Staffordshire County Council and Stoke-on-Trent City Council
Joint Municipal Waste Management Strategy

Waste Management Options Appraisal

November 2007
SLR Ref: 402-1395-00001

solutions for today's environment

EXECUTIVE SUMMARY

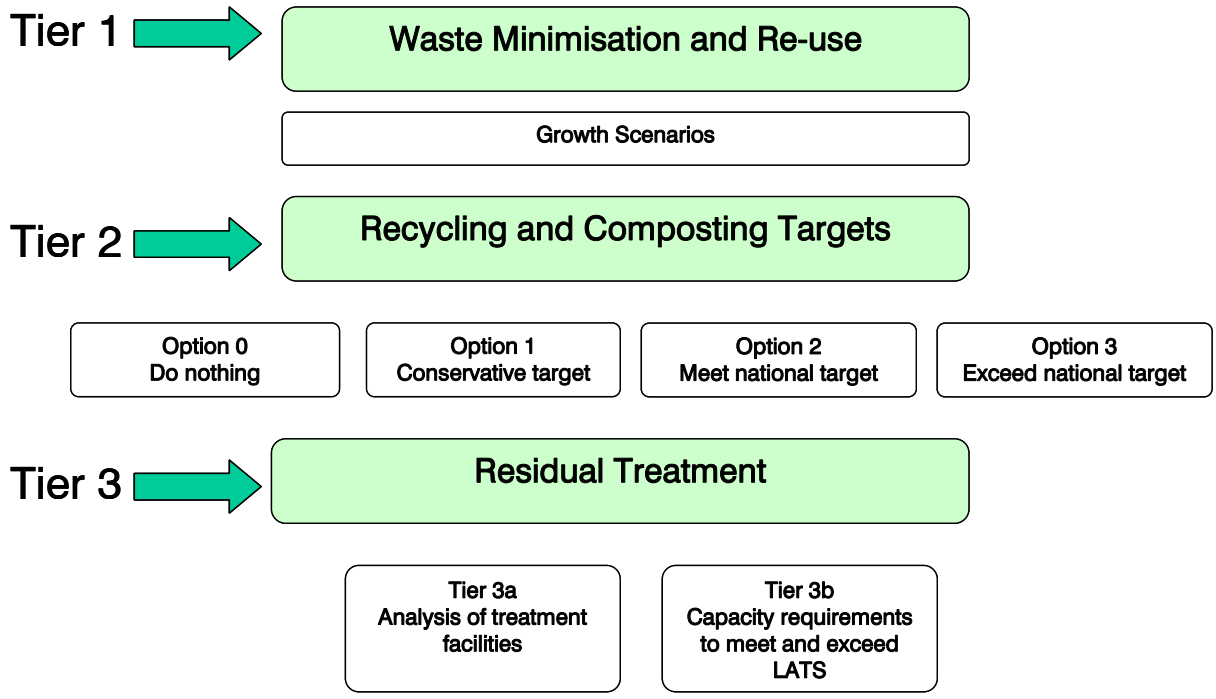
SLR Consulting Limited (SLR) has been commissioned by the Staffordshire County and Stoke-on-Trent City Council (Staffordshire and Stoke-on-Trent herein) to provide an options appraisal for the long term management of the County and City's municipal solid waste (MSW). This report summarises the assessment of long term (for the year 2020) integrated waste options for MSW management in Staffordshire and Stoke-on-Trent.

The aim of the option selection process is to enable an assessment of potential waste management solutions for the County and City when compared to a range of sustainability indicators. The assessment process is designed to be auditable, consistent and robust, and, assist in the identification of a preferred waste management option(s) for all municipal wastes arising in Staffordshire and Stoke-on-Trent for the long term.

An assessment methodology following Government guidance has been applied, to provide an assessment of a range of viable waste management options for the year 2020, the assessment year.

For ease of understanding the three tier options process is characterised pictorially in Figure ES1 below and reflects the way in which the preferred option is derived and describes the 3 tier sequential assessment process for assessing; minimisation and re-use (tier 1), recycling and composting (tier 2) and then residual waste treatment (tier 3).

Figure ES1
Schematic of options appraisal method



Summary descriptions of the waste management options which have been developed within this report are given below. It should be noted however that these descriptions are limited in how accurately they can reflect the principal differences between each option[1]. The descriptors used at each tier within this report include:

[1] See Glossary of Terms for a more detailed definition of the technical terms used. At this stage however EfW=Energy from Waste and MBT=Mechanical Biological Treatment.

Tier 1 assessment - minimisation and re-use (analysis of growth rates)

Table ES1 shows the results of the Tier 1 assessment of differing growth rates and municipal waste arisings forecasted for Staffordshire and Stoke-on-Trent for the year 2020. Of the 4 possible growth scenarios modelled, the adopted MSW forecast used in tier 2 and 3 assessment stages is summarised in Tables ES1 and ES2 and reflect how growth patterns may change over time as a result of interactions between increased waste minimisation, household forecasts and per capita waste generation changes.

Table ES1
Adopted MSW growth scenarios for Stoke City and Staffordshire

Year	Growth
2006 - 2010	1.4%
2011 - 2013	1%
2014 - 2020	0.5%

Table ES2
Predicted tonnages at key target years for Stoke City and Staffordshire

Year	MSW (tonnes)
2010	640,107
2013	659,246
2015	672,148
2020	693,070

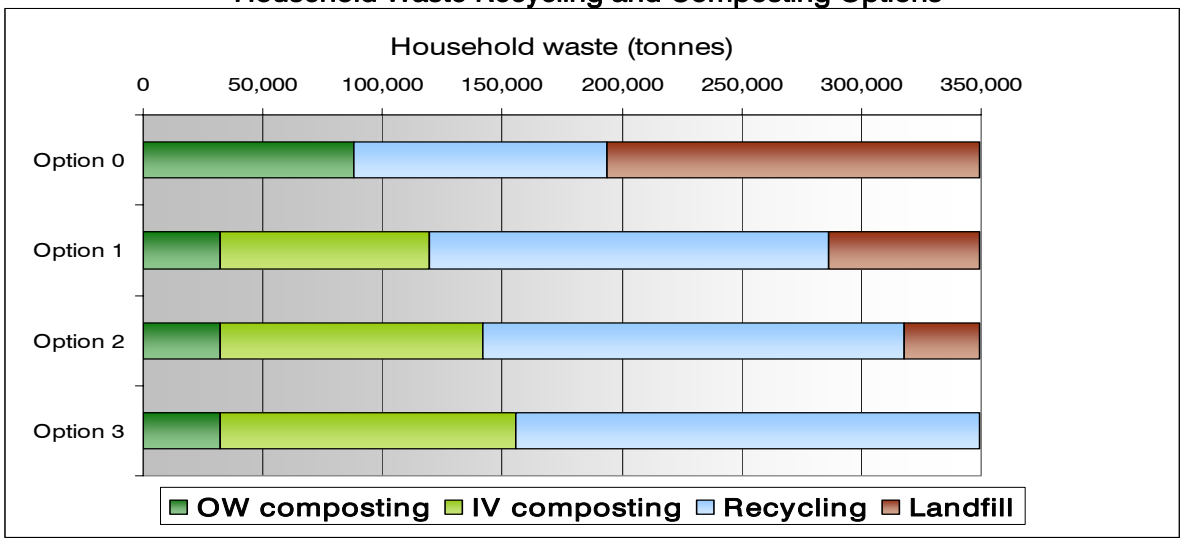
Tier 2 assessment - Recycling and composting

Tier 2 assesses only the fraction of MSW that is recycled and composted. Using the adopted MSW forecast summarised in Table ES2, four recycling and composting options have been considered within the Tier 2 assessment stage using household waste performance targets. These four options include:

- **Option 0** – "Stay as you are target of 31% for household waste (equivalent to 28% of MSW)"
- **Option 1** – "Conservative target of 45% for household waste (equivalent to 41% of MSW)"
- **Option 2** – "Meet proposed National target of 50% for household waste (equivalent to 46% of MSW)"
- **Option 3** – "Exceed proposed National target 55% for household waste (equivalent to 50% of MSW)"

Figure ES1 details the tier 2 recycling and composting options including the baseline 'stay as you are' option for comparison.

Figure ES1
Household Waste Recycling and Composting Options[2]



Option 0, the 'stay as you are' scenario, has been included in the sustainability appraisal assessment as a basis to compare the above options with the existing management methods, although Option 0, will clearly not meet the waste policy recycling requirements in future years. The tier 2 recycling and composting Option 1 above meets existing long term statutory waste management targets, with options 2 and 3 exceeding Waste Strategy 2000 recycling and composting targets and meeting the targets proposed in the latest waste strategy review.

The assessment process described below identified Option 3, of 55% household waste recycling and composting (equivalent to ~ of all MSW), as the adopted performance level to take forward through to the tier 3 assessment stage.

Tier 3 assessment - Residual treatment (using the preferred tier 2 recycling and composting option)

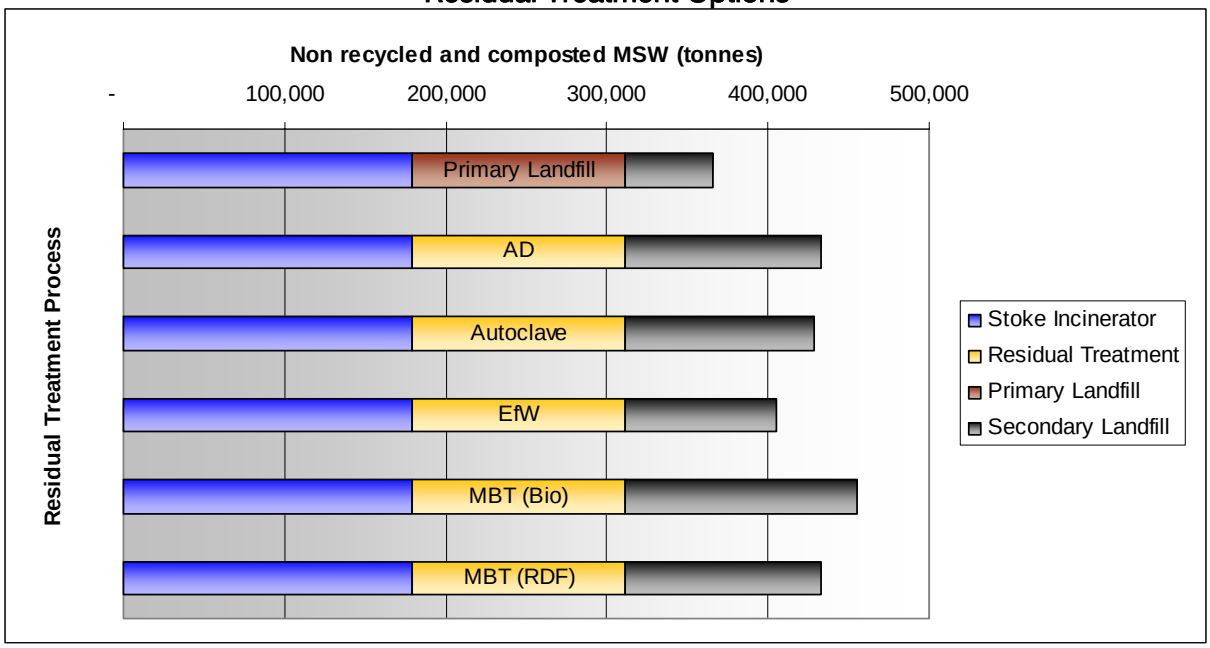
Tier 3 assesses only the fraction of MSW that remains following recycling and composting of 55% of household waste (equivalent to 50% of all MSW). This remaining fraction is known as residual MSW. Using the adopted MSW forecast summarised in Table ES1, six residual treatment options have been considered and includes:

- **Baseline Option** – "180,000 tonnes to Stoke EfW and remaining residual to landfill"
- **Anaerobic Digestion (AD)** – "maintain tonnage to Stoke EfW and remaining residual to AD"
- **Autoclave Option** – "maintain tonnage to Stoke EfW and remaining residual to Autoclave"
- **Energy from Waste Option** – "maintain tonnage to Stoke EfW and remaining residual to EfW"
- **Mechanical Biological Treatment (with Bio stabilisation)** – "maintain tonnage to Stoke EfW and remaining residual to MBT (bio stabilisation)"
- **Mechanical Biological Treatment (with RDF[3]) Option** – "maintain tonnage to Stoke EfW and remaining residual to MBT (RDF)"

[2] Note: two forms of composting are considered: OW = Open Windrow, IV = In-Vessel
[3] Refuse Derived Fuel – See glossary of terms for further details

Figure ES2 details the tier 3 residual treatment options including a baseline 'stay as you are' option for comparison.

