Paper (K)

Environmental Option Assessment BPEO

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1. Introduction

1. An analysis has sought to identify, through the application of Wizard a preferred option for the long term management of municipal and household waste in Wiltshire. The option identified needed to be compliant with a number of indicators established in accordance with the UK government's interpretation of the provisions of the Landfill Directive, and represent value for money. A major part of the analysis was to consider whether it was possible to identify an option that may be classified as the BPEO, within the constraints of the existing waste management contract framework, between Hills Minerals and Waste and Wiltshire County Council.

2. Alternative Waste Management Solutions and their Analysis

1. The necessity to develop an alternative approach to the management of waste in Wiltshire is being driven by legislative requirements that will seek to the encourage recycling and composting, recover value from the waste stream and divert the biodegradable fraction, of the residual waste stream, away from landfill. This will necessitate the introduction of new waste processing and treatment technologies into Wiltshire at one or a number of sites. A number of alternative approaches to meeting this challenge have been developed for analysis.

2. These options consider both solutions centred around the continuation of landfill disposal with the purchase of permits to make up any shortfall in performance and those that seek to deploy both established (in the UK) and innovative technological waste processing solutions. In seeking to set out a range of alternative solutions for analysis, two alternative service levels have been assumed. The first assumes that the predicted levels of service for 2005/06 are met and maintained throughout the project period and the second considers an enhanced service performance from kerbside activity. However, the cost of providing the enhanced kerbside recycling services has not been modelled within this analysis.

3. **In terms of the comparative environmental performance those options that deliver the requirements for recycling, composting and of the landfill directive, and those that seek to promote higher levels of recycling have a lower overall environmental impact**. This may be delivered through enhanced

kerbside collection or via a Mechanical Biological Treatment (MBT) facility. It may therefore be concluded that the first steps to be taken in delivering the long term waste management solution should be the consideration of improving and enhancing the performance of the recycling and green waste collection service provided at the kerbside. This may also include further development of the performance of the household recycling centres networks.

4. The alternative solutions identified for analysis are typical of the alternatives currently being considered elsewhere in England. The principal technological solutions currently favoured within the UK are based around MBT, with the residues directed to landfill, or combustion as a refused derived fuel/solid recovered fuel. However, the markets for refuse derived fuel (RDF) are currently underdeveloped, and therefore uncertain. The currently identified markets include cement kilns and power stations. In the future a limited number of specialised plants may be developed to take RDF from a number of centres or, alternatively, dedicated plants may de developed adjacent to the MBT sites. The WISARD modelling suggests that environmental performance, against a number of performance measures, may be enhanced if RDF is used for raising steam in preference to generating electricity.

5. The waste flow modelling suggests that a solution based on MBT may be capable of meeting the requirements of the Landfill Directive for a considerable part of the project period. However, over time, this may be reliant on the interpretation of the efficiency of the biological stage of the MBT process, by the regulators from the Environment Agency and the Department for Environment Food and Rural Affairs (DEFRA). It should be noted however that although the tonnage of biodegradable waste directed to landfill will be reduced, it is still likely to attract landfill tax at the standard rate, under current definitions.

6. It is apparent from the mass balance analysis that all of the viable, in terms of compliance with the Landfill Directive, alternative approaches examined are generally comparable and although the analysis suggests that some perform better than others, there is no clear preference in terms of the delivery of the landfill diversion targets and overall environmental performance between the alternatives examined.

7. In order to avoid the possibility of suffering financial penalties from the **Landfill Allowance Trading Scheme** (LATS) as a result of the inability to meet the required targets by the due dates, the adopted solution had to be capable of being delivered. The ability to deliver the adopted solution within the Wiltshire County Council (WCC) timeframe was therefore an overriding project objective. To this end it was necessary to examine the comparative risks associated with the delivery of the various technologies and ability of the market to deliver the required solution within the agreed timeframe.

8. The analysis was commissioned in order to facilitate the development of a medium to long term waste management solution for Wiltshire within the context of the existing contractual structure between Hills Minerals and Waste and WCC. It has taken as its starting point the current situation and assumed that WCC and District Councils will be able to meet their currently published targets for recycling and composting by 2006/07, and has identified and examined a number of possible waste management options for the future.

