th>Hectares (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Midlands</td>
<td>6</td>
<td>421</td>
</tr>
<tr>
<td>Yorkshire and Humber</td>
<td>5</td>
<td>343</td>
</tr>
<tr>
<td>London</td>
<td>3</td>
<td>306</td>
</tr>
<tr>
<td>West Midlands</td>
<td>3</td>
<td>196</td>
</tr>
<tr>
<td>East of England</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>South East</td>
<td>8</td>
<td>633</td>
</tr>
<tr>
<td>South West</td>
<td>5</td>
<td>175</td>
</tr>
<tr>
<td>North East</td>
<td>6</td>
<td>383</td>
</tr>
<tr>
<td>North West</td>
<td>12</td>
<td>548</td>
</tr>
<tr>
<td>Wales</td>
<td>5</td>
<td>239</td>
</tr>
<tr>
<td>Scotland</td>
<td>5</td>
<td>1740</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>5</td>
<td>345</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>67</strong></td>
<td><strong>5938</strong></td>
</tr>
</tbody>
</table>

7.1 Data quality

The number of sites identified as a result of contact with consultees varies across each region, with some regions showing higher numbers of sites than others. Twelve sites were identified in the North West for example, with three sites identified in the West Midlands. This reflects the difficulties experienced by certain organisations in providing accurate information within the project timeframe and that some regions are likely to have more sites that others due to historic land uses.

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20 i.e. using compost to remediate hydrocarbon contaminated soils
Where this has been problematic, additional desk research has been undertaken, with contact through additional regional regeneration organisations to identify priority sites in each region (e.g. REMADE Lancashire). It is suggested that some of the consultees may not have considered certain sites as appropriate for the purposes of the research or may consider there is limited use of compost in site regeneration. Gaps in the research are particularly apparent with respect to the East of England, where difficulties were experienced in establishing contact with the appropriate representatives.

Gaps identified in the research limit the ability to assess in more detail the total opportunity, both in terms of site availability and potential use of compost across the sector. The size of the market for compost use in land regeneration should be considered in light of these data gaps.

It is recommended that further research is undertaken to identify sites across regions such as the East of England since it is one of the major growth zones identified in the National Brownfield Strategy. In this instance desk research has identified a limited number of sites identified for development by EEDA where compost could potentially be specified as part of regeneration works.

Data has also been provided by WRAP on the location of compost facilities that are BSi PAS 100:2005 certified, which has been used to plot compost facilities against regeneration sites using a simple GIS based system.

### 7.2 Compost use calculations

A compost calculator modelling tool has been developed to estimate potential volumes of compost that could be specified as part of the regeneration of those sites identified in the study. The model has been informed using data provided by the organisations consulted. It will allow for sensitivity analysis as timescales change and the addition of further sites identified where compost can be specified in regeneration projects.

Calculations for potential compost use have been based upon a number of assumptions developed for the purpose of the study. Assumptions were developed for a range of end uses relating to regeneration works, such as woodland and urban housing, and are illustrated below in Table 4.

<table>
<thead>
<tr>
<th>Use</th>
<th>End use Opportunities</th>
<th>Green area %</th>
<th>Compost rate t/ha</th>
<th>Compost tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodland</td>
<td>In situ soil improvement / mulch</td>
<td>100</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Golf course</td>
<td>Top dressing / landscaping</td>
<td>100</td>
<td>125</td>
<td>125</td>
</tr>
<tr>
<td>Parks/POS</td>
<td>In situ soil improvement / landscaping</td>
<td>100</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Mixed Development</td>
<td>Topsoil manufacture / landscaping / in situ soil improvement</td>
<td>20</td>
<td>250</td>
<td>50</td>
</tr>
<tr>
<td>Urban housing</td>
<td>Landscaping</td>
<td>25</td>
<td>250</td>
<td>62.5</td>
</tr>
<tr>
<td>Rural housing</td>
<td>Landscaping</td>
<td>40</td>
<td>250</td>
<td>100</td>
</tr>
<tr>
<td>Urban shop/sports complex</td>
<td>Landscaping</td>
<td>5</td>
<td>250</td>
<td>12.5</td>
</tr>
<tr>
<td>Large colliery regeneration</td>
<td>In situ soil improvement / landscaping / topsoil manufacture / bioremediation</td>
<td>100</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

The above assumptions were developed using existing knowledge of compost use in regeneration projects. Where knowledge relating to a particular end use did not exist, research has been undertaken to compare and test the assumptions to ensure compost estimates are as accurate as possible.
Calculations for potential compost use across sites are based upon the primary end use, multiplied against the known size (ha) of the site. The model has also assumed the specification of compost in each of the development sites put forward by consultees, therefore figures provided are estimates for potential compost use rather than determined specifications.

Other products such as sludges and other organic composts will therefore be potentially competing against source segregated composts in many of these projects, thus reduce the total calculated volumes provided in the model. For some of those sites identified, contractors may need to be persuaded of the benefits of compost use. Furthermore, existing soil quality has not been taken into account for sites.

Timescales for likely material specification requirements are uncertain for many of the projects proposed by consultees, with sites such as the Clyde Gateway development occurring over a twenty year period. Potential compost use has therefore been spread equally across each of the years of development, based on timescales provided, since opportunities for material specification is also likely to be staggered. Timescales for all site developments provided by consultees have been considered in the model.

In order to maximise its use the model should be treated as a live tool and therefore updated as regional data is acquired. Current estimates have been provided using data obtained from previous regeneration projects where compost has been specified. It is acknowledged however, that limited data is available on previous uses of compost in regeneration projects, with difficulties in obtaining data on certain end uses. It is recommended therefore that accurate data is obtained from future projects across the sector over the next two years.

### 7.3 Potential use of compost

Table 5 provides data on projected tonnes of compost in regeneration by region 2006-07. Total tonnes of compost for those sites put forward are estimated at 233,190 tonnes. All figures provided are based on potential use rather than actual agreements for specification, therefore competing products could potentially be specified in the place of source segregated compost. Figures are maximum tonnage potential if all those sites identified through the study used compost materials.

Similarly Table 6 provides data for compost use in regeneration for those sites identified for the period 2009-10, which estimates potential use of compost as 355,700 tonnes over the three years.