Figure ES2
Residual Treatment Options



The final stage of the options appraisal is to assess the relative implications on a cost basis of either meeting or exceeding LATS.

The assessment process described below identified Option EfW and Option Autoclave jointly as the most preferred tier 3 residual treatment stage.

Assessment process

An appraisal methodology, involving a seven-stage process, has been applied where possible to each of the options in tier 2 and 3. The seven stages of this methodology are as follows:

- Step 1 – Set overall goals for decision making for waste management, subsidiary objectives and the criteria against which all options will be measured
- Step 2 – Identify all viable options
- Step 3 – Assess the performance of options identified within Step 2 against the criteria identified within Step 1
- Step 4 – Value the performance scores for each option
- Step 5 – Weighting. Balance the different objectives or criteria against one another.
- Step 6 – Evaluate and rank the different options
- Step 7 – Sensitivity analysis. Analyse how sensitive the results are to variations in the assumptions made or the data used

Each option has been assessed against 21 sustainability indicators to generate overall performance scores.

Assessment results

Performance scores for each indicator have been derived through a combination of quantitative evaluation and professional judgement. Valued performance scores have then been derived by 'normalising' the overall performance scores on a scale of 0 to 1, where 0 represents worst and 1 represents best. Results of the valued performance scores are shown in Table ES3 for tier 2, recycling and composting and Table ES4 for residual treatment and recovery. Using this methodology, the higher the score the more sustainable the option is considered to be.

Table ES3
Total Valued Performance Scores and Ranked Position for Recycling and Composting Tier 2 Options

	Option 0	Option 1	Option 2	Option 3
TOTAL VALUED PERFORMANCE SCORES	5.00	13.00	14.02	17.41

	Option 0	Option 1	Option 2	Option 3
RANKED PERFORMANCE SCORES	4	3	2	1

The results of the sustainability assessment indicate that in tier two, recycling and composting, Option 3 is the highest scoring waste management option followed by Option 2. Option 0 is the lowest scoring option relative to all other options and this result was expected given it is the option with the lowest recycling rate therefore having greatest impact in the life cycle analysis calculations. To test the robustness of the methodology, each option has been taken through a sensitivity analysis which still shows Option 3 to achieve the highest score.

Option 3 assumes an increased recycling and composting diversion that exceeds targets set out in the Review of England's Waste Strategy – A Consultation Document, February 2006[4]. Combined household recycling and composting performance is significantly improved from the present rate of 31% to 55% by the year 2020.

Table ES4
Total Valued Performance Scores and Ranked Position for Residual Treatment Tier 3 Options

	Baseline	EfW	AD	MBT (Bio)	MBT (RDF)	Autoclave
TOTAL VALUED PERFORMANCE SCORES	6.1	16.0	15.0	11.3	13.3	16.0

	Baseline	EfW	AD	MBT (Bio)	MBT (RDF)	Autoclave
RANKED PERFORMANCE SCORES	6	1	3	5	4	1

Tier 3 of the options assessment process uses the highest ranking recycling and composting option and is assessed each of the chosen residual treatment options to provide an optimum recycling and recovery strategy for Staffordshire and Stoke-on-Trent. The results of the residual treatment and recovery assessment stage shows Option 3 with

[4] This document has now been superseded by the Waste Strategy 2007 however there has been no change to the targets proposed in the consultation document.

EfW and Option 3 with Autoclave scoring equally high with both processes ranked as number 1.

It should be noted that the assessment developed has not weighted the 21 criteria in order of importance. Indeed, it is probable that different criteria will be considered to have varying levels of importance. An example of how different weightings may impact on the final chosen outcome is discussed and presented within this report, although our conclusions are based upon un-weighted valued performance scores. Staffordshire and Stoke-on-Trent may wish to consider if such a weightings exercise should be undertaken.

The overarching strategy framework for MSW

It is clear from the options assessment undertaken that the higher recycling performance option will conform to the highest ranking option. The conclusion therefore at this stage, in the absence of any local weighting, is that high recycling should form an essential part of the overarching framework for the Staffordshire and Stoke-on-Trent Municipal Waste Management Strategy, with little or no untreated waste to landfill and the remainder of the waste sent to a recovery process. This framework can be summarised as follows:

- **Increased recycling:** Combined household recycling and composting target of 55% (equivalent to 50% of all MSW)
- **Recovering benefit from all remaining MSW:** Sending approximately 50%[5] of all MSW for recovery
- **Zero waste to Landfill:** Minimising all forms of waste to landfill through increased recycling followed by maximum recovery of all remaining residual waste, thus placing landfill as the last and final option

Agreement on the above outline strategic framework will enable development of the final MSW strategy. Assessment of the short to medium term needs with respect to improvements in recycling and composting can then also be made. The development of the strategy provides essential support to future contract procurement for MSW management.

[5] 5% of the MSW total is rubble which is recycled at HWRCs, and therefore does not require further residual treatment. Government definitions exclude rubble from household waste recycling figures.

DOCUMENT ISSUE REGISTER

Project Title		**Job Number**	402.1395.00001
		Phase Number	
Client	Staffordshire County Council and Stoke-on-Trent City Council	**Client Contact**	Ian Benson

The Following Documents are issued by SLR Consulting Limited:

		Day	02	22						
		Month	01	11						
		Year	07	07						
Document Reference	**Title**	**Reason for Issue**	**Revision Number (x = pre revision issue)**							
	Options Assessment Report	D	1							
	Options Assessment Report (Post Consultation Report)	F		1						

Reason for Issue:	
P	Preliminary
A	Approval
C	Comments
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S	Issue Sheet Only
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CONTENTS

APPENDICIES

1 INTRODUCTION

SLR Consulting Limited (SLR) has been commissioned by Staffordshire County Council and Stoke-on-Trent City Council (Staffordshire and Stoke-on-Trent herein) to provide a Waste Strategy for the long term management of the City and County's municipal waste. As part of the strategy, an appraisal has been undertaken on a range of viable waste management options. This report summarises the sustainability assessment of the long term (for the year 2020) integrated waste management options for Staffordshire and Stoke-on-Trent.

Planning Policy Statement 10: *Planning for Sustainable Waste Management*, herein referred to as PPS10, supports the overall Government Policy Objective of sustainable development. Through a step change in the way waste is handled and investment in new facilities, the Government aims to break the link between economic growth and waste growth; and develop sustainable waste management by driving waste up the 'waste hierarchy' of reduce, reuse, recycle and recover.

DEFRA's 'Practice Guide for the Development of Municipal Waste Management Strategies'[6] is consistent with the Key Planning Objectives of PPS10 and provides an opportunity to align the MWMS and SEA processes. A Strategic Environmental Assessment (SEA) is being developed in unison with the production of the Staffordshire and Stoke-on-Trent MWMS to assess the associated impacts of the plan. The DEFRA guide highlights the need to evaluate options for future waste management, the options assessment process has developed from the previous principles of BPEO[7] to incorporate assessment of social, economic and policy factors in addition to environmental criteria which can be used to feed the SEA/SA (sustainability appraisal) process.

The decision making principles outlined in PPS10 involve "robust analysis of available data and information, and an appraisal of options". The DEFRA practice guide for development of MWMS states the "method by which Authorities assess options needs to be transparent and robust". The detailed methodology is described below and follows Government guidance. The process incorporates social, economic, policy and environmental objectives and indicators and is a robust and transparent process.

The following seven steps are generally accepted as fulfilling the requirements of an options appraisal process are as follows:

- Step 1 – Set overall goals for decision making for waste management, subsidiary objectives and the criteria against which all options will be measured
- Step 2 – Identify all viable options
- Step 3 – Assess the performance of these options against the criteria identified within Step 1
- Step 4 – Value the performance scores for each option
- Step 5 – Weighting. Balance the different objectives or criteria against one another.
- Step 6 – Evaluate and rank the different options
- Step 7 – Sensitivity analysis. Analyse how sensitive the results are to variations in the assumptions made or the data used

The aim of the option selection process is to enable an assessment of potential waste management solutions for the City and County when compared to a range of sustainability

[6] November 2005 DEFRA. http://www.defra.gov.uk/environment/waste/localauth/practice-guidance/pdf/practice-guide.pdf#search=%22defra%20guide%20to%20municipal%20waste%20strategies%22
[7] Best Practicable Environmental Option; the process underpinning the decision making process in Waste Strategy 2000.

indicators. The assessment process is designed to be auditable, consistent and robust, and, assist in the identification of a preferred waste management option for all municipal wastes arising in Staffordshire and Stoke-on-Trent in the long term. For this reason the assessment process summarised in this Report assesses each option for the year 2020 as this is seen as an acceptable long term planning horizon and has been used during the regional plan development work. In subsequent reviews the planning horizon may require extending in order to reflect new policy and legislative drivers as well as to reflect increase certainty levels with respect to data and technology developments.

2 OPTIONS TO BE ASSESSED

Revisions of municipal waste strategies have changed and evolved in a relatively short space of time as a result of greater understanding of the waste management industry and its associated impacts. In recent years the LCA process has been refined and developed to include the ever evolving and changing practices within the waste management industry. In line with these changes the development of municipal waste management strategies has also evolved and rather than a single LCA approach the new preferred method of assessment is to adopt a three tier system comprised of waste minimisation and re-use, recycling and composting, and residual treatment.

2.1 Waste Minimisation and Re-use

Previous waste strategies contained little mention of waste minimisation and re-use despite its inclusion at the very top of the waste hierarchy, however in recent years there has been an increasing emphasis on 'breaking the link between economic growth and the amount of waste produced'[8]. Waste minimisation and re-use has the potential to;

- reduce costs associated with waste collection and management;
- reduce the size and/or number of waste management facilities needed in the future;
- avoid environmental impacts of materials extraction and use;
- improve the authorities' balance of landfill allowances under the Landfill Allowance Trading Scheme (LATS); and
- could assist in generating significant social and economic benefits

Much of the success of waste minimisation and re-use initiatives can be achieved through increased awareness of community recycling schemes and sustainable purchasing policies.