9. The options were systematically analysed using a number of tools in accordance with standard industry practice and a number of conclusions may be drawn:

- **The cost drivers associated with the continued landfill disposal of waste are a significant influence on the overall cost of an option. Those options that place most reliance on landfill as a disposal option are the most costly**
- **The recovery of waste through kerbside recycling has environmental benefits and reduces the overall waste treatment and disposal costs incurred (exclusive of collection costs)**
- **The systems incorporating MBT are relatively attractive in terms of both environmental performance and cost and may present a lower planning failure risk**
- **If an Energy from Waste EFW solution is proposed, analysis based on optimised waste collection vehicle movements suggests a two site solution may be preferable to a single site alternative**

3. Identification of Preferred Options for Assessment

1. In identifying the various options for evaluation a number of scenarios have been identified that represent a range of different approaches that Wiltshire County Council could follow. As a starting point for the analysis the base case option has been identified as the one that meets the currently published BVPI targets for the recycling and composting of household waste by 2005/06. This assumes that both the County and its Districts will be able to deliver the commitments set out within the Waste Management Strategy adopted in 2002, and that these levels of activity are maintained throughout the strategy period to 2025. The other options seek to deliver, by a variety of different means, a waste management solution for municipal wastes that takes account of the other statutory and non-statutory obligations within the assessment period.

3.1 Assessment Methodology

1. Each of the selected options have been modelled and projected over a 25 year period. In order to model realistic scenarios a number of assumptions have been made with regard to the following:

- Materials targeted via kerbside recycling schemes
- Kerbside recycling scheme and bring site capture rates
- Kerbside recycling scheme and bring site participation rates
- Recycling of bulky waste collected at the kerbside
- Recycling and waste minimisation education and awareness campaigns
- Annual growth in waste arisings
- Composition of the waste
- Process efficiencies of all treatment plants
- Composition of treatment plant residues and products
- Percentage of landfilled waste that is considered ‘active’
- Percentage of waste that is considered biodegradable

2. The assumptions vary according to each option and all assumptions are listed in the description of each option. It is assumed that treatment plants could become operational in 2009/10 at the earliest. Any delay could mean that Landfill Directive targets are not met.

3.2 Option Identification

1. A number of long term options were identified to enable a variety of future scenarios for Wiltshire to be investigated using modelling techniques. The long term options selected for consideration include a 'do nothing' approach which relies on landfill for the primary route of waste disposal. The other options include examples of currently available technologies for landfill diversion, namely Energy from Waste and Mechanical/Biological Treatment (MBT).

2. The recycling performance for each model falls into one of 2 distinct categories as follows:

3. **Baseline and Options 1, 2 and 3:** Recycling performance is increased to enable the County to meet their 30% statutory recycling and composting targets for 2005/06, with some improvement thereafter due to improving waste awareness of the participants in recycling schemes

4. **Options 4 to 10:** Recycling performance is maximised, through increased participation rates and the collection of kitchen food waste.

3.2.1 Baseline

Baseline meets statutory BVPI recycling and composting targets for 2005/06. Strategy will be driven by District Councils continuing kerbside collection services and HRC recycling. Landfill continues to be the principal disposal route for residual waste.

- Will not meet obligations set out within the Landfill Directive. Shortfall to be made up through purchase of tradeable permits.

3.2.2 Option 1

As baseline scenario, i.e. meets BVPI targets for 2005/06, but portion of residual waste treated through EfW in order to meet Landfill Directive targets.

- Meets Landfill Directive targets for 2020

3.2.3 Option 2

As baseline scenario, i.e. meets BVPI targets for 2005/06, with residual waste treated by MBT with residues disposed to landfill.

- Shortfall in meeting Landfill Directive targets

3.2.4 Option 3

As baseline scenario, i.e. meets BVPI targets for 2005/06, with residual waste treated by MBT with residues sent to EfW in order to meet Landfill Directive targets.

- Meets Landfill Directive targets for 2020

3.2.5 Option 4

Maximised dry recycling and composting by diversion of recyclable waste from kerbside collection. Residual waste to landfill for disposal. Although there is a shortfall in Landfill Directive targets, option 4 meets the Regional Waste Strategy target for household waste (51%).