<table>
<thead>
<tr>
<th>Region</th>
<th>2006</th>
<th>2007</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Midlands</td>
<td>10,650</td>
<td>16,300</td>
<td>26,950</td>
</tr>
<tr>
<td>Yorkshire and Humber</td>
<td>0</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td>London</td>
<td>2,010</td>
<td>2,010</td>
<td>4,020</td>
</tr>
<tr>
<td>West Midlands</td>
<td>70</td>
<td>5,320</td>
<td>5,390</td>
</tr>
<tr>
<td>East of England</td>
<td>70</td>
<td>120</td>
<td>190</td>
</tr>
<tr>
<td>South East</td>
<td>380</td>
<td>8,290</td>
<td>8,670</td>
</tr>
<tr>
<td>South West</td>
<td>2,430</td>
<td>2,430</td>
<td>4,860</td>
</tr>
<tr>
<td>North East</td>
<td>3,010</td>
<td>12,950</td>
<td>15,950</td>
</tr>
<tr>
<td>North West</td>
<td>15,720</td>
<td>61,840</td>
<td>77,560</td>
</tr>
<tr>
<td>Wales</td>
<td>910</td>
<td>1,490</td>
<td>2,400</td>
</tr>
<tr>
<td>Scotland</td>
<td>34,280</td>
<td>34,280</td>
<td>68,560</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>0</td>
<td>6,630</td>
<td>6,630</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>69,530</strong></td>
<td><strong>163,660</strong></td>
<td><strong>233,190</strong></td>
</tr>
</tbody>
</table>

*Note: Figures have been estimated to the nearest 10 tonnes*
Table 6: Potential tonnes of compost use 2008-10 by region

<table>
<thead>
<tr>
<th>Region</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Midlands</td>
<td>15,800</td>
<td>2,150</td>
<td>2,150</td>
<td>20,100</td>
</tr>
<tr>
<td>Yorkshire and Humber</td>
<td>22,130</td>
<td>17,940</td>
<td>17,940</td>
<td>58,100</td>
</tr>
<tr>
<td>London</td>
<td>2,010</td>
<td>2,010</td>
<td>2,010</td>
<td>6,030</td>
</tr>
<tr>
<td>West Midlands</td>
<td>5,320</td>
<td>13,320</td>
<td>8,070</td>
<td>26,710</td>
</tr>
<tr>
<td>East of England</td>
<td>120</td>
<td>120</td>
<td>70</td>
<td>310</td>
</tr>
<tr>
<td>South East</td>
<td>11,020</td>
<td>5,390</td>
<td>5,020</td>
<td>21,420</td>
</tr>
<tr>
<td>South West</td>
<td>1,930</td>
<td>1,170</td>
<td>730</td>
<td>3,830</td>
</tr>
<tr>
<td>North East</td>
<td>16,110</td>
<td>16,320</td>
<td>16,320</td>
<td>48,750</td>
</tr>
<tr>
<td>North West</td>
<td>47,970</td>
<td>340</td>
<td>340</td>
<td>48,650</td>
</tr>
<tr>
<td>Wales</td>
<td>1,740</td>
<td>1,740</td>
<td>3,990</td>
<td>7,470</td>
</tr>
<tr>
<td>Scotland</td>
<td>34,280</td>
<td>30,120</td>
<td>30,120</td>
<td>94,520</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>6,630</td>
<td>6,630</td>
<td>6,630</td>
<td>19,890</td>
</tr>
<tr>
<td>Total</td>
<td>165,060</td>
<td>97,250</td>
<td>93,390</td>
<td>355,700</td>
</tr>
</tbody>
</table>
8 Opportunities for compost use

The following section outlines some of the opportunities for using compost in land regeneration in light of national and regional priorities for the restoration of brownfield land. Developments that will affect the future use of compost are also discussed, such as the Quality Protocol for Compost. Other emerging markets for compost such as the biofuels sector are also discussed and some of the progress towards development of such schemes across some of the UK regions is described.

8.1 Regional markets for compost

The continued redevelopment of brownfield land is likely to be a feature of future compost market development with sites likely to utilise material in topsoil manufacture, as a landscaping material, with further opportunities to use compost in bioremediation.

Data obtained from private sector sources concerning brownfield development sites has been limited, therefore the full extent of opportunities across this sector is somewhat incomplete. However the 2005 ODPM report on Previously Developed Land (PDL) suggests that private sector ownership represents 56% of all PDL in England, with public sector bodies (including central government) owning 16%, and local authorities owning 11%. This would suggest that opportunities across the private sector are significant.

The continued emphasis on brownfield land being development across the UK opens up a new market for composted materials. The applications in terms of topsoil manufacture, landscaping and bioremediation are all either well established practices or are being examined and developed through a number of WRAP-funded projects, such as the Thames Gateway land remediation and the Mersey Forest Healthy Soils projects.

Composting facilities are normally sited relatively close to the site of waste generation and those sites that are closest to areas of regeneration will benefit most from this expansion. It may also accelerate the establishment of new facilities treating additional wastes because of the increased demand for composted materials. Regions such the North West, West Midlands, East Midlands plus Scotland and Wales all show favourable correlations in terms of the distance between those regeneration sites identified and PAS 100 compost facilities, suggesting that it would be economically feasible to supply compost to these sites. Other regions such as the East of England and the South West show less favourable spatial correlations, which would perhaps limit supply of compost products due to inhibitive transportation costs.

The study represents a fraction of all brownfield sites but includes those priority regeneration sites highlighted by research consultees. Gaps in the data exist for certain regions such London and the East of England where organisations contacted were only able to provide limited data on brownfield development sites scheduled for regeneration. The 2005 ODPM Report on PDL land suggests however, that London has the least available PDL available with 2.5 % of total land area, although forthcoming developments such as the London Olympics should present significant opportunities for compost use in landscaping and topsoil manufacture. The same study identifies the East of England as the region with the highest proportion of PDL land suitable for housing, which would also suggest significant opportunities exist for the use of compost across similar sectors.

Regions including Yorkshire & Humber, the North East and London show potential shortages of PAS 100 facilities. This may therefore present opportunities for the development of additional PAS 100 capacity in such areas.

Consideration should also be given to other sources of organic materials where PAS 100 grade is not available (i.e. sludges). Demand for compost could also be catered for from other facilities, and it should be noted that Compost Association members yet to join the PAS 100 scheme, other EA registered sites and APEX members were not mapped as part of the study. Since further green waste composting capacity is an inevitable requirement to take account of increased local authority collection and national landfill diversion policy, application to brownfield land is likely to develop as a key end market for compost.