2.1.1 Growth rate scenarios

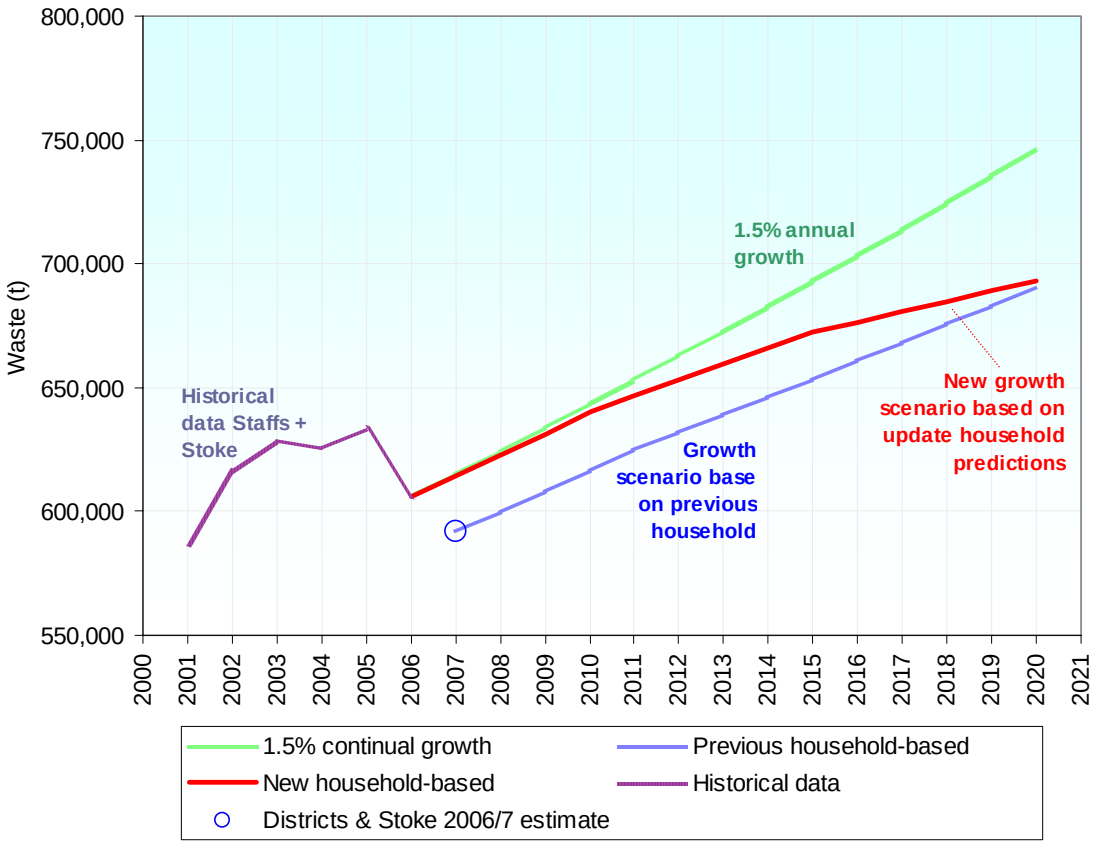
The success of waste minimisation and re-use strategies will have a direct impact on the total amount of waste arisings and these initiatives will need to be considered when calculating forecasted growth rates. The forecasted waste arisings for Staffordshire and Stoke-on-Trent are based upon projected household growth and the projected growth in waste per household.

Tier 1, waste minimisation (see Figure 2-1) compares a range of MSW forecasts based upon the following:

- projected housing growth,
- the UK trend in increasing MSW per household – with a simple 1.5% growth scenario,
- previous household growth based scenario employing Regional Spatial Strategy (RSS) data.

[8] Defra (2005) Guidance on Municipal Waste Management Strategies

Figure 2-1
Forward waste projections based on waste produced per household



Discussion of how the adopted growth scenario used throughout this report incorporates forecasted interactions between increasing waste minimisation, household forecasts and per capita waste generation changes is given below.

Household Growth Forecasts: Table 2-1 shows the total projected new households in Staffordshire and Stoke-on-Trent as provided in Option 2 of the Regional Planning Guidance 2006 (working draft) and the average annual increase in dwellings over the 25 year projection period.

Table 2-1
Projected household growth for Staffordshire and Stoke-on-Trent to 2026

	New dwellings, 2001 to 2006	Years for increase	Average annual dwellings built
Staffordshire	67,900	25	2,716
Stoke-on-Trent	21,000		840

Source: latest (21/11/2006) working draft of the regional planning guidance, provided by Bruce Braithwaite

Average annual dwellings built are calculated to 2020 (allowing for annual demolitions as set out in Regional Spatial Strategy[9] and a vacancy rate of 3%[10]).

[9] Annual demolitions for Stoke = 500 dwellings per year and for Staffordshire = 50 dwellings per year until 2011 and 110 dwellings per year until 2026
[10] As discussed with Bruce Braithwaite

Per Capita Consumption: Table 2-2 shows assumed annual growth in MSW per household up to 2020.

Table 2-2
Assumed annual growth in MSW per household up to 2020

	Until 2010	2011 to 2015	2016 onwards
Growth in MSW per household (kg/hh/yr)	10	5	0

The preferred growth rate scenario assumes that the annual growth in MSW per household will start to decline after 2010 and from 2016 it is anticipated that there will no longer be an increase in waste arisings per household per year.

Adopted MSW profile: It is assumed that minimisation and re-use initiatives, as part of the waste strategy will encourage the reduction of waste being created and any increase in total household waste will be attributable to the increase in houses built. Using the above analysis a forecast of MSW has been adopted for use throughout this report and is considered both realistic and achievable. This forecast is summarised in Table 2.3 below:

Table 2-3
Adopted MSW growth scenarios for Stoke City and Staffordshire

Year	Growth
2006 – 2010	1.4%
2011 – 2013	1%
2014 – 2020	0.5%

2.1.2 Minimisation and re-use initiatives

The introduction of waste minimisation and re-use initiatives can be co-ordinated at the County level so as to take advantage of an integrated public awareness campaign which would demonstrate clear and unified messages across the Districts and deliver potential cost savings associated with solitary communication campaigns and marketing materials. A number of waste minimisation and re-use initiatives have been successfully implemented and typical examples[11] are shown below in Table 2-4.

[11] As suggested in Defra 'Practice Guide for the Development of Municipal Waste Management Strategies' (2005) Information Sheet 10

Table 2-4
Waste Minimisation and Re-use Initiatives

Initiative Type	Examples
Purchasing	Promote durable/reusable items (vs disposable) Reusable shopping bags Encourage 'smart shopping' – buying goods with less packaging Join Mailing Preference Service to reduce junk mail
Diverting material from waste stream	Home Composting Re-usable nappies
Education and awareness	Market campaigns at schools and through community centres
Waste reduction in the work place	Promote energy efficient practices Sustainable purchasing
Financial incentives	Pay as you throw schemes to reduce residual waste
Targets and monitoring	Set per household or per capita arisings and residual targets Monitor progress of targets and effectiveness of initiatives
Re-use	Furniture WEEE Paint Scrap metal Wood Community Recycling Networks

Although waste minimisation and re-use initiatives have been utilised for a number of years it is only recently that they have been specifically introduced as part of a strategy tool. Subsequently, there is little in the way of data collected to be able to quantify or accurately attribute an actual reduction in waste with minimisation and re-use strategies. For this reason the growth rate scenario for Tier 1 uses an estimated tonnage reduction in waste produced per household per year and assumes the above initiatives will help to achieve these targets.

2.2 Recycling and Composting

Tier 2 of the options appraisal focuses on improving the capture of materials for recycling and composting.

Recycling and composting is placed below minimisation and reuse in the waste hierarchy. The aim of improving recycling and composting rates historically was to divert potential resources from landfill which have a market value, thus recovering revenue from a potential waste, reducing the need for virgin resources, and in many cases reducing the energy requirements to process materials (the latter two representing an environmentally beneficial practice). The introduction of the EU Landfill Directive provides the second driver for improving recycling and composting rates, as the UK must reduce its landfill of biodegradable wastes to landfill, or face fines from the European Union. The Landfill Directive has arguably become primary driver for Local Authorities to obtain high recycling (of biodegradable materials) and composting rates, due to the concerns of facing heavy fines for failing to meet the diversion targets.

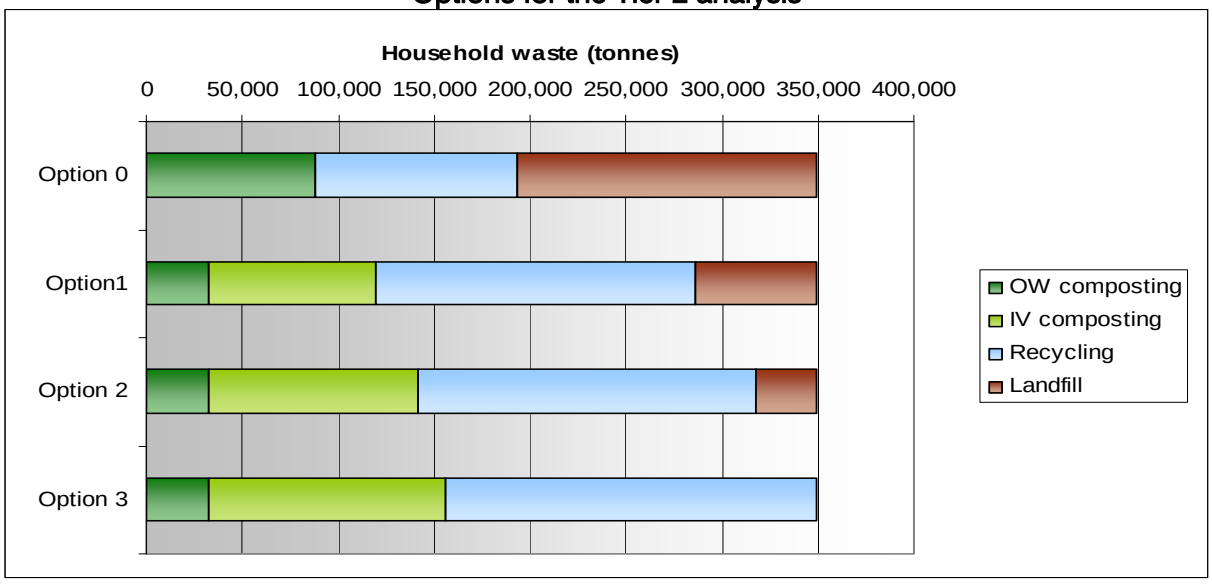
2.2.1 Targets for recycling and composting options

A total of four recycling and composting options were developed for appraisal in the Tier 2 analysis. Table 2-5 describes each option and its characteristics, Figure 2-2 presents a graphical representation of the options where recycling and composting performance is being assessed as a diversion of materials from landfill.

Table 2-5
Outline of Tier 2 Recycling and Composting Options

Option Number	Option Title	Option Characteristics	Additional Information
OPTION 0	"STAY AS YOU ARE"	Continue with current recycling and composting rates.	Household recycling and composting 31% (2005/06 BVPI submissions) remains constant to 2020
OPTION 1	"CONSERVATIVE TARGET"	Meet the 2010 and 2015 Recycling and Composting Targets set out in Review of England's Waste Strategy – A Consultation Document (February 2006), flatline the 2015 target for all future years.	Recycle and Compost 40% (2010), 45% (2015) of household waste, with the 2015 target constant to 2020
OPTION 2	"MEET R/C TARGETS"	Meet Recycling and Composting Targets set out in Review of England's Waste Strategy – A Consultation Document (February 2006)	Recycle and Compost 40% (2010), 45% (2015) and 50% (2020) of household waste.
OPTION 3	"EXCEED R/C TARGETS"	Exceed Recycling/Composting Targets set out in Review of England's Waste Strategy - A Consultation Document (February 2006)	Recycle and compost 45% (2010), 50% (2015) and 55% (2020) of household waste.