- Shortfall in meeting Landfill Directive targets

3.2.6 Option 5

As option 4 but residual waste treated within a MRF/MBT plant to stabilise it prior to landfill disposal in order to meet landfill Directive targets.

- Meets Landfill Directive targets for 2020

3.2.7 Option 6

Maximised dry recycling and composting with portion of remaining residual waste treated by EfW in order to meet Landfill Directive targets.

- Meets Landfill Directive targets for 2020

3.2.8 Option 7

As option 5, but tests increased bio-stabilisation through MBT in order to meet or exceed the Landfill Directive.

- Exceeds Landfill Directive targets

3.2.9 Option 8

Maximised dry recycling and composting with all of remaining residual waste treated by EfW in order to exceed Landfill Directive targets.

- Exceeds Landfill Directive targets

3.2.10 Option 9

Maximised dry recycling and composting with all of remaining residual waste treated by MBT and the organic fraction of MBT outputs then sent to Anaerobic Digestion in order to exceed Landfill Directive targets.

- Exceeds Landfill Directive targets

3.2.11 Option 10

As option 4, with fixed third party contract for 100,000 tonnes of EfW, and 60,000-90,000 tonnes local bio-stabilising MBT, with RDF sent to energy recovery.

- 10a Assumes EfW and RDF sent to third party markets out of county
- 10b Assumes RDF is treated in county in an industrial boiler with a CHP unit. EfW still out of County

4. Waste Flow Analysis by Option

1. The waste flows through the ten options identified have been modelled using Excel, whereby the targeted materials for recycling and recovery are removed through various collection and bring systems and the remaining residual waste is then treated or disposed of using different technologies. The recycling performance for each model falls into one of 2 distinct categories as follows:

- Recycling performance is maximised to a degree that enables Wiltshire Local Authorities to meet their individual statutory recycling and composting targets for 2005/06.
- Recycling performance is maximised in order that they exceed statutory recycling and composting targets for 2005/06.

2. The residual waste treatment technologies have been identified from an assessment of waste management solutions being considered throughout England (2005).

4.1 Shortlist of Options

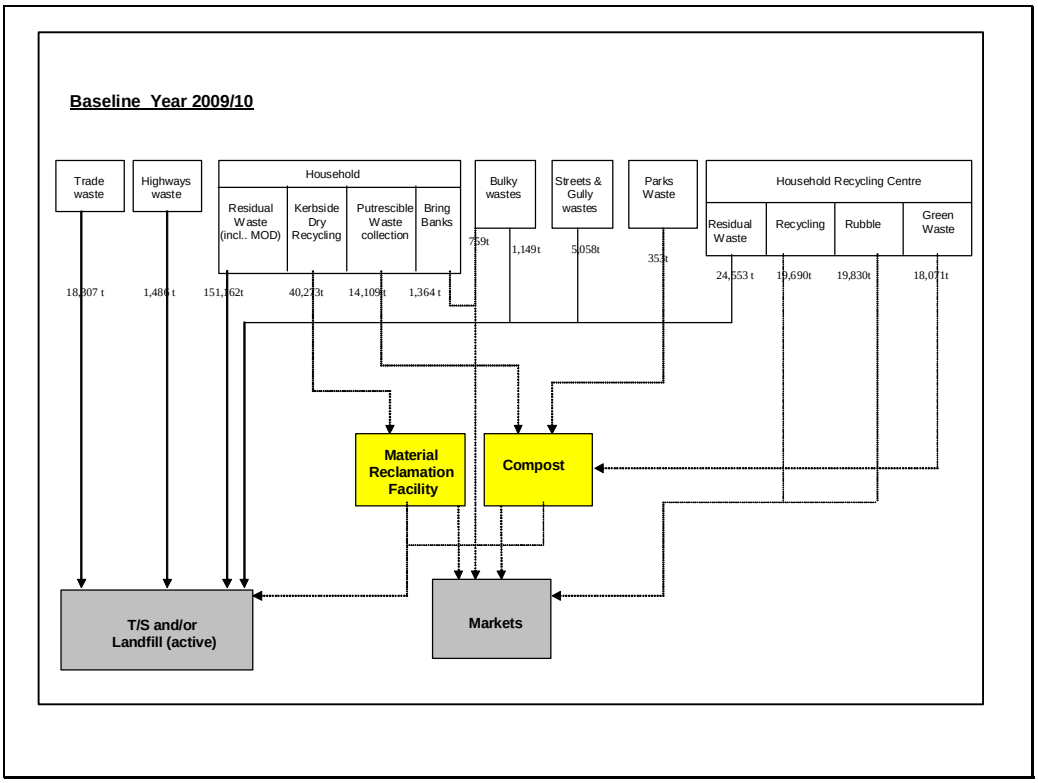
1. The waste flows through the ten options and the resultant performance against relevant national and local targets have been evaluated. A selection of options were further modelled using the WISARD life cycle assessment tool and the Facilities Locator tool.