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21 Compost Specifications for the Landscape Industry (Landscape Institute, London 2003)
22 Results from the National Land Use Database of Previously Developed Land.
23 Ownership is unknown for the remaining 16%.
Waste Strategy reviews are being undertaken by many regions and often give consideration to end markets for recyclables. These should yield data relating to the availability of compost product across each region and include brownfield land regeneration as an end market for compost.

8.2 Quality protocol for compost

Defining when composted materials have been ‘fully recovered’ and therefore no longer be classified as a controlled waste is one issue that has caused a great deal of uncertainty for the composting industry for many years. Under the interpretation of the European Waste Framework Directive a material remains a waste product until the point of full recovery. Under current regulation a waste management exemption would be required for use of the material, with a waste carriers licence required for its transportation. Subjecting these additional costs, burdens and potentially liabilities to end users has limited the use of composts in a number of UK end markets.

Moves towards clarifying the position at which materials including compost cease being a waste and are reclassified as products is currently underway. WRAP and the EA have secured funding through the Business Resource Efficiency and Waste (BREW) Programme, to develop up to ten protocols for the recovery of waste materials, including compost. These protocols will be modelled on the Quality Protocol for Aggregates developed by WRAP in 2005. A protocol for compost is viewed as a priority and will tackle the issue of when a material ceases to be a waste and becomes classified as a product. In Scotland, the Environment Protection Agency has provided clarity in recognising PAS 100 as a suitable benchmark, with Northern Ireland also recently following suit.

A Parliamentary Question was tabled in December 2005 seeking clarification from Government on what steps are being taken to develop a quality protocol for certified compost material to enable it to be defined as a product rather than waste. In response Parliamentary Under-Secretary of State for the Environment, Ben Bradshaw responded that: “The Environment Agency (EA) considers that (a) source-segregated waste which, after composting, meets a recognised and suitable quality standard (e.g. BSI PAS 100) is likely to be fully recovered within the meaning of the (Waste Framework) Directive; and (b) mixed waste which is composted is likely to remain waste until it is used in a further recovery operation (e.g. land treatment resulting in agricultural benefit or ecological improvement subject to control by the Agency under a licence or registered licensing exemption).”

It is hoped that the protocols will demonstrate the stage at which materials including composts are considered to have no adverse environmental impact. Whilst a complex issue, the process is necessary in order to tackle the long standing regulatory constraints and help to increase user confidence in specifying material across the landscaping, topsoil and land restoration sector.

8.3 Benefits of compost use

The various benefits of compost use have been highlighted across end market sectors such as the landscaping and topsoil industries and are likely to be realised further as the brownfield land market continues to develop. Organisations including WRAP and members of the Remade Network continue to undertake end user trials aimed at communicating the various technical and commercial benefits of using compost.

Section 6 has outlined examples of how compost use has helped to restore previously degraded or poor areas of land across sites in the UK and highlighted the associated financial savings in doing so. Other key benefits of using PAS 100 compost include:

- **Increased user confidence** - PAS 100 provides a standard for compost producers. PAS 100 has helped to improve confidence in composted materials among end users, allowing producers to differentiate products that are safe, reliable and high performance. WRAP are currently working with the EA to develop Quality Protocols for compost which may lead to amendments to the current PAS 100 standard in order to ensure that the same levels of confidence can be assured for specifiers within the contaminated land and regeneration sectors.

- **Cost benefits** - Examples in the previous section, such as Chorley Royal Ordnance site demonstrated the potential cost benefits associated with specifying compost in projects. However, composts also often contain beneficial microorganisms that can help to suppress plant diseases resulting in increased survival rates of newly planted trees and shrubs.

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24 This differs from legislation covering sewage sludges and biosolids, which comes under The Sludge Regulations rather than Para 7A
25 Composting News – Compost Association, February 2006
26 www.remadenetwork.org.uk/
**Increased nutrient availability** - Compost typically contains quantities of nitrogen and phosphate in a slow releasing form, and provide potash in a readily available form. Other primary nutrients such as calcium, magnesium and sulphur, are also partly available, as are a full range of micronutrients. Many conventional fertilisers do not contain trace elements, with products that do include them being relatively expensive. Where composts are incorporated into low grade soils nutrient availability will encourage better plant growth and survival.

**Increased organic matter content** - compost addition may be of particular benefit across brownfield or urban regeneration sites where soil quality has suffered as a result of direct development. Organic matter may often be less than 2%. Composts can enrich soils which have been left in poor condition.

**Structural improvement** - the availability of organic matter present in compost improves the aggregate strength of soils and therefore allows soil to resist compaction, thus enabling roots to penetrate more easily to find water and nutrients, thus improving overall soil health, leading to increased vigour and regeneration of plant species.

**Water holding capacity** - as a consequence of improved soil structure, infiltration of rainfall and irrigation is improved, as is soil water holding capacity. Light soils will retain moisture over a longer period, therefore aiding plant survival rates.

**Blending opportunities** - compost can be added at various ratios to improve the quality of poor soils, subsoils, or other inert materials. Manufactured topsoil can substitute for natural topsoil which is often expensive and scarce across some UK regions. By manufacturing soils on site transport costs may also be significantly reduced.

**Carbon sequestration** - Current research suggests how carbon sequestration in soils is most likely to occur in soils whose carbon content has been depleted to relatively low levels due to previous development/management. Research has highlighted the potential role compost will play in storing carbon following application to land.

**Versatility of product** - compost is used in a variety of end use applications in landscaping, as a mulch, in topsoil blends and as a remediation material.

Further details on the benefits of compost are available via the WRAP Compost Information Fact Sheets via the website [28].

### 8.4 Cluster sites and compost use

Recent efforts have been made to encourage adjustments relating to the economics of supply chain issues for certain sites, which includes the supply of compost in projects. The CLUSTER project [29], managed by CL:AIRE, could materially improve the reliability of managing the logistics for certain sites. A CLUSTER is considered to include a group of sites that are categorised as land affected by contamination, that include shared decontamination capacity located at one site (the hub) to produce recovered materials that are reused by itself and by the other sites in the group. This definition can be adapted to suit the needs of a group of brownfield sites that are not necessarily (but could be) contaminated, and that share processing plant (composting/soil manufacturing plant). The CLUSTER approach is being developed specifically for roll-out of the compost-to-brownfield scenario at the time of this report.