Figure 2-2
Options for the Tier 2 analysis



2.2.2 Options assessment

The Tier 2 recycling and composting assessment will involve the assessment of each option against a total of 21 criteria (Environmental, Socio-Economic, Operational and Waste Management Policy objectives) which are outlined in Table 2-6. The options assessment process is described in more detail in Section 3 to Section 8 of this report. Following the

Tier 2 assessment process and the identification of the highest scoring recycling and composting option, this level of recycling and composting will inform the next Tier of the assessment process.

Table 2-6
Assessment Objectives and Indicators/Criteria

OBJECTIVES	INDICATORS/CRITERIA
Environmental Objectives	**Environmental Indicators/Criteria**
1. To ensure prudent use of land and other resources	a) Depletion of resources, such as wood, water, fuels and ores b) Landtake
2. To reduce greenhouse gas emissions	c) Greenhouse gases emitted
3. To minimise adverse impacts on air quality and public health	d) Emissions which are injurious to public health e) Emisions contributing to air acidification f) Emissions contributing to depletion of the ozone layer g) Extent of odour problems h) Extend of dust problems
4. To conserve landscapes and townscapes	i) Extent of visual and landsacpe impacts
5. To protect local amenity	j) Extent of noise problems k) Extent of litter and vermin problems
6. To minimise adverse effects on water quality	l) Emissions contributing to eutrophication m) Extent of water pollution
Socio-economic Objectives	**Socio-economic Indicators/Criteria**
7. To minimise local transport impacts (congestion, severence, fear and intimidation, physical damage)	n) Total waste kilometres (by mode) o) Transport along roads other than motorways
8. To provide employment opportunities	p) Number of jobs likely to be created
9. To provide opportunities for public involvement and education	q) Extent of opportunitites for public involvement and education (concerning sustainable waste management practices)
Operational Objectives	**Operational Indicators/Criteria**
10. To minimise the increased costs of waste management	r) Costs of collection, management and disposal, including material and energy revenues
11. To ensure reliability of delivery	s) Likelihood of implementation wihtin required timescale, taking account of maturity of technology, necessary level of public participation, and the need for planning permission (taking account of scale of development and likely perceived adverse impacts)
Waste Management Policy Objectives	**Waste Management Policy Indicators/Criteria**
12. To conform to waste policy	t) Percentage landfill u) Percentage recycled/composted

2.3 Residual Treatment

Following the recycling and composting of waste, there is an element of the residual waste stream remaining. The waste hierarchy states that the treatment and recovery of waste to recover value, heat and/or power is more beneficial than the disposal (the lowest level of the waste hierarchy) of residual waste. Tier 3 of the options appraisal focuses on identifying the technology process with the highest score, or lowest environmental, socio-economic, operational and policy impacts.

2.3.1 Residual treatment options

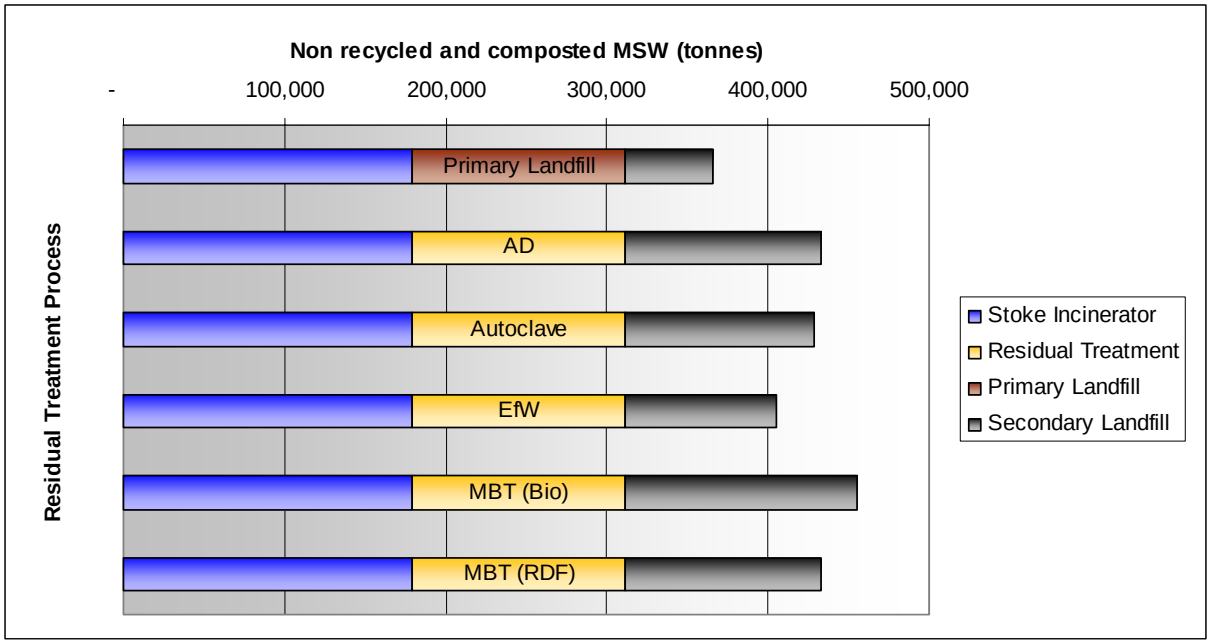
The range of technology processes assessed includes landfill (as the baseline situation) plus all other technology process that are deemed to be operational and achievable in the UK market. Currently, a significant proportion (circa 180,000 tonnes) of residual waste is treated at the Stoke-on-Trent incinerator. This incinerator, will be part of all future waste management options, and therefore has been included as a constant in the Tier 3 assessment. The non recycled and composted proportion of the waste stream, minus that residual waste sent Stoke is assessed with the technologies identified below:

- Energy from Waste;
- Mechanical Biological Treatment (MBT) (RDF);
- Mechanical Biological Treatment (Biostabilisation);

- Anaerobic Digestion; and
- Autoclave

A graphical representation (based on a 55% recycling and composting rate) is presented in Figure 2-3.

Figure 2-3
Tier 3 Scenarios for Assessment



2.3.2 Options assessment

The Tier 3 residual treatment technology process appraisal involves the assessment of each technology against 21 criteria (Environmental, Socio-Economic, Operational and Waste Management Policy objectives) which are outlined in Table 2-6, above. The options assessment process is described in more detail in Section 3 to Section 8 of this report.

2.4 Waste management capacity requirements

An assessment of total capacity requirements for Staffordshire and Stoke-on-Trent for composting and recycling (tier 2) and residual treatment (tier 3) has been made and is summarised in Table 2-7 and Table 2-8.

Table 2-7
Tier 2 - Recycling and Composting Options Capacity Requirements

DESCRIPTION		PRIMARY WASTE HANDLING				
		PRIMARY SOURCE SEGREGATION			RESIDUAL TREATMENT	Total plant for initial treatment (tpa)
Option	Waste Stream	OW Compost Plant	MRF Plant	IV Plant	Direct to Landfill	
0	31% recycling and composting rate achieved by 2020	88,301	105,425	0	155,575	349,301
1	45% recycling and composting rate achieved by 2020	32,485	166,479	87,095	63,242	349,301
2	50% recycling and composting rate achieved by 2020	32,485	175,839	109,187	31,790	349,301
3	55% recycling and composting rate achieved by 2020	32,485	193,699	123,116	0	349,301

Note:
Assessment year is taken as 2020
Tonnage data includes Stoke City and Staffordshire

Table 2-8
Tier 3 - Residual Treatment Scenario Capacity Requirements

DESCRIPTION	PRIMARY WASTE HANDLING					SECONDARY WASTE HANDLING					
Waste Stream	RESIDUAL TREATMENT				Total plant for initial treatment (tpa)	Landfill for AD Residue	Landfill for ash from EfW	Landfill for MBT ash	Landfill for MBT stabilised material	Landfill capacity for MBT rejects	Capacity for total waste handled (tpa)
	AD Plant	MBT plant Total	Energy from waste plant	Direct to Landfill							
Baseline			178,935	132,593	311,528		53,681				365,208
EfW			311,528		311,528		93,458				404,986
AD	132,593		178,935		311,528	22,597	53,681			44,566	432,371
MBT (Bio)		132,593	178,935		311,528		53,681		34,932	55,302	455,442
MBT (RDF)		132,593	178,935		311,528		53,681	15,258	21,598	31,111	433,175
Autoclave		132,593	178,935		311,528		53,681	20,153		43,104	428,465

Note:
Assessment year is taken as 2020
Tonnage data includes Stoke City and Staffordshire

3 APPRAISAL METHODOLOGY

To ensure a consistent approach in assessing each future long term option for Staffordshire and Stoke-on-Trent, an appraisal methodology has been used which is consistent with Government guidance. The five principal stages of this methodology can be summarised as follows:

- Establishing sustainability objectives and indicators
- Identifying overall performance scores for each sustainability indicator
- Establishing a valued performance score for each sustainability indicator
- Applying a weighting to each sustainability indicator to generate a final score
- Undertaking a sensitivity analysis of the results

The performance of Options within each tier using the above methodology is assessed in this report with the aim of identifying a preferred waste management option for Staffordshire and Stoke-on-Trent.

Performance scores for each option have been developed from two main sources;

- Life Cycle Assessment (LCA), using the Environment Agency WISARD software to generate potential environmental impacts. A description of LCA methodology and the WISARD software is provided in Appendix A of this report.
- Professional judgement based on experience within the UK, rest of Europe and elsewhere. A description of the methodology is presented in Appendix B.

4 SUSTAINABILITY OBJECTIVES AND EVALUATION CRITERIA

Government guidance[12] has been used to identify the sustainability objectives and criteria against which all options are to be measured. A summary of which is given in Table 4-1. The sustainability objectives and indicators established are divided into four categories; environmental criteria, socio-economic criteria, operational criteria and waste management policy criteria.

A brief review of each sustainability objective follows. At this stage each sustainability indicator should be regarded as having equal importance. The application of weighting, by way of an example, to each indicator is discussed in Section 10 of this report.