2. The Baseline option represents the implications for the County if no further landfill diversion action is taken, other than meeting the statutory recycling targets for 2005/06. Options 1, 2 and 3 offer variations on the baseline, whereby no extra front-end recycling is implemented and only residual waste is treated in order to reduce the quantity of waste disposed of to landfill.

3. Options 4 to 10 are all based on enhanced front-end recycling and composting options being maximised, therefore increasing the quantity and/or variety of materials recycled from kerbside, bulky and household recycling centres.

4. Option 7 was not modelled as it was deemed to be the same as option 5, in that until a decision is made on the degree of stability of waste following an MBT process, it is not realistic at this stage, to assume that treatment by MBT will stabilise waste to such a degree that it will exceed landfill targets.

4.1.1 Baseline

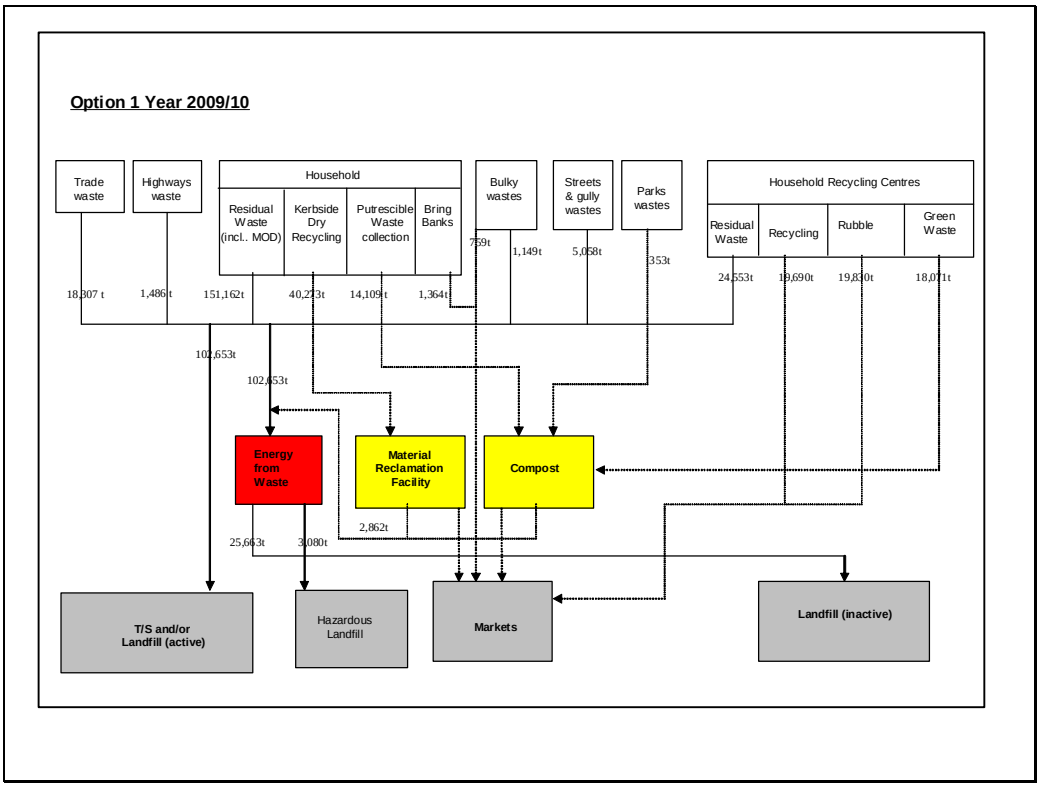


The Baseline model relies on all residual waste being disposed of via landfill. The baseline model assumes increased recycling and composting in order to meet statutory recycling targets for the districts and the county, but maintains the current method of residual waste treatment/disposal.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	30%	33%	36%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	35%	38%
WS 2000 Recovery	40%	45%	67%