### 8.5 Energy crops and compost use

The growing of energy crops continues to increase across many of the UK regions, with significant support from RDAs/DAs to help facilitate schemes. In some instances Agencies are providing capital support for biomass heat and power projects rather than direct support for energy cropping. Many schemes are developing across areas of previously degraded areas such as the Markham Willows project, where hectares of willow have been grown across former colliery sites. There are currently two crop species supported under Defra’s Energy Crop Scheme – both short rotation coppice (SRC) willow or poplar and elephant grass (Miscanthus).

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27 Any product blending should take account of national guidance on assessing the risks to health from brownfield soils and include interpretation of soil guidance values for contaminated land.

28 [www.wrap.org.uk/organics](http://www.wrap.org.uk/organics)

29 [www.claire.co.uk/sites.php](http://www.claire.co.uk/sites.php)
There is interest in other species as energy crops, or energy forestry species, notably eucalyptus and many other species can be grown on set aside land and processed for heat and/or power. Similarly there is a continuum in the farming landscape from annual cropping through energy crops to farm forestry, woodland and finally forest product serving industry. All, to a greater or lesser degree, could (or already do) act as recipients for composted materials.

Opportunities for incorporating compost into energy cropped fields occurs at a number of times in the crop’s lifetime:

- At planting – low levels of compost could be incorporated immediately prior or even during the planting process
- Larger quantities could be applied post-planting as a weed suppressant and moisture retaining mulch
- Following cut-back or harvest – as a weed suppressant and moisture retaining mulch. This would follow an annual pattern for Miscanthus and a three year pattern for SRC
- During crop removal.

According to Defra and the Biomass Task Force, 668 ha of Miscanthus planted in England & Wales by September 2005 and a further 660 ha of SRC under the Energy Crop Scheme. Significantly higher numbers of grants have been awarded since then, and the total of crops in the ground and cropping pending (as at February 2006) is presented in Table 7 below.

### Table 7: Area of Miscanthus and SRC planted or planting pending, as of February 2006
(Source: Defra RDS)

<table>
<thead>
<tr>
<th>Region</th>
<th>Miscanthus (Ha)</th>
<th>SRC (Ha)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Midlands</td>
<td>137.52</td>
<td>580.28</td>
<td>717.8</td>
</tr>
<tr>
<td>West Midlands</td>
<td>623.31</td>
<td>14.74</td>
<td>638.05</td>
</tr>
<tr>
<td>Yorkshire &amp; Humber</td>
<td>654.61</td>
<td>334.33</td>
<td>988.94</td>
</tr>
<tr>
<td>North West</td>
<td>17.69</td>
<td>40.23</td>
<td>57.92</td>
</tr>
<tr>
<td>South West</td>
<td>167.81</td>
<td>48.85</td>
<td>216.66</td>
</tr>
<tr>
<td>South East</td>
<td>63.32</td>
<td>134.87</td>
<td>198.19</td>
</tr>
<tr>
<td>North East</td>
<td>0</td>
<td>280.57</td>
<td>280.57</td>
</tr>
<tr>
<td>East</td>
<td>418.01</td>
<td>110.72</td>
<td>528.73</td>
</tr>
<tr>
<td>Total</td>
<td>2082.27</td>
<td>1544.59</td>
<td>3626.86</td>
</tr>
</tbody>
</table>

The above data refers only to SRC and Miscanthus planted under the energy crops scheme. Approximately 1,500 ha planted under the earlier Farm Woodland Scheme can also be added to the SRC data. There is considerably more Miscanthus planted out with the scheme for propagation or alternative fibre markets. These plantings are more dispersed and the total figure is very difficult to quantify reliably. Industry claims are that 1,500 – 4,000 hectares are planted for non-energy uses. Taking the upper figures suggests a total area of Miscanthus and SRC of a little more than 9,000 ha, approximately 2% of the set-aside area in England & Wales (477,000 ha; Defra Agricultural Census, 200530).

Defra anticipate that as much as 25,000 hectares will be planted in the next four years31. Much of this land will include arable, but a significant proportion is also likely to include areas of brownfield land previously neglected. This represents a significant opportunity for compost producers to secure long term markets for oversized product across those regions where energy crops are harvested.

31  Biomass Task Force, Annex D
9 Barriers to compost use

Opportunities for continued use of compost across brownfield land are diverse and represent real opportunities for growth across the market sector. The following section discusses some of the barriers which will require attention to assist this continued market development.

Responses to both the questionnaires together with interviews with organisations revealed a number of potential barriers regarding the use of compost in regeneration schemes. Issues were wide ranging and are endemic to other compost end uses, such as cost, availability and competition of other products. However, some of the concerns raised following consultation relate specifically to the regeneration and brownfield land sector itself, such as the use of Soil Guideline Values (SGVs) and the geotechnical properties of compost and soil forming materials. Each of the barriers are discussed in turn.

9.1 Awareness of Compost as a Resource

Many of the individuals consulted felt that project managers or consultants leading projects were unaware of the potential applications of compost as a resource. Despite a number of regeneration projects currently being led across regions such as the South West and Yorkshire, regeneration managers consulted felt very few were currently specifying compost. This is often compounded by the fact that consultants are often reluctant to specify alternative materials in projects due to liability issues.

Whilst many developers are open to using recycled products, some of those consulted felt that information on what products and materials are available is not always accessible to companies. The majority of RDAs have a formal or informal sustainability driver for projects which seeks to encourage sustainable or green procurement. However, there is a perception that use of such materials by consultants and contractors is often hampered by limited knowledge of what products are available, where to source products or technical knowledge of how to specify such materials.

9.2 Security of Supply

The ability to secure sufficient volumes of consistent product for restoration works is a key requirement for large scale regeneration projects. Project managers need to ensure sufficient quantities of product are available in bulk at the right time to meet demand. Furthermore, landscapers and contract managers will often want to source such materials at short notice, with other regeneration project timescales being unclear and complex. Inability or failure of local composting infrastructure to meet such a demand is likely to limit or reduce confidence within the landscape and regeneration sector in sourcing compost or result in the use of conventional materials.

Typical required volumes for previous coalfield regeneration projects have been in the region of 50,000 tonnes for site restoration works. Some of those RDAs consulted raising doubts as to whether the local composting infrastructure could meet such requirements if supply was required over a short period of time. Projects of such magnitude are likely to outstrip current compost supply across some UK regions, or require careful phasing and supply chain planning.