[12] http://www.communities.gov.uk/index.asp?id=1145890 [Site accessible December 2006]

Table 4-1
Sustainability Assessment Objectives and Evaluation Criteria

OBJECTIVES	INDICATORS/CRITERIA	METHOD OF MEASUREMENT
Environmental Objectives	**Environmental Indicators/Criteria**	**Method of Measurement**
1. To ensure prudent use of land and other resources	a) Depletion of resources, such as wood, water, fuels and ores b) Landtake	WISARD output result Professional judgement based on performance of existing facilities
2. To reduce greenhouse gas emissions	c) Greenhouse gases emitted	WISARD output result
3. To minimise adverse impacts on air quality and public health	d) Emissions which are injurious to public health e) Emisions contributing to air acidification f) Emissions contributing to depletion of the ozone layer g) Extent of odour problems h) Extend of dust problems	WISARD output result WISARD output result WISARD output result Professional judgement based on performance of existing facilities Professional judgement based on performance of existing facilities
4. To conserve landscapes and townscapes	i) Extent of visual and landsacpe impacts	Professional judgement based on performance of existing facilities
5. To protect local amenity	j) Extent of noise problems k) Extent of litter and vermin problems	Professional judgement based on performance of existing facilities Professional judgement based on performance of existing facilities
6. To minimise adverse effects on water quality	l) Emissions contributing to eutrophication m) Extent of water pollution	WISARD output result Professional judgement based on performance of existing facilities
Socio-economic Objectives	**Socio-economic Indicators/Criteria**	**Method of Measurement**
7. To minimise local transport impacts (congestion, severence, fear and intimidation,	n) Total waste kilometres (by mode) o) Transport along roads other than motorways	WISARD input data WISARD input data
8. To provide employment opportunities	p) Number of jobs likely to be created	Professional judgement based on performance of existing facilities
9. To provide opportunities for public involvement and education	q) Extent of opportunitites for public involvement and education (concerning sustainable waste management practices)	Professional judgement based on performance of existing facilities
Operational Objectives	**Operational Indicators/Criteria**	**Method of Measurement**
10. To minimise the increased costs of waste management	r) Costs of collection, management and disposal, including material and energy revenues	Professional judgement based on performance of existing facilities
11. To ensure reliability of delivery	s) Likelihood of implementation wihtin required timescale, taking account of maturity of technology, necessary level of public participation, and the need for planning permission (taking account of scale of development and likely perceived adverse impacts)	Professional judgement based on performance of existing facilities
Waste Management Policy Objectives	**Waste Management Policy Indicators/Criteria**	**Method of Measurement**
12. To conform to waste policy	t) Percentage landfill u) Percentage recycled/composted	WISARD input data WISARD input data

5 ENVIRONMENTAL RELATED CRITERIA

A further explanation of scoring methodology employed is presented in Appendix B.

5.1 To Ensure Prudent Use of Land and Other Resources

A key sustainable development objective is to use finite natural resources (such as fossil fuels and land) more efficiently. Producing more with less, for example by reusing or recycling waste, reduces the environmental pollution and degradation caused by extraction, use and disposal of natural resources.

The choice of waste management option can have a significant influence on the consumption of finite natural resources. For example, reuse and recovery of materials should result in a reduction in the consumption of primary raw materials. Non-renewable resource depletion is assessed for both the recycling and composting and residual treatment tiers using the WISARD life cycle assessment tool, and is summarised in Appendix C Table C1a Recycling and Composting (performance scores) and C1a Residual Treatment. For ease of comparison Tables C1b Recycling and Composting and C1b Residual Treatment, as shown in Appendix C present the results as valued scores on the same scale. These scores indicate that with regard to recycling and composting Option 3 has the highest avoided burden (and therefore is the most sustainable) and Option 0 has the lowest avoided burden (and is therefore the least sustainable). A similar assessment is performed for the residual treatment options with Autoclave having the highest avoided burden (resulting in a more sustainable option) and the 'do nothing' or baseline residual treatment option having the lowest (and is therefore the least sustainable).

Land is also a finite resource, and the emphasis of government policy is to `recycle' the use of land and buildings through brownfield site development and re-use of buildings. Some waste management options require a larger footprint/land-take than others. Landtake is measured using professional judgement based on the typical size of different facilities. An estimate of landtake (in hectares) for each facility type is given in Appendix C Table C2a. A summary of the potential 'total landtake' for the recycling and composting options is given in Appendix C, Table C2b Recycling and Composting Summary, indicating that Option 0 requires a total of 114 hectares of land, whereas Option 3 only requires an estimated 46 hectares. Similarly, the 'total landtake' for the residual treatment and recovery options in Table C2b Landtake Impacts for Residual Treatment shows the baseline or 'do nothing' scenario requiring 26 hectares, whereas Energy from Waste (EfW) only requires an estimated 20 hectares. Therefore the overall 'landtake' for the highest scoring option plus optimum residual treatment is approximately 67 hectares.

5.2 To Reduce Greenhouse Gas Emissions

Global climate change is widely recognised as one of the greatest environmental challenges facing the world today. The clear message from the scientific community is that climate change is due, at least in part, to the increasing concentrations of greenhouse gases in the atmosphere.

A number of waste management operations give rise directly or indirectly to emissions of greenhouse gases. The decomposition of waste in landfill sites also produces methane (CH_4), which is around 20 times more potent a greenhouse gas as CO_2. A key objective of

the Landfill Directive is to reduce our reliance on landfill and to thereby cut methane emissions.

Measurement of this sustainability objective is made through assessing greenhouse gas emissions for both the recycling and composting options and residual treatment and recovery options using the WISARD life cycle assessment tool. Scores are summarised in Appendix C, Table C1a Recycling and Composting (Performance Scores) and Table C1b Recycling and Composting (Valued Scores) indicating that for tier two, recycling and composting, Option 3 has the highest avoided burden (and therefore is the most sustainable) and Option 0 has the lowest avoided burden (and is therefore the least sustainable). Scores for the tier three, residual treatment as shown Tables C1a Residual Treatment (Performance Scores) and C1b Residual Treatment (Value Scores) indicate that Autoclave has the highest avoided burden (and therefore is the most sustainable) and the 'do nothing' or baseline scenario has the lowest avoided burden (and is therefore the least sustainable).

5.3 To Minimise Adverse Impacts on Air Quality and Public Health

A key sustainable development objective is to control air pollution in order to reduce the risks to human health, the natural environment and quality of life. Pollutants that raise more concerns to Government include: Nitrogen Dioxide; Sulphur Dioxide; Carbon Monoxide; particles (PM10); and Ozone. Measurement of these indicators is made for Options in tier two, recycling and composting and tier three, residual treatment and recovery using the WISARD life cycle assessment tool, and summarised in Appendix C, Table C1a (Performance Scores) and Table C1b (Valued Scores) for the following impact assessment categories: human toxicity, air acidification and ozone depletion.

Human toxicity has been used as a proxy measure for public health. Tables C1a Recycling and Composting (Performance Scores) and C1b Recycling and Composting (Value Scores), and Tables C1a Residual Treatment and C1b Residual Treatment indicate the Options that have the highest avoided burden (and therefore are the most sustainable) through to the lowest avoided burden (and are therefore the least sustainable). For the recycling and composting tier Option 3 had the highest avoided burden and for the residual treatment and recovery tier Autoclave had the highest avoided burden.

Air acidification, also summarised in Tables C1a and C1b and indicate that Option 3 for the recycling and composting, and Autoclave for residual treatment and recovery, have the highest avoided burden (and therefore are the most sustainable).

Ozone depletion as summarised in Tables C1a and C1b and indicate that Option 3 for recycling and composting and EfW for residual treatment have the highest avoided burden (and therefore would be the most sustainable).

The soiling of property through dust emission is a common cause of complaint. Dust is defined as small particles in the range 1-75 microns in diameter. Small particles of dust (PM10) are prejudicial to public health. A range of waste management processes potentially give rise to dust, particularly where mechanical operations and storage of waste take place in open air. Vehicle movements can also be a significant dust generator, both on and off site. Professional judgement based on experience of existing facilities is used to measure (on a nominal scale) the dust generation for each facility type, as shown in Table C3a, indicating that large landfills are 100 times more likely to have an adverse dust impact than a large transfer station. A summary of performance scores for dust for the recycling and

composting options are given in Appendix C, Table C3b Recycling and Composting, indicating that Option 0 scores worst and Option 3 scores best. Similarly, summary performances for the residual treatment and recovery options are presented in Table C3b, indicating that the 'do nothing' or baseline option scores worst and EfW scores best.

Odour is a common cause of public concern in relation to waste management. Like dust, odours can be particularly acute where mechanical operations and storage of waste take place in open air. Odours are difficult and expensive to abate. Measurement of this indicator is made using professional judgement based on experience of existing facilities. A qualitative scoring allocation for each facility type is given in Table C3a. A summary of the total 'dust and odour' scores for recycling and composting Options and the residual treatment Options are given in Table C3b Recycling and Composting and C3b Residual Treatment, respectively, indicating Option 0 scores worst and Option 3 scores best for recycling and composting, and for residual treatment 'do nothing' or baseline scenario scores worst and EfW scores best.

5.4 To Conserve Landscapes and Towns

Landscapes and townscapes have strong economic, social and community value. All waste management options involve the development of components such as buildings, processing plant, access roads, lighting/signage, storage mounds and perimeter bunds. These can generate impact on landscape (effects on the general landscape character and quality of the surrounding area) and visual impacts (including changes in available views, the effect of those changes on people and the overall impact on visual amenity). Whilst the extent of landscape and visual impacts is strongly influenced by the nature of the receiving environment, concern is likely to be greatest where options involve emissions stacks, large enclosed facilities or significant storage/disposal of waste above ground level.

In this report measurement of this sustainability objective is made using professional judgement based on the typical nature, size and number of facilities proposed for each of the options considered. A qualitative scoring allocation for each facility type is given in Appendix C, Table C4a suggesting that landfills have a far greater impact than any other facility type. A summary of the total 'landscape impact' scores for recycling and composting, and residual treatment and recovery options are given in Table C4b Recycling and Composting and C4b Residual Treatment respectively. The tables indicate that Option 3 scores best for recycling and composting and EfW scores best for residual treatment and recovery.

5.5 To Protect Local Amenity

Living and working environments make an important contribution to 'quality of life.' In addition to attractive streets and buildings, access to green spaces, and community safety, low levels of noise and litter are also important considerations. All waste management options generate noise and litter, as they involve the storage, treatment and transport of waste. However, litter is most likely to be of concern where the waste is stored or processed/deposited in the open. Noise is most likely to be of concern in relation to sites that operate outside standard working hours, or use particularly noisy unenclosed plant (e.g. screening/crushing machinery).

In this report measurement of this sustainability objective is made using professional judgement based on the current performance of existing facilities proposed for each of the options considered. For 'noise impacts' a qualitative scoring allocation for each facility type

is given in Appendix C, Table C5a. The table suggests that EfW and MBT facilities score noticeably worse than composting. A summary of the total 'noise impact' scores for recycling and composting is given in Appendix C, Table C5b Recycling and Composting, indicating Option 0 scores best and Options 2 and 3 score worst. A similar assessment is also conducted for the residual treatment impacts and is shown in Table C5b Residual Treatment in which the 'do nothing' or baseline options scores best with MBT and Autoclave scoring worst.

For 'litter impact' a qualitative scoring allocation for each facility type is assumed to be the same for dust and odour impacts and therefore summarised in Table C3a. A summary of the total 'litter impact' scores for the recycling and composting options is given in Table C3b Recycling and Composting, indicating Option 0 scores worst and Option 3 scores best. Table C3b Residual Treatment shows a similar assessment for the residual treatment options, indicating that the 'do nothing' or baseline option scores worst and EfW scores best.

5.6 To Minimise Adverse Effects on Water Quality

All waste management options will create potential impacts on water as they involve the following:

- The storage of waste (e.g. run off from rain and dust suppression sprays, leaching of contaminants)
- The transport of waste (e.g. run off from the delivery and tipping of materials, wheel washing)
- The operation of plant and vehicles (e.g. potential pollution from oil and solvents, including the risk of accidental spillage).

However, some waste management options present a greater risk to water quality than others, for example with recycling and composting options:

- Composting: Leachate may be generated as part of the process. The liquor may contain heavy metals and other contaminants.

Similar assessments are also conducted for the residual treatment and recovery options

- Anaerobic digestion: The process results in a digestate liquor which may contain high levels of metals and other contaminants.
- Incineration: Cooling and cleaning water may contain high levels of contaminants, whilst the storage and disposal of ash and air pollution control residues poses a further threat to water quality.
- Landfill/landraising: The risk of pollution depends on the characteristics of the wastes, the standard of site engineering, the underlying geology and the proximity of water courses and abstraction points. The Environment Agency's advice is that, however well engineered a landfill site, there is a risk of leachate release to the water environment.