4.1.2 Option 1

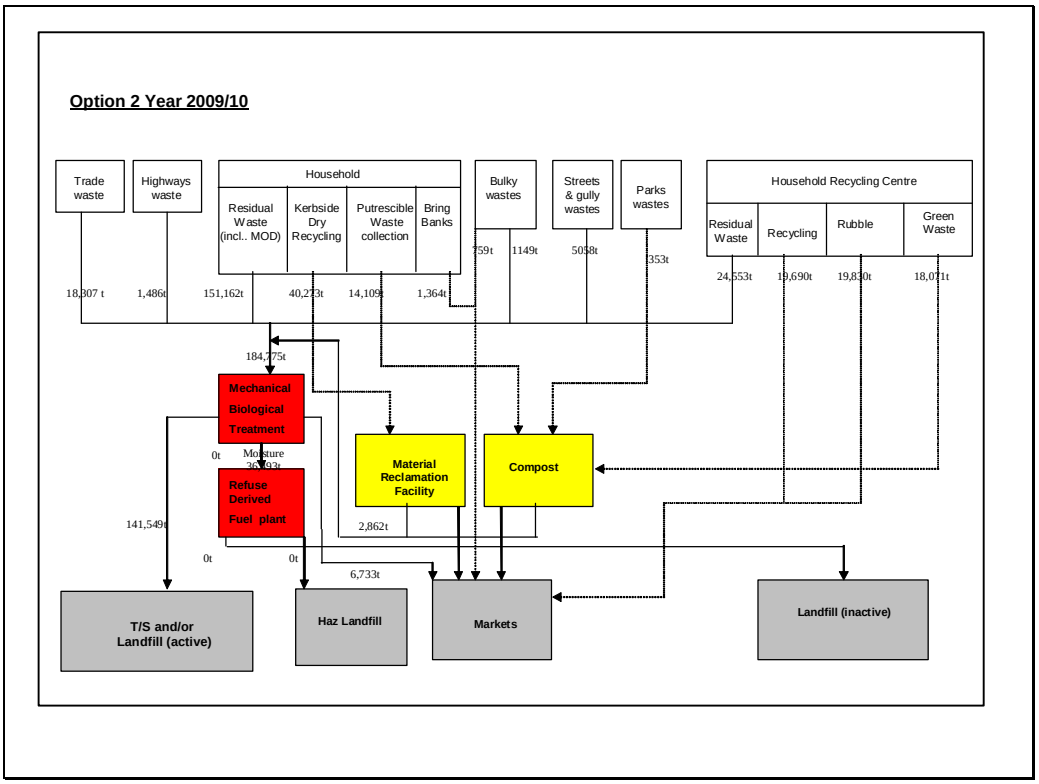


Option 1 assumes that the statutory recycling targets are met and introduces an EfW plant at year 2009/10. A proportion of the residual waste is treated via the EfW plant in order to meet the Landfill Directive targets for the following year. As the years progress, so the proportion of residual waste sent to the EfW increases in order that the landfill directive targets are met for each target year. The remaining proportion of residual waste is disposed of directly to landfill.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	30%	35%	38%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	68%	81%
WS 2000 Recovery	40%	45%	67%