9.3 Competing Products

Project managers have a range of alternative organic materials to specify in contracts, including horse manure, spent mushroom compost and sewage sludges. Whilst the supply and the quality of these materials are not always ideal, such materials are often available at low cost as a waste material. Sewage sludge has historically been sourced for previous restoration projects across former coalfields in South Yorkshire as a landscaping and restoration material.

Other materials such as paper crumb are also used as part of restoration works. With liquid, cake, pellet and thermally dried products improving in quality over recent years, a number of products are available that are able to meet the desired specifications.

32 This may be due in part to few sites in the region producing PAS 100 grade compost.
Compost will therefore be competing against such materials in terms of quality, cost and availability. Whilst certain regions are experiencing shortages of topsoil supply, compost will continue to compete where soils are still plentiful in other regions. Whilst there are no objections to using compost in topsoil manufacture, for instance, virgin soils remain available, with limited regulatory incentives encouraging the sector to use alternative recycled products (i.e. no minimum target for recyclables in the Code for Sustainable Homes). Increased availability of compost is generally acknowledged as presenting opportunities for the brownfield remediation sector in terms of the ability to improve supply requirements.

9.4 Cost/ Price

Compost will also be competing against a range of materials on a cost basis. Many agencies adopt a ‘material neutral’ approach to projects, where possible, whereby soils and amelioration products are often imported or accepted on to site from waste management or utility companies keen to be rid of such materials at neutral cost. Individuals responsible for material specification at the Welsh Development Agency recognise PAS 100 as a standard for compost, yet there is the perception that compost will still be competing unfavourably economically. Mushroom composts and sludges are often accepted in this manner, with contractors often receiving one or more materials on to a restoration site for blending to the required specification. Many sites are able to source biosolids free of charge for use on site.

Cost of transportation is a long standing barrier to the development of markets for compost which is also prevalent in the regeneration sector. Typical costs for transportation of finished green waste compost product equates to between £6 – 9 per tonne\(^3\). Costs for product additional to transportation will be dependent on the grade, with 0-40mm typically fetching around £1/tonne. Product screened to 10 mm is more marketable to end users at around £5/tonne. However compost facilities will often subsidise or give oversized product away in return for transportation costs if suitable outlets for high grade product already exist.

9.5 Concerns over Quality and Effectiveness

Concerns were expressed over the quality of compost and flagged as a reason for its preclusion in previous regeneration and reclamation projects. Despite the development of standards for compost products a poor perception of compost still exists amongst some end users. Concerns still exist over whether compost products are fit for purpose, with consultants often citing liability concerns and effect on indemnity insurance. Perceptions of compost amongst some individuals consulted are that compost could have technical limitations, since past product quality and consistency has historically been varied.

Remediation schemes led by RDAs have included requirements for bioremediation of contaminated soils, however knowledge relating to the uses of compost as a bioremediation technology is limited and is an area for further research. US literature has documented the use of compost as a bioremediation medium but scientifically robust trials are relatively limited in the UK. Therefore the contaminated land industry is uncertain about the effectiveness of utilising composts.

With regards restoration projects, The Forestry Commission (FC) provides support towards the development of many of the regional schemes across the UK. In Yorkshire and Humber FC are consultees to coalfield site regeneration schemes and support the specification and procurement of materials for site development.

The FC acknowledges that there is good evidence that compost can be beneficial and that there is greater interest from waste producers to apply material in forests, yet state in a recent publication that compost has received only limited testing for its value in improving tree performance on reclaimed land\(^4\).

\(^{33}\) Costs based on Remade Essex Shell Haven bioremediation trials December 2005

\(^{34}\) Moffat (2006) Use of sewage sludges and composts in forestry, Forestry Commission Information Note January 2006
9.6 Compost and Soil Guidance Values (SGVs)

Concerns over quality have been exacerbated by the tightening up of legislation concerning contaminated soils. Soil Guidance Values (SGVs) replaced the previous ICRCL\textsuperscript{35} guidance values and were introduced to help determine whether soil concentrations containing contaminants posed a significant risk to human health. Concentrations for a limited number of heavy metal determinands have been defined in PAS100. The derivation/ source of these threshold concentrations in PAS100 is not given. However, the PAS100 thresholds are generally comparable to, or below SGVs / other relevant threshold values (eg Dutch Intervention Values). Where the PAS100 are lower than the SGVs, they tend to be comparable to the (now withdrawn) ICRCL values. For information purposes, the Table below sets out the threshold concentrations for each of these systems.

Table 8: Illustrative listing of soil contaminant determinands

<table>
<thead>
<tr>
<th>Determinand</th>
<th>ICRCL [NOW WITHDRAWN] Mg/ kg</th>
<th>SGV [residential + plant uptake] mg/ kg</th>
<th>Maximum allowable in PAS100 mg/ kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>10</td>
<td>20</td>
<td>Not specified</td>
</tr>
<tr>
<td>Cadmium</td>
<td>3</td>
<td>1-8 (pH dependant)</td>
<td>1.5</td>
</tr>
<tr>
<td>Chromium</td>
<td>25</td>
<td>130</td>
<td>100</td>
</tr>
<tr>
<td>Lead</td>
<td>500</td>
<td>450</td>
<td>200</td>
</tr>
<tr>
<td>Mercury</td>
<td>1</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Copper</td>
<td>130</td>
<td>190*</td>
<td>200</td>
</tr>
<tr>
<td>Nickel</td>
<td>70</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Zinc</td>
<td>300</td>
<td>720*</td>
<td>400</td>
</tr>
</tbody>
</table>

Note: * No SGVs have been published for these phytotoxic determinands and the thresholds cited are the Dutch Intervention Values (based on ecological risk).

SGVs combine both authoritative science with policy judgement and represent the concentration of a substance in the soil, at or below which human exposure can be considered to represent a ‘tolerable’ or ‘minimal’ risk. Concentrations significantly above this level could pose an unacceptable risk to the health of site users and that further investigation and/or remediation is required. There is considerable uncertainty around this issue at present. Defra and the EA are considering further guidance with respect to just how far above a SGV a concentration would have to be for risks to become potentially significant\textsuperscript{36}. Three typical indicator land uses including residential (with and without vegetable growing), allotments and commercial/industrial provide the benchmarks.