In this report, WISARD has been used to quantify water eutrophication as a measure of water contamination and is summarised for recycling and composting in Appendix C, Table C1a Recycling and Composting (Performance Scores) and Table C1b Recycling and Composting (Valued Scores), indicating Option 0 scores worst and Option 3 scores best. A summary of the same test is also available for residual treatment in Table C1a Residual Treatment (Performance Scores) and C1b Residual Treatment (Value Scores), indicating that AD scores worst and Autoclave scores best.

Professional judgement has also been used to determine the current performance of the existing facilities. A qualitative scoring allocation for each facility type is given in Appendix C, Table C6a, suggesting the adverse impact of landfill is far greater than for all other facility types. A summary of the potential 'water contamination impact' scores for recycling and composting options is given in Table C6b Recycling and Composting, indicating Option 0 scores worst and Option 3 scores best. Scores for residual treatment options are presented in Table C6b Residual Treatment and indicate that the 'do nothing' or baseline scenario scores worst and EfW scores best.

6 SOCIO ECONOMIC RELATED INDICATORS

A further explanation of the scoring methodology employed is presented in Appendix B.

6.1 To Minimise Local Transport Impacts

An efficient transport system is needed to support a strong and prosperous economy and to maintain and improve people's quality of life. However, congestion and unreliability of journeys add to the costs of business, and undermine competitiveness. Major traffic arteries cause 'severance' within a community when people become separated from places and other people; and 'fear and intimidation' amongst pedestrians. Heavy levels of traffic also damage towns and cities, and harm the countryside.

All waste management options have local transport impacts as they involve some degree of off-site movement of waste. The scale of impacts will be influenced by factors such as vehicle size, frequency of vehicle movements, road/pavement width, and traffic speeds. The scope to mitigate or avoid impacts (e.g. by avoiding sensitive receptors, restricting hours of operation and 'backloading' vehicles) is also important.

Measurement of this sustainability objective uses total waste kilometres travelled for each recycling and composting option. This information is estimated from input data to the WISARD modelling undertaken and the total distance travelled for each of the Options 0 - 3 is presented in Appendix C, Table C7 Recycling and Composting. As the recycling rate increases so does the relative distance travelled due to an increase in the number of recyclables collected and requiring distribution.

6.2 To Provide Employment Opportunities

A high employment rate is one of the key objectives of sustainable development. It is considered that employment enables people to meet their needs and improve their living standards, and thereby to help tackle poverty and social exclusion.

Development of new waste management facilities will create temporary construction employment, which may be available to local people, and their long-term operation will create jobs, the nature of which will depend on the facility.

Professional judgement based on experience of job creation at existing facilities is made to measure this sustainability objective. A qualitative scoring allocation for the recycling and composting options is presented in Appendix C, Table C8a Recycling and Composting with Option 3 scoring best which suggests that the greater the recycling the greater number of jobs created. A similar qualitative scoring allocation is also calculated for each facility type and is given in Table C8a, suggesting facilities employing greater than 10 staff include all MBT, most EfW and large MRFs and large In-Vessel Composting facilities. A summary of the 'total jobs' estimated for residual treatment is given in Table C8b Residual Treatment, indicating that the 'do nothing' or baseline scenario scores worst and MBT (biostabilisation) scores best.

6.3 To Provide Opportunities for Public Involvement and Education

Public participation is at the heart of sustainable development. Indeed, the notion of '*thinking globally, acting locally'* underpins the Local Agenda 21 process.

In this context it is important for the Government, locally and regionally, to *'send the right signals'* to the public in order to encourage changes in behaviour and lifestyles.

Measurement of this sustainability objective is made using professional judgement based on experience of existing facilities and the extent to which they are likely to provide opportunities for positive public involvement. A qualitative scoring allocation for each facility type is given in Table C9a, suggesting the facilities with least opportunity include landfill, transfer stations, EfW and AD. A summary of the potential 'public involvement' scores for recycling and composting options is given in Appendix C, Table C9b Recycling and Composting, indicating Option 0 scores worst and Option 3 scores best. Scores for public involvement associated with residual treatment are shown in Table C9b with the 'do nothing' or baseline option scoring worst and AD, MBT (Bio), MBT (RDF) and Autoclave scoring best.

7 OPERATIONAL RELATED INDICATORS

A further explanation of the scoring methodology employed is presented in Appendix B.

7.1 To Minimise the Costs of Waste Management

Costs are clearly a key concern for local authorities, waste contractors and the general public and can have a significant impact in determining the nature of waste management to be developed. The principal costs relate to waste collection and waste treatment/disposal. It should be noted that no account of any potential LATS fines have been considered within this assessment.

Professional judgement based on experience of waste management costs is made to measure this sustainability indicator. Unit costs and their derivation are provided for each waste treatment, disposal and transfer route and are generally based on current costs. The exception to this is landfill tax for active wastes which has been assumed to increase to £35/t prior to 2020, the assessment year. Unit costs assumed within this assessment are summarised within Appendix C, Table C10a. A detailed assessment of the costs for each recycling and composting option is summarised in Appendix C, Table C10b Recycling and Composting, indicating Option 3 to be the most expensive and Option 0 the least expensive. A similar assessment for the residual treatment options is summarised in Table C10b Residual Treatment, indicating the 'do nothing' or baseline scenario to be most expensive and EfW the least expensive.

7.2 To Ensure Reliability of Delivery

Although a waste management option may perform well against a range of indicators, it may not be possible to implement the option due to practical constraints. Such constraints may include:

- Availability of financial resources.
- Technological issues, related to the availability of the appropriate plant and machinery
- Difficulties in obtaining planning consents

These constraints are extremely difficult to predict. Nonetheless, measurement of this objective in this report is made using a qualitative assessment based on planning likelihood, hours of operation, and perceived adverse environmental and health impacts. Planning likelihood takes into consideration the existing Stoke Energy from Waste facility. A qualitative scoring allocation for each facility type is given in Appendix C, Table C11a, suggesting MBT facilities are least likely to be deliverable. A summary of the total 'deliverability' scores for the recycling and composting options are given in Appendix C, Table C11b Recycling and Composting, indicating Options 0 is the most deliverable whereas Option 2 is least likely to be delivered. A similar assessment for the residual treatment options is summarised in Table C11b Residual Treatment indicating that the 'do nothing' baseline scenario is most likely to be deliverable and MBT (RDF) and Autoclave are least likely to be deliverable.

8 WASTE MANAGEMENT POLICY RELATED INDICATORS

A further explanation of the scoring methodology employed is presented in Appendix B.

8.1 To Conform with Waste Policy

The Government actively promotes the waste hierarchy, including (in the following order of preference) waste reduction, re-use, recycling and composting, energy recovery, with disposal as a last resort. The Government also wishes to see waste managed in line with the proximity principle which states that waste should generally be disposed of as near to its source as possible. This is in part to ensure that waste problems are not simply exported to other regions or countries, and also recognises that the transportation of wastes can have significant environmental impacts.

The principal aim of this waste assessment process is to comply with local, national and European waste policy. A range of statutory and non statutory targets have been used to develop the options described earlier in this report.

Measurement of this sustainability objective is through assessment of the percentage landfill and recycling achieved for each option considered. A summary of performance for each recycling and composting option is summarised in Table C12a Recycling and Composting. Options 3 achieves 55% recycling and source segregated composting of municipal wastes by 2020, followed by Options 2 and 1 achieving 50% and 45% respectively, and Option 0 only 31%. The highest landfill requirement is for Option 0.

The tier 3 residual treatment options stage will only be assessed using the preferred option from tier 2 and therefore this assessment criteria will only compare the percentage to landfill. Table C12a Residual Treatment shows EfW with the least amount of waste to landfill at 15% and the ‘do nothing’ or baseline scenario sending the highest amount at 29%.

9 PERFORMANCE OF OPTIONS

The assessment criteria discussed in previous sections represents a comprehensive sustainability and environmental appraisal framework for assessment of the three tiers, minimisation and re-use, recycling and composting, and residual waste treatment. Wherever possible, the performance of each option against the above criteria has been quantified, for example through the use of the Environment Agency's WISARD life cycle assessment tool. Where this is not possible a qualitative assessment of performance has been made.

9.1 Overall Performance Scores

The purpose of appraising the performance of Options in tier two and three against the objectives and indicators summarised in Section 8 is to inform decision makers about their relative advantages and disadvantages. The appraisal undertaken in this report is systematic in scoring each option within the tier against each indicator. The overall performance scores for Options in tier two and tier three are presented in Table 9-1 and Table 9-2 respectively.

Analysis of Tables 9.1 and 9.2 is difficult because of the matrix's complexity and the use of different units for each sustainability criterion. Establishing 'valued' performance scores provides a possible solution to this problem and thus is discussed in the next section.

9.2 Valued Performance Scores

'Valued' performance scores interpret overall performance scores on a scale of 0 to 1, where 0 is the worst performance, and 1 the best. This enables the discrepancy between scores to be retained, whilst allowing the performance of options against all criteria to be placed on a common scale. In this report it is assumed that a linear relationship exists between the best and worst 'value' scores. This approach is used to apply a linear function relationship to the performance scores and the resulting 'valued' performance scores for recycling and composting and residual treatment are summarised in Table 9-3 and Table 9-4 respectively.

Tables 9.3 and indicates that should each evaluation criteria be given equal weighting the higher scoring recycling and composting option is Option 3, the higher recycling rate of 55% and the lowest scoring option is the baseline, Option 0 therefore indicating preference for higher recycling and composting and a higher diversion away from landfill.

The 'valued' performance scores for tier 3 are summarised in Table 9.4 and shows an equal preference for both EfW and Autoclave based on the 21 assessment criteria with the 'do nothing' scenario scoring the lowest and therefore also indicating preference for higher diversion away from landfill.