4.1.3 Option 2

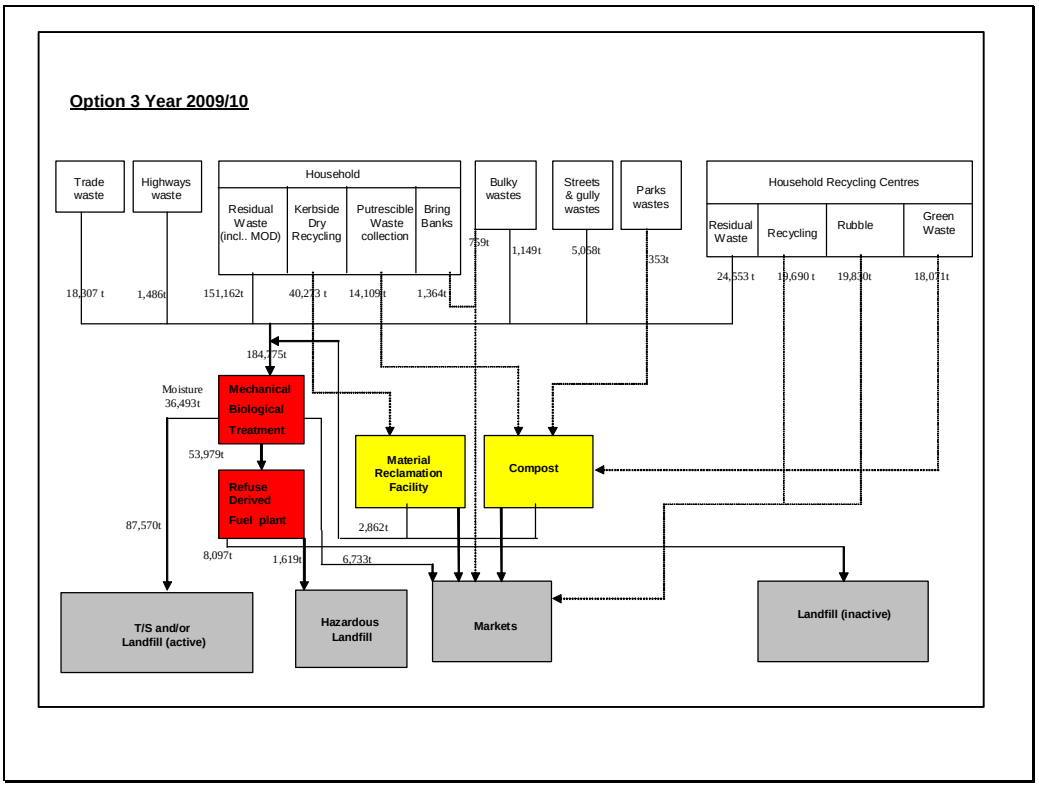


Option 2 also assumes the statutory recycling targets are met and introduces and MBT plant at year 2009/10 in order to try and meet the Landfill Directive target for the following year. It is assumed that the MBT plant produces RDF, which is landfilled together with the MBT residue. Materials separated for recovery and recycling are directed to the relevant markets.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	30%	36%	39%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	37%	40%
WS 2000 Recovery	40%	45%	67%