One of the common problems in soils of both engineered ground and natural strata has been the presence of carcinogenic polycyclic aromatic hydrocarbons (PAHs), specifically benzo(a)pyrene[BaP], a by-product of coal fires and bonfires. Although a SGV specifically for benzo(a)pyrene has not been released by the Environment Agency, a TOX report\textsuperscript{37} was published in May 2002 allowing the derivation of screening values for benzo(a)pyrene. These screening values are often close to or at background levels in many soils.

Where soils have concentrations of B(a)P significantly greater than the calculated guidance value, materials should not be reused in topsoil manufacture, as compost is likely to only dilute contaminants rather than degrading them. Under current guidance, local authorities could classify a recently completed development (which otherwise met previously agreed criteria) as “Contaminated Land” under Part IIA of the EPA 1990. This could identify either the developer or the supplier of the material as the “Appropriate Person” designated with remediation of the site.

\textsuperscript{35} Interdepartmental Committee for the Reclamation of Contaminated Land
\textsuperscript{36} Contaminated Land Advisory Note Defra. 02/05
\textsuperscript{37} Collation of toxicological data and intake values for humans in soil
There may also be difficulties in the interpretation of the levels of petroleum hydrocarbons in soils, as a number of methods of analysis can include natural organics such as the breakdown products of tannins, humic and fulvic acids, distorting the results. Adding compost to the soil increases these natural organics which contribute to the total petroleum hydrocarbon (TPH) concentration. This may inadvertently result in the soil exceeding screening values due to the addition of these natural organics. Chemical analysis can (on specific request to the laboratory) be carried out on a “cleaned up” sample of soil. Such clean up results in the removal of the natural organics (humic/fulvic acids etc) and should be carefully considered when analysing compost containing material.

Currently, potentially toxic elements (PTEs) (or contaminants) are analysed as part of the PAS 100 accreditation system, which includes analysis for metals (Cd, Cr, Cu, Pb, Hg, Ni and Zn) as standard. However there is no requirement in the PAS 100 Specification for the analysis of Polycyclic Aromatic Hydrocarbons (PAHs) or petroleum hydrocarbons and this may be needed for certain brownfield site applications. In addition, concentrations set in PAS 100 for copper and zinc do not have corresponding SGVs and reference is normally made to the relevant Dutch Standard. WRAP are working closely with the EA to develop a Quality Protocol for compost, which may result in changes to PAS 100.

Further concerns are raised by the contaminated land industry regarding the sources of feedstock for compost. With green waste compost generally manufactured using feedstock secured from variable sources (i.e. civic amenity sites and kerbsides) with limited controls, there is concern that levels of contaminants may be present in the compost above the derived screening values. Efforts to develop a Quality Protocol for compost are likely to address these concerns.

### 9.7 Geotechnical Properties

The use of compost presents potential structural and engineering constraints in its application. The addition of compost into soils increases the organic matter and water holding capacity of a substrate, affecting the texture of the material and causing the soil structure to become less compact. This inevitably makes the material unsuitable for geotechnical purposes in the sense that the soil cannot be backfilled into deep excavations or trenches.

Following consultation with industry on some the barriers for using compost in remediation, organisations were able to provide feedback as to the experiences of using material in this capacity. Whilst recognising the potential benefits, one company acknowledged how compost use is potentially limiting since you have to be careful to ensure geotechnical properties are not destroyed by adding too much organic matter.

For many developments the addition of compost in this capacity would therefore only be suitable for topsoils and subsoils in areas not subject to build development. This can affect the remedial target/screening value of the soil, as if it is to be used as backfill in excavations i.e. > 1m deep and covered in hard standing, the soil will be part of a less sensitive end use than if it is to be used in areas of landscaping or back gardens. The remedial target/screening value will therefore be lower in these shallow soils. Around 90% of those sites which another national brownfield land owner brought forward for remediation are for a hard standing final end use, therefore the use of compost as a remediation material is likely to be unsuitable for most of those developments brought forward.

### 9.8 Definition of Waste

As to whether a compost product is defined under UK waste management legislation as a waste or a fully recovered product is an important issue with regeneration managers consulted. Under the interpretation of European Waste Framework Directive a material remains a waste product until the point of full recovery. Until such a time a waste management exemption would be required for use of the material, with a waste carriers licence required for its transportation. Subjecting these additional costs, burdens and potentially liabilities to end users have limited the use of composts in a number of UK end markets.

The effect of compost addition on final disposal of waste materials may also have a bearing on whether compost is considered as a preferred remediation technique, since the addition of compost can adversely affect the potential disposal methods of the soil. Where composts have been used in a bioremediation trial as a pre-treatment method, consideration must be made to the addition of the extra organic matter from the compost.

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This differs from legislation covering sewage sludges and biosolids, which comes under The Sludge Regulations and therefore not Para 7A
9.9 Language and terminology

Waste management companies do not usually overlap with the contaminated land sector, resulting in confusion over terminology and definitions. Work should be undertaken to encourage the two sectors to engage and develop joint approaches.

Landowners can be suspicious of bringing in imported materials which they have no knowledge of use or specification. Understandably consultants and land owners are concerned about risk and liability in many respects in ‘experimenting’ with products they consider ‘unproven’.

Additionally composters have not had much experience of pitching into this market and are sometimes not sure whether to label their product as ‘top soil replacement’, ‘compost’, ‘non-engineering fill’ or ‘bioremediation medium’.
Conclusions and recommendations

The study has identified a number of significant regeneration projects across each region that have the potential to specify compost in different end use capacities. Regeneration projects included represent those priority development sites considered by the organisations consulted, either as part of regional regeneration prospectus or BLAP development. The study is therefore not exhaustive, but indicates the potential size of the market that exists for using compost in brownfield land regeneration. More detailed market assessment is therefore recommended to determine the full potential market size for compost use across the sector. Where gaps in the current study have been identified, further analysis is recommended to determine the potential opportunities that exist for compost use.

Market opportunities exist for using compost in a broad capacity across the regeneration sector, with previous applications demonstrating effective use in topsoil manufacture, landscaping or mulch, and possibly in some capacity, the remediation of contaminated soils. With drives towards the redevelopment of brownfield land across each region such opportunities for using compost in such applications are likely to continue. Demand for topsoil, increased cost of transportation and continued reduction in traditional dig and dump remediation solutions all present significant opportunities for the use of compost product in UK regeneration strategies.

Previous studies suggest how significant opportunities exist for the application of compost in brownfield regeneration schemes nationally, with the market size estimated at general restoration market of several million tonnes per annum. Large flag ship regeneration projects are prevalent across each region, presenting demands which can potentially be met using compost in landscaping non-engineering fill, and in-situ soil improvement applications for instance.