Table 9-1
Tier 2 - Overall Recycling and Composting Performance Scores for Options 0 - 3

Sustainability Objective	Sustainability Criteria	Option 0	Option 1	Option 2	Option 3
Minimise Costs	Net Present Value (£M)	28,887,258	31,277,544	31,953,386	32,678,480
Conform with Waste Policy	% Landfill	24%	10%	5%	0%
	% Recycling & Composting	31%	45%	50%	55%
Ensure Reliability of Delivery	Planning Likelihood, Operating Hours, etc.	89	99	105	99
Conserve Landscapes and Townscapes	Nature, scale and number of facilities	2,933	1,432	1,134	814
Protect Local Amenity	Noise	82	84	88	88
	Litter	214	95	71	53
Minimise Local Transport Impact	Total Waste Kilometres	971,483	1,029,114	1,047,052	1,073,582
	Transport along roads other than motorways	0	0	0	0
Create Employment Opportunities	Number of jobs created	75	98	106	114
Opportunities for Public Involvement	Potential for participating in recycling/composting	289	295	328	356
Prudent Land use	Resource Depletion	-1,605,730	-4,050,520	-4,314,407	-4,865,438
	Land take	114	58	55	46
Reduce Greenhouse Gases	Total CO2 Emissions	71,786,248,408	-1,525,902,037	-16,049,819,744	-37,544,126,289
Minimise Air Quality	Human Toxicity	-453,412,814	-979,277,629	-1,021,285,002	-1,277,629,470
	Air Acidification	-11,865,569	-25,072,190	-26,128,011	-32,915,853
	Ozone Depletion	-1,983	-9,604	-9,745	-16,106
	Odour	214	95	71	53
	Dust	214	95	71	53
Minimise Water Quality	Eutrophication	10,588,524	4,273,843	2,046,399	-263,072
	Potential extent of water contamination	240	107	80	54

Table 9-2
Tier 3 - Overall Residual Treatment Performance Options

Sustainability Objective	Sustainability Criteria	Baseline	EfW	AD	MBT (Bio)	MBT (RDF)	Autoclave	Comments
Minimise Costs	Net Present Value (£M)	35,194,886	24,922,209	28,899,988	28,899,988	28,899,988	28,899,988	A lower score is preferable
Conform with Waste Policy	% Landfill	29%	15%	19%	23%	19%	18%	A lower score is preferable
	% Recycling & Composting	55%	55%	55%	55%	55%	55%	A higher score is preferable
Ensure Reliability of Delivery	Planning Likelihood, Operating Hours, etc.	26	84	60	77	132	132	A lower score is preferable
Conserve Landscapes and Townscapes	Nature, scale and number of facilities	2,108	1,223	1,437	1,738	1,521	1,472	A lower score is preferable
Protect Local Amenity	Noise	75	112	88	113	113	113	A lower score is preferable
	Litter	184	88	120	141	117	112	A lower score is preferable
Minimise Local Transport Impact	Total Waste Kilometres	-	-	-	-	-	-	A lower score is preferable
	Transport along roads other than motorways	0	0	0	0	0	0	A lower score is preferable
Create Employment Opportunities	Number of jobs created	26	40	30	42	41	41	A higher score is preferable
Opportunities for Public Involvement	Potential for participating in recycling/composting	20	31	36	36	36	36	A higher score is preferable
Prudent Land use	Resource Depletion	38,508	-136,064	-1,274,240	-467,381	-362,281	-1,318,341	A lower score is preferable
	Land take	26	20	22	25	23	23	A lower score is preferable
Reduce Greenhouse Gases	Total CO2 Emissions	70,811,720,199	-5,840,595,266	-21,518,782,363	7,969,141,425	798,801,581	-26,954,960,327	A lower score is preferable
Minimise Air Quality	Human Toxicity	-57,320,666	-73,219,726	-317,970,618	-88,513,523	-125,773,858	-337,149,887	A lower score is preferable
	Air Acidification	-1,048,912	-1,103,764	-7,744,835	-1,845,529	-2,479,433	-8,102,980	A lower score is preferable
	Ozone Depletion	-9.E-02	-1.E-01	-9.E-02	-8.E-02	-1.E-01	-1.E-01	A lower score is preferable
	Odour	184	88	120	141	117	112	A lower score is preferable
	Dust	184	88	120	141	117	112	A lower score is preferable
Minimise Water Quality	Eutrophication	9,364,787	1,141,124	208,180,863	3,986,100	2,494,252	2,162,366	A lower score is preferable
	Potential extent of water contamination	182	91	119	144	119	114	A lower score is preferable

Table 9-3
Tier 2 - Valued Recycling and Composting Scores for Options 0 – 3

Sustainability Objective	Sustainability Criteria	Option 0	Option 1	Option 2	Option 3
Minimise Costs	Net Present Value (£M)	1.00	0.37	0.19	0.00
Conform with Waste Policy	% Landfill	0.00	0.59	0.80	1.00
	% Recycling & Composting	0.00	0.59	0.80	1.00
Ensure Reliability of Delivery	Planning Likelihood, Operating Hours, etc.	1.00	0.40	0.00	0.36
Conserve Landscapes and Townscapes	Nature, scale and number of facilities	0.00	0.71	0.85	1.00
Protect Local Amenity	Noise Impact	1.00	0.65	0.00	0.05
	Litter Impact	0.00	0.74	0.89	1.00
Minimise Local Transport Impact	Total Waste Kilometres	1.00	0.44	0.26	0.00
	Transport along roads other than motorways	1.00	1.00	1.00	1.00
Create Employment Opportunities	Number of jobs created	0.00	0.59	0.82	1.00
Opportunities for Public Involvement	Potential for participating in recycling/composting	0.00	0.09	0.58	1.00
Prudent Land use	Resource Depletion	0.00	0.75	0.83	1.00
	Land take	0.00	0.83	0.87	1.00
Reduce Greenhouse Gases	Total CO2 Emissions	0.00	0.67	0.80	1.00
Minimise Air Quality Impact	Human Toxicity	0.00	0.64	0.69	1.00
	Air Acidification	0.00	0.63	0.68	1.00
	Ozone Depletion	0.00	0.54	0.55	1.00
	Odour	0.00	0.74	0.89	1.00
	Dust	0.00	0.74	0.89	1.00
Minimise Water Quality Impact	Eutrophication	0.00	0.58	0.79	1.00
	Potential extent of water contamination	0.00	0.71	0.86	1.00
TOTAL VALUED PERFORMANCE SCORES		**5.0**	**13.0**	**14.0**	**17.4**
Note: A score of 1 represents the best option … a score of 0 represents the worst of options					

Table 9-4
Tier 3 - Valued Scores for Residual Treatment Options

Sustainability Objective	Sustainability Criteria	Baseline	EfW	AD	MBT (Bio)	MBT (RDF)	Autoclave
Minimise Costs	Net Present Value (£M)	0.00	1.00	0.61	0.61	0.61	0.61
Conform with Waste Policy	% Landfill	0.00	1.00	0.70	0.46	0.70	0.75
	% Recycling & Composting	1.00	1.00	1.00	1.00	1.00	1.00
Ensure Reliability of Delivery	Planning Likelihood, Operating Hours, etc.	1.00	0.45	0.68	0.52	0.00	0.00
Conserve Landscapes and Townscapes	Nature, scale and number of facilities	0.00	1.00	0.76	0.42	0.66	0.72
Protect Local Amenity	Noise Impact	1.00	0.04	0.67	0.01	0.00	0.01
	Litter Impact	0.00	1.00	0.66	0.45	0.70	0.75
Minimise Local Transport Impact	Total Waste Kilometres	1.00	1.00	1.00	1.00	1.00	1.00
	Transport along roads other than motorways	1.00	1.00	1.00	1.00	1.00	1.00
Create Employment Opportunities	Number of jobs created	0.00	0.90	0.25	1.00	0.96	0.96
Opportunities for Public Involvement	Potential for participating in recycling/composting	0.00	0.66	0.98	1.00	0.98	0.98
Prudent Land use	Resource Depletion	0.00	0.13	0.97	0.37	0.30	1.00
	Land take	0.00	1.00	0.70	0.26	0.49	0.55
Reduce Greenhouse Gases	Total CO2 Emissions	0.00	0.78	0.94	0.64	0.72	1.00
Minimise Air Quality Impact	Human Toxicity	0.00	0.06	0.93	0.11	0.24	1.00
	Air Acidification	0.00	0.01	0.95	0.11	0.20	1.00
	Ozone Depletion	0.13	1.00	0.19	0.00	0.65	0.47
	Odour	0.00	1.00	0.66	0.45	0.70	0.75
	Dust	0.00	1.00	0.66	0.45	0.70	0.75
Minimise Water Quality Impact	Eutrophication	0.96	1.00	0.00	0.99	0.99	1.00
	Potential extent of water contamination	0.00	1.00	0.69	0.42	0.69	0.74
TOTAL VALUED PERFORMANCE SCORES		**6.1**	**16.0**	**15.0**	**11.3**	**13.3**	**16.0**

10 WEIGHTING OF SUSTAINABILITY INDICATORS

It is unlikely that each assessment criterion is of equal significance. It is therefore necessary to apply additional weight to those criteria which are of greater importance. At present there is no national guidance on the relative significance of each performance criteria.

A weightings consultation exercise has not as yet been carried out for Staffordshire and Stoke-on-Trent. In order to provide an example of such assessment, the results from a consultation exercise undertaken by the East Midlands Region Technical Advisory Board have been used and a summary of responses is given in Table 10.1.

Table 10-1
Weighting of EMRTAB Consultation Evaluation Criteria

OBJECTIVES			INDICATORS/CRITERIA		
Environmental Objectives	**Weighting**	**Ranking**	**Environmental Indicators**	**Weighting**	**Ranking**
1. To ensure prudent use of land and other resources	12.1%	2	a) Depletion of resources, such as wood, w	7.07%	3
			b) Landtake	5.05%	7
2. To reduce greenhouse gas emissions	6.1%	8	c) Greenhouse gases emitted	6.06%	5
3. To minimise adverse impacts on air quality and public health	23.2%	1	d) Emissions which are injurious to public h	8.08%	1
			e) Emisions contributing to air acidification	4.04%	12
			f) Emissions contributing to depletion of th	5.05%	7
			g) Extent of odour problems	3.03%	16
			h) Extend of dust problems	3.03%	16
4. To conserve landscapes and townscapes	4.0%	10	i) Extent of visual and landsacpe impacts	4.04%	12
5. To protect local amenity	4.0%	10	j) Extent of noise problems	2.02%	20
			k) Extent of litter and vermin problems	2.02%	20
6. To minimise adverse effects on water quality	7.1%	6	l) Emissions contributing to eutrophication	3.03%	16
			m) Extent of water pollution	4.04%	12
Socio-economic Objectives	**Weighting**	**Ranking**	**Socio-economic Indicators**	**Weighting**	**Ranking**
7. To minimise local transport impacts (congestion, severence, fear and	9.1%	4	n) Total waste kilometres (by mode)	5.05%	7
			o) Transport along roads other than motor	4.04%	12
8. To provide employment opportunities	3.0%	12	p) Number of jobs likely to be created	3.03%	16
9. To provide opportunities for public involvement and education	5.1%	9	q) Extent of opportunitites for public involvement and education (concerning	5.05%	7
Operational Objectives	**Weighting**	**Ranking**	**Operational Indicators**	**Weighting**	**Ranking**
10. To minimise the increased costs of waste management	8.1%	5	r) Costs of collection, management and disposal, including material and energy	8.08%	1
11. To ensure reliability of delivery	7.1%	6	s) Likelihood of implementation wihtin required timescale, taking account of maturity of technology, necessary level of public participation, and the need for	7.07%	3
Waste Management Policy Objectives	**Weighting**	**Ranking**	**Waste Management Policy Indicators**	**Weighting**	**Ranking**
12. To conform to waste policy	11.1%	3	t) Percentage landfill	5.05%	7
			u) Percentage recycled/composted	6.06%	5

11 SENSITIVITY ANALYSIS

The adopted approach for identifying the preferred option ensures that a number of significant indicators are addressed explicitly in arriving at a choice of option. However, the process has inherent uncertainties, associated with the choice of options, the chosen indicators and the weights derived for the indicators. To examine the robustness of the overall results, an examination of their sensitivity to these uncertainties should be undertaken.

Sensitivity analysis has been carried out by:

- *Sum all of the criteria or some of the criteria.* The eight options for consideration have been assessed by considering all the selected assessment criteria. A form of sensitivity analysis is to remove criteria and assess if and how the results change. This process has been undertaken by reducing the number of criteria from 21 (the assessment described and undertaken above) to a reduced number of 10. The assessment included in this sensitivity analysis comprise the WISARD related factors (eutrophication, acidification, depletion of resources, human toxicity, ozone depletion and global warming), deliverability, cost and conforming to waste policy. The results of this analysis are discussed below.

Further sensitivity analysis could be undertaken by:

- *Change weightings applied to each indicator.* This could be carried out by inverting the weightings, such that the highest weighted indicator becomes the lowest weighted indicator and vice versa. This analysis has been undertaken using EMRTAB weightings as an example; the results of this analysis are discussed below.