4.1.4 Option 3 and 3a



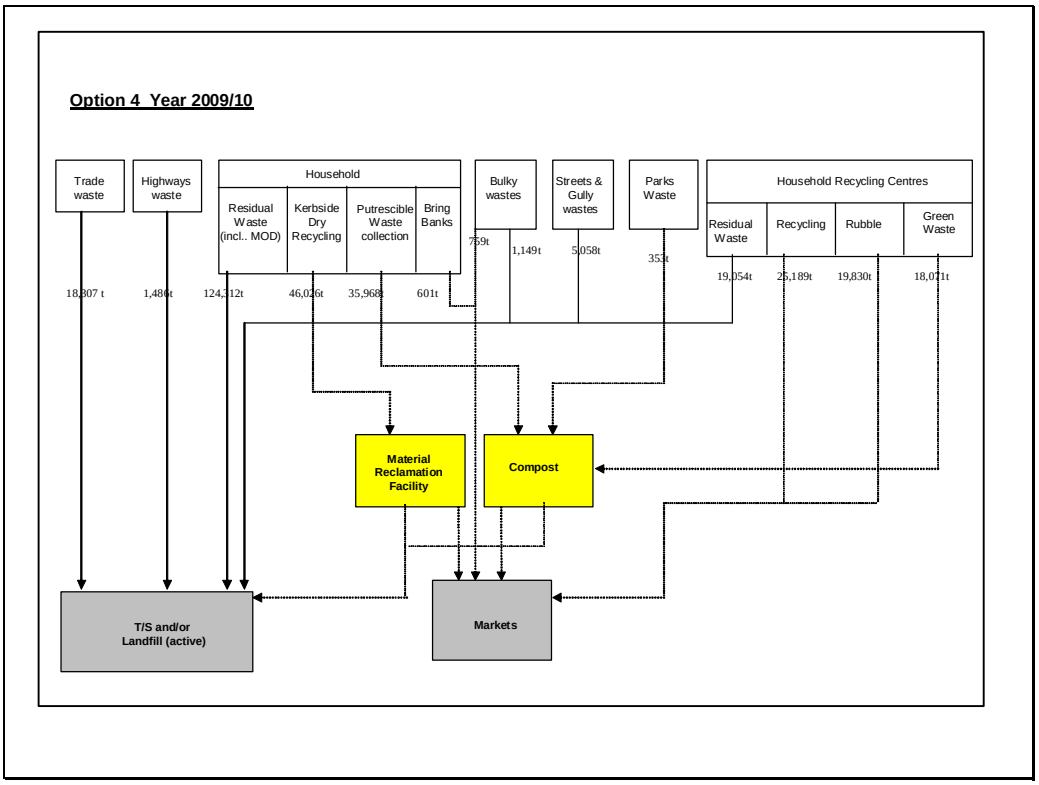
Option 3 assumes that statutory recycling targets are met and also introduces an MBT plant at year 2009/10. The RDF produced via the MBT process is sent for combustion to ensure all Landfill Directive targets are met. The residues from the MBT process are disposed of via landfill and the materials separated for recovery and recycling are directed to the relevant markets.

Two variations on the RDF combustion have been modelled in WISARD; OPTION 3a models the impacts of RDF combustion in a specific EfW plant, whereas option 3 models the effects of burning RDF as a replacement fuel in an industrial process. There are notes as Options 3 and 3a in the WISARD analysis.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	30%	35%	38%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	54%	56%
WS 2000 Recovery	40%	45%	67%

4.1.5 Option 4



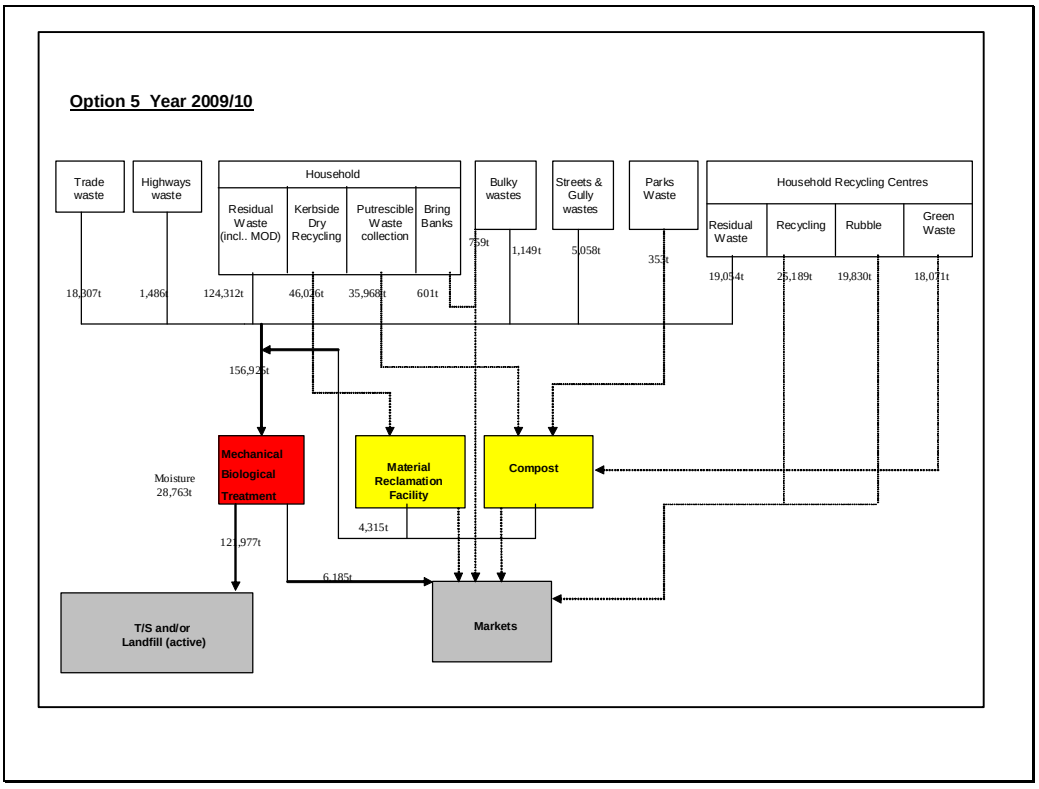
Option 4 assumes that recycling and composting are maximised in order to exceed statutory targets. All remaining residual waste is then sent to landfill. Option 4 only differs from the baseline model in so far as the increased recycling performance and therefore less residual waste disposal is required.