Projects such as the London Olympics and the Clyde Waterfront and Gateway initiatives in Glasgow present real opportunities to specify composts and other recycled materials as part of regeneration proposals. The Coalfield Programme has demonstrated the benefits of sourcing composts as part of restoration works, with many sites earmarked for reclamation through EP in partnership with (amongst others) RDAs, the Forestry Commission and the LRT over the next few years.

If such opportunities are to be fully realised however, key actions are required in order to tackle some of the persisting barriers that continue to limit compost specification as part of projects. Where awareness of compost as a resource is a factor limiting its uptake, further demonstration trials are required that promote it uses and availability for projects. The contaminated land sector, brownfield project managers, remediation contractors and technology vendors have a limited appreciation of the use of compost, with few experiences across the sector in using material in such capacities. Demonstration trials and targeted dissemination across the sector is suggested in order to encourage greater specification of compost as standard in project design.

Recommendation 1

WRAP should continue to develop and promote best practice examples of compost use in regeneration across the regeneration and contaminated land remediation industry to encourage greater awareness across the sector. Further opportunities to support existing and future demonstration trials should be explored.

Key audiences should include:

- Contaminated land consultants
- RDAs (including Development Managers, Sustainability Officers, Contaminated Land Manager/Engineers
- Local Authorities (Contaminated Land Officers, Development Managers, Project Managers)
- English Partnerships
- Urban Regeneration Companies
- Project Managers/Broad based or multi-disciplined consultants
- Regulators (EA, Welsh EA, SEPA, EHS Northern Ireland)
- Industry groups (e.g. SAGTA, AGS)
- Compost producers

Remediation strategy permitting
The lead-time for securing an order for a land restoration application of recovered material is often very long because of the large number of people involved in projects. This can be complicated by long reclamation processes and site remediation works. Where composts are not written into specification, the contractor is free to specify alternative materials, which is difficult for compost producers to prepare or service these markets.

**Recommendation 2**

**WRAP should work to facilitate greater specification of compost at early stages of development processes, working with project managers to source material at match supply with demand.**

Whilst sustainability drivers have significant bearing on project procurement in organisations, specifying materials fit for purpose is the overriding factor in project design. Site remediation and restoration will usually be determined by individual project managers, however ensuring the availability of case study evidence promoting the use and availability of composts were suggested as methods to encourage further specification of product by those organisations consulted. EP are leading the development in partnership with the RDAs for the remaining coalfield sites under the UK Coalfield Programme, many of which are scheduled for development over the next few years.

Development timescales are complex, however and often subject to change. Sites will also be added to the Programme over time. WRAP should continue to work closely with EP and other partners to determine which sites are coming forward and determine which sites are likely to require ameliorants. Consultation should include partners such as the LRT and the FC, who are responsible for restoration and specifications across many of the sites identified as part of the study and will therefore be responsible for procuring materials. Both organisations have explored uses of compost and other competing products in site restoration.

**Recommendation 3**

**WRAP should seek to engage with LRT, and other organisations involved in restoration works such as the Forestry Commission and the Groundwork Trusts to encourage greater specification of composts in projects and discuss further methods encouraging greater adoption of compost in projects further.**

Regeneration activity across each region varies considerably with dissimilar drivers and priorities undertaken by each of the Agencies. Localised partnerships are often involved in key development considerations and decision making processes, with Urban Regeneration Companies (URCs) increasingly play a central role in driving projects and prioritising development in each region.

Where local authority and RDA landowners have a strong sustainability remit, this normally drives a particular project to consider various methods of embracing sustainable development, however in the absence of sustainable procurement policy, focus could be towards energy conservation or waste minimisation for example. In the absence of sustainability or sustainable procurement drivers, material specification will normally be decided by contractors alone. It is recommended that dissemination of best practice should extend to URCs, with WRAP exploring opportunities to engage with URCs through RDAs, local authorities and other organisations such as EP to promote best practice uses of recycled materials in design and procurement.

**Recommendation 4**

**WRAP should engage with URCs such as ILEX in Northern Ireland and SENTRI in the North East as target markets and explore opportunities to engage with such organisations.**

Limited scientific trial data currently exists that supports the use of compost in bioremediation. Small scale trials have been undertaken to date, however suspicions still exist concerning the use of compost over traditional bioremediation mediums such as chicken litter or mushroom composts. Larger scale industry supported trials are likely to encourage dialogue, wider acceptance and market penetration in this sector.

**Recommendation 5**

**It is recommended that WRAP support further technical trials in conjunction with widespread dissemination and consultation amongst the contaminated land community to provide robust scientific data on the subject in the UK and improve knowledge across the sector.**

The development of standards for compost has improved confidence across certain end user groups such as the landscaping industries, by setting minimum requirements for certain parameters. In order to encourage specification of composts by the contaminated land industry allowance must be made for Soil Guideline Values which set out exposure limits to threshold and non-threshold substances. Currently PTEs are analysed as part of the PAS 100 accreditation system, however there is no requirement for the analysis of Polycyclic Aromatic Hydrocarbons (PAHs) or petroleum hydrocarbons. Since composts may potentially add heavy metals and other contaminants to a soil, statutory contamination issues must be resolved with industry and regulators.

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40 This includes analysis for metals (Cd, Cr, Cu, Pb, Hg, Ni and Zn) as standard.
Recommendation 6
WRAP are already undertaking actions to tackle the issues over acceptance of compost by the contaminated land industry. It is recommended that these efforts continue to support the development of a specification for the use of compost on brownfield sites.

WRAP should continue to support the SGV Taskforce with regards tackling the issues associated with SGVs that are contributing to the uncertainties regarding the use of recycled brownfield materials. Further support could include the provision of advice on this issue amongst the waste industry, since current knowledge amongst compost producers and end users is limited.

Steps currently being taken to develop a quality protocol for certified compost material should resolve the long standing issues over when compost should be defined as a product rather than waste, with the ten quality protocols for the recovery of waste materials scheduled for development by WRAP likely to alleviate concerns with the industry and amongst end users and regulators over specification of recycled materials in general.