- *Addition of indicators.* Further indicators could be added if considered an issue by stakeholders, for example, aerosol emmissions from composting or dioxins from incineration. We have not included this type of sensitivity analysis in this study as it is considered the 21 criteria used reflect the full scope of sustainability objectives required for an assessment fo this type.

The results of a sensitivity analysis using inverted weightings for recycling and composting are presented in Table 11-1 and Table 11-2 Comparison of the ranked scores in, given in Table 11-1, shows that a weightings inversion has no effect on the ranked performance with regards to the preferred option assessment – Option 3 remains the preferred options and Option 0 remains as the least preferable option. Table 11-2 shows detailed overall valued performance scores determined on the basis of inverted weightings.

A similar assessment for the residual treatment options is also presented in Tables 11-3 and 11-4 and show that a weightings inversion puts the Autoclave option as the preferred option with EfW as second preference with all other residual treatment options remaining the same. The difference in scores between Autoclave and EfW is minimal with only 0.2 of a point between each facility type.

Table 11-1

Tier 2 - Sensitivity Assessment of Recycling and Composting Options using Inverted Regional Weightings

	Option 0	Option 1	Option 2	Option 3
TOTAL INVERTED REGIONAL WEIGHTED PERFORMANCE SCORES	23.91	62.33	66.55	84.23

	Option 0	Option 1	Option 2	Option 3
RANKED INVERTED REGIONAL WEIGHTED SCORES	4	3	2	1

Table 11-2

Tier 2 - Sensitivity Analysis Weighted Performance Scores for Recycling and Composting Options

Sustainability Objective	Sustainability Criteria	Option 0	Option 1	Option 2	Option 3
Minimise Costs	Net Present Value (£M)	4.04	1.49	0.77	0.00
Conform with Waste Policy	% Landfill	0.00	1.80	2.41	3.03
	% Recycling & Composting	0.00	1.80	2.41	3.03
Ensure Reliability of Delivery	Planning Likelihood, Operating Hours, etc.	5.05	2.03	0.00	1.82
Conserve Landscapes and Townscapes	Nature, scale and number of facilities	0.00	4.77	5.72	6.73
Protect Local Amenity	Noise Impact	4.71	3.08	0.00	0.25
	Litter Impact	0.00	1.50	1.80	2.02
Minimise Local Transport Impact	Total Waste Kilometres	4.04	1.76	1.05	0.00
	Transport along roads other than motorways	6.06	6.06	6.06	6.06
Create Employment Opportunities	Number of jobs created	0.00	2.96	4.12	5.05
Opportunities for Public Involvement	Potential for participating in recycling/composting	0.00	0.43	2.74	4.71
Prudent Landuse	Resource Depletion	0.00	1.52	1.68	2.02
	Landtake	0.00	5.59	5.83	6.73
Reduce Greenhouse Gases	Total CO2 Emissions	0.00	2.71	3.25	4.04
Minimise Air Quality Impact	Human Toxicity	0.00	3.22	3.48	5.05
	Air Acidification	0.00	5.07	5.48	8.08
	Ozone Depletion	0.00	3.63	3.70	6.73
	Odour	0.00	3.74	4.49	5.05
	Dust	0.00	3.49	4.19	4.71
Minimise Water Quality Impact	Eutrophication	0.00	3.53	4.77	6.06
	Potential extent of water contamination	0.00	2.15	2.60	3.03
TOTALVALUED PERFORMANCE SCORES		23.91	62.33	66.55	84.23

Table 11-3

Tier 3 - Sensitivity Assessment of Residual Treatment Options using Inverted Regional Weightings

	Baseline	EfW	AD	MBT (Bio)	MBT (RDF)	Autoclave
TOTAL INVERTED REGIONAL WEIGHTED PERFORMANCE SCORES	29.60	75.18	69.33	51.34	61.99	75.38

	Baseline	EfW	AD	MBT (Bio)	MBT (RDF)	Autoclave
RANKED INVERTED REGIONAL WEIGHTED SCORES	6	2	3	5	4	1

Table 11-4
Tier 3 - Sensitivity Analysis Weighted Performance Scores for Residual Treatment Options

Sustainability Objective	Sustainability Criteria	Baseline	EfW	AD	MBT (Bio)	MBT (RDF)	Autoclave
Minimise Costs	Net Present Value (£M)	0.00	4.04	2.48	2.48	2.48	2.48
Conform with Waste Policy	% Landfill	0.00	3.03	2.14	1.38	2.11	2.26
	% Recycling & Composting	3.03	3.03	3.03	3.03	3.03	3.03
Ensure Reliability of Delivery	Planning Likelihood, Operating Hours, etc.	5.05	2.26	3.42	2.63	0.00	0.01
Conserve Landscapes and Townscapes	Nature, scale and number of facilities	0.00	6.73	5.11	2.81	4.46	4.84
Protect Local Amenity	Noise Impact	4.71	0.20	3.18	0.03	0.00	0.05
	Litter Impact	0.00	2.02	1.34	0.90	1.41	1.51
Minimise Local Transport Impact	Total Waste Kilometres	4.04	4.04	4.04	4.04	4.04	4.04
	Transport along roads other than motorways	6.06	6.06	6.06	6.06	6.06	6.06
Create Employment Opportunities	Number of jobs created	0.00	4.56	1.26	5.05	4.87	4.83
Opportunities for Public Involvement	Potential for participating in recycling/composting	0.00	3.10	4.62	4.71	4.62	4.60
Prudent Landuse	Resource Depletion	0.00	0.26	1.95	0.75	0.60	2.02
	Landtake	0.00	6.73	4.70	1.76	3.27	3.71
Reduce Greenhouse Gases	Total CO2 Emissions	0.00	3.17	3.82	2.60	2.89	4.04
Minimise Air Quality Impact	Human Toxicity	0.00	0.29	4.70	0.56	1.24	5.05
	Air Acidification	0.00	0.06	7.67	0.91	1.64	8.08
	Ozone Depletion	0.89	6.73	1.27	0.00	4.37	3.19
	Odour	0.00	5.05	3.34	2.26	3.51	3.77
	Dust	0.00	4.71	3.12	2.11	3.28	3.52
Minimise Water Quality Impact	Eutrophication	5.82	6.06	0.00	5.98	6.02	6.03
	Potential extent of water contamination	0.00	3.03	2.08	1.29	2.10	2.25
TOTALVALUED PERFORMANCE SCORES		**29.60**	**75.18**	**69.33**	**51.34**	**61.99**	**75.38**

12 CONCLUSIONS AND DISCUSSION

By adopting the methodology described in this report it is possible to compare different options against a number of different assessment criteria. This assessment has considered a number of options within each of the three assessment tiers for management of waste in 2020 (assessment year) and are comprised of:

- Minimisation and re-use - Tier 1;
- Recycling and composting – Tier 2; and
- Residual treatment - Tier 3

Minimisation and Re-use

The preferred growth rate scenario assumes that the annual growth in MSW per household will start to decline after 2010 and from 2016 it is anticipated that there will no longer be an increase in waste arisings per household per year. It is assumed that minimisation and re-use initiatives, as part of the waste strategy will encourage the reduction of waste being created and any increase in total household waste will be attributable to the increase in houses built.

The introduction of waste minimisation and re-use initiatives can be co-ordinated at the County level so as to take advantage of an integrated public awareness campaign which would demonstrate clear and unified messages across the Districts and deliver potential cost savings associated with solitary communication campaigns and marketing materials.

Recycling and Composting

A total of four recycling and composting options were developed for appraisal in the Tier 2 analysis;

- **Option 0** – "Stay as you are target of 31% for household waste (equivalent to 28% of MSW)"
- **Option 1** – "Conservative target of 45% for household waste (equivalent to 41% of MSW)"
- **Option 2** – "Meet proposed National target of 50% for household waste (equivalent to 46% of MSW)"
- **Option 3** – "Exceed proposed National target 55% for household waste (equivalent to 50% of MSW)"

The Tier 2 recycling and composting assesses of each options against a total of 21 criteria (Environmental, Socio-Economic, Operational, and Waste Management Policy objectives). The result of the options assessment process identifies Option 3, 55% household recycling rate (50% MSW) as the preferred option with Option 0 31% recycling and composting scoring lowest of all options assessed. Option 3, 55% recycling and composting has been taken forward to the third tier (residual treatment) of the options assessment process.

Residual Treatment

Following the recycling and composting of waste, there is an element of the residual waste stream remaining. The waste hierarchy states that the treatment and recovery of waste to

recover value, heat and/or power is more beneficial than the disposal (the lowest level of the waste hierarchy) of residual waste. Tier 3 of the options appraisal focuses on identifying the technology process with the highest score, or lowest environmental, socio-economic, operational and policy impacts.

The range of technology processes assessed includes landfill (as the baseline situation) plus all other technology process that are deemed to be operational and achievable in the UK market. Currently, a significant proportion (circa 180,000 tonnes) of residual waste is treated at the Stoke-on-Trent incinerator. This incinerator, will be part of all future waste management options, and therefore has been included as a constant in the Tier 3 assessment. The non recycled and composted proportion of the waste stream, minus that residual waste sent Stoke is assessed with the technologies identified below:

- Energy from Waste;
- Mechanical Biological Treatment (MBT) (RDF);
- Mechanical Biological Treatment (Biostabilisation);
- Anaerobic Digestion; and
- Autoclave

The performance scores for the tier 3 assessment show an equal preference for both EfW and Autoclave based on the 21 assessment criteria with the baseline scenario scoring the lowest and therefore also indicating preference for higher diversion away from landfill.

Following this extensive three tier assessment process the final results for the preferred joint waste strategy option for Staffordshire and Stoke-on-Trent suggest a recycling and composting target of 55% of household waste (equivalent to 50% total MSW) by 2020 with all remaining residual waste[13] to either an energy from waste (EfW) or Autoclave facility. The preparation of the final waste strategy will require a decision as to which of these facilities is taken forward as the preferred option.

There are a number of comparisons which the City and County may wish to analyse when considering which technology is the preferred and most appropriate residual treatment option. Factors to consider may include;

- the extent to which the preferred technology is established and proven within this country;
- the predicted availability of sustainable markets for residual treatment output (autoclave RDF and EfW bottom ash);
- the ability to divert BMW from landfill;
- number of treatment stages and percentage of material requiring secondary landfill; and
- direct cost comparison

It is clear from the options assessment undertaken that the higher recycling performance option will conform to the highest ranking option. The conclusion therefore at this stage, in the absence of any local weighting, is that high recycling should form an essential part of the overarching framework for the Staffordshire and Stoke-on-Trent Municipal Waste Management Strategy, with little or no untreated waste to landfill and the remainder of the waste sent to a recovery process. This framework can be summarised as follows:

[13] Excluding rubble

- **Increased recycling:** Combined household recycling and composting target of 55% (equivalent to 50% of all MSW)
- **Recovering benefit from all remaining MSW:** Sending approximately 50%[14] of all MSW for recovery
- **Zero waste to Landfill:** Minimising all forms of waste to landfill through increased recycling followed by maximum recovery of all remaining residual waste, thus placing landfill as the last and final option

Agreement on the above outline strategic framework will enable development of the final MSW strategy. Assessment of the short to medium term needs with respect to improvements in recycling and composting can then also be made. The development of the strategy provides essential support to future contract procurement for MSW management.

[14] 5% of the MSW total is rubble which is recycled at the HWRCs, and therefore does not require further residual treatment. Government definitions exclude rubble from household waste recycling figures.