Key Target Indicators

	2005/06	2010/11	2015/16

Recycling Rate	31%	45%	52%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	46%	52%
WS 2000 Recovery	40%	45%	67%

4.1.6 Option 5



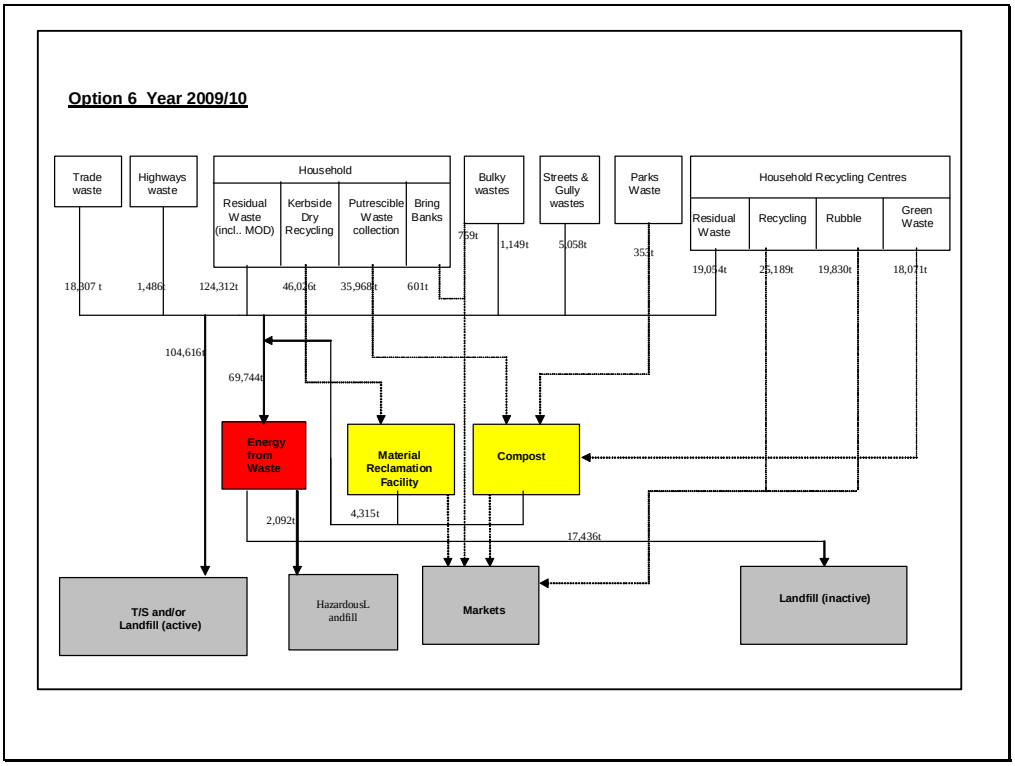
Option 5 assumes that recycling and composting are maximised in order to exceed statutory targets. All remaining residual waste is treated through an MBT plant, introduced in the year 2009/10, in an attempt to meet the Landfill Directive target for the following year. It is assumed that the MBT plant produces RDF, which is landfilled together with the MBT residue. Materials separated for recovery and recycling are directed to the relevant markets. Option 5 only differs from Option 2 in so far as the increased recycling performance and therefore less residual waste treatment is required.

Key Target Indicators