Many of the sites identified by organisations comprise clusters of small (half hectare) brownfield areas which individually limit treatment methods and cause potential transportation difficulties due to unfavourable economies of scale. A number of those Agencies consulted showed interest in the development of centralised ‘soil hospital’ facilities, or the CLUSTER approach\(^{41}\), whereby contaminated soils can be treated (possibly using composts) with opportunities to manufacture bespoke soil blends for projects. The CLUSTER concept would involve feeding a temporary soil treatment centre with contaminated soils from many smaller sites. Such treatment methods have been suggested as a potential method of limiting disposal and supplying materials for the London Olympics, however current regulatory issues prohibit widespread use by remediation contractors and developers.

Under current regulation a Waste Management Licence is required together with planning permission. Waste Carriers Licenses are also required, making the process prohibitively time consuming and expensive. Actions currently being undertaken by CL:AIRE are likely to tackle this issue under the CLUSTER project. It is recommended WRAP should be engaged in this process.

The compost calculator has been developed as a modelling tool, which if used in conjunction with accurate data, can be used to forecast potential volumes of compost utilisation over a set period. Limited reliable data exists across many regions however, on previous uses of compost in a number of applications. Project timescales and site end uses also change according to certain factors.

Recommendation 7
WRAP are likely to support a number of best practice demonstration projects over the next phase of its business plan using compost in various applications. Since data on potential material use nationally is currently limited WRAP should seek to maximise data collation as a requirement for projects in order to monitor more closely potential volumes of material use in the regeneration sector.

Research has included mapping of PAS 100 facilities. It is recommended to get a full appreciation of ability to ensure supply can meet demand, full mapping of compost facilities including those under the APEX scheme, fully licensed sites and Compost Association members should be included.

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\(^{41}\) A project run by CL:AIRE funded by EP and Grantscape.
Description of terms

BIOREMEDIATION:
The process by which living organisms act to degrade or transform hazardous organic contaminants.

BROWNFIELD:
No formal definition of brownfield land exists although it is usually accepted that it means a site that has been previously used, particularly for transport, commercial or industrial purposes or even domestic housing. It is therefore virtually anything that is not greenfield.

COMPOST:
Solid particulate material that is the result of composting, that has been sanitized and stabilized and that confers beneficial effects when added to soil and/or used in conjunction with plants.

COMPOSTING:
Process of controlled biological decomposition of biodegradable materials under managed conditions that are predominantly aerobic and that allow the development of thermophilic temperatures as a result of biologically produced heat, in order to achieve compost that is sanitary and stable.

CONTAMINATED LAND:
Defined in Section 78 A (2) of the Environmental Protection Act 1990 as “any land which appears to the local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that: a) significant harm is being caused or there is a significant possibility of such harm being caused; or b) pollution of controlled waters is being, or is likely to be caused.”

GREENFIELD DEVELOPMENT:
Development of land where there has been no previous development.

HEAVY METALS:
Metallic elements with high atomic weights, e.g., mercury, chromium, cadmium, arsenic, and lead. They can cause damage to living organisms at very low concentrations and tend to accumulate in the food chain.

HYDROCARBON:
An organic chemical compound consisting only of carbon and hydrogen atoms in the gaseous, liquid or solid phase.

IN-SITU:
Refers to remediation work carried out without moving soil or displacing existing structures or buildings.

PREVIOUS DEVELOPMENT LAND:
Land which is or was occupied by a permanent structure (excluding agriculture or forestry buildings) and associated fixed surface infrastructure. PDL may occur in both built up and rural settings.

PAH:
Polynuclear aromatic hydrocarbon. Multi-ring compounds found in fuels, oils, and creosote. These are also common combustion products.
Uses of compost in regeneration and remediation of brownfield sites in the UK

PAS 100:2005 – Specification for Composted materials

Public Available Specification for Compost, developed by the Compost Association and British Standards Institutions with sponsorship from WRAP. The PAS 100 sets minimum standard parameters for composted products for use in, for example, horticulture and landscaping.

POS:

Public Open Space.

RECLAMATION:

Operations designed to return an area to an acceptable environmental state, whether for the resumption of the former land use or for a new use. This may include restoration, aftercare, soil handling, filling and contouring operations.

REGENERATION:

The process of upgrading an area or renewing old sites that have become disused or rundown through social, economic and infrastructure investment and improvement.

REMEDICATION:

Cleanup or other methods used to remove or contain a toxic spill, historical contaminants or hazardous materials. Refers to any procedures or strategies used to address a hazardous waste site. For example, a Remedial Investigation determines what areas of a site need to be addressed (cleaned up or remediated), a proposed remedial action plan describes remedial actions (cleanup methods or corrective actions) that have been recommended for a specific site; remediation of a site could include removing contaminated soil.

A remediation action falling within the definition of Section 78 A (7) the Environmental Protection Act 1990 is “doing any works, the carrying out of any operations or the taking of any steps in relation to any land or waters for the purpose of a) preventing or minimising, or remediying or mitigating the effects of any significant harm, or any pollution of controlled waters, by reason of which the contaminated land is such land, or b) of restoring the land or waters to their former state.”

REMETATION SCHEME:

The complete set or sequence of remediation actions (preferable to one or more significant pollutant linkages) to be carried out with respect to the relevant land or waters.

SOIL GUIDANCE VALUES (SGVs):

Used in connection with the formal requirements of Part II A of the Environmental Protection Act 1990 SGVs combine both authoritative science and policy judgement. Three typical indicator land uses including residential (with and without vegetable growing), allotments and commercial/industrial provide the benchmarks.

SOIL IMPROVER:

Material added to a soil in situ primarily to maintain or improve its physical properties, and which may improve its chemical and/or biological properties or activity.

SITE INVESTIGATION:

This term is used to describe the process of carrying out investigations on land to determine whether there is contamination present. The investigation is carried out in several stages. These stages are typically a desk study to assess historical land use, intrusive investigation using trial pits and boreholes, sampling of materials, assessment of risk, and preparation of remediation proposal.

TOPSOIL:

Material with a mineral base which will perform the functions of natural topsoil. Three standard grades have been categorised in accordance with BS: 3882.
TPH:
Total petroleum hydrocarbons.

URBAN REGENERATION:
Comprehensive vision and action which leads to the resolution of urban problems and which seeks to bring about lasting improvement in the economic, physical, social and environmental conditions of an area that has been subject to change.
Disclaimer

This report was commissioned by the Waste and Resources Action Programme on terms specifically limiting the liability of Enviros Consulting Limited and CL:AIRE. Conclusions are the result of the exercise of our best professional judgment, some of which are based upon the assumptions developed as part of the research and information provided by research consultees.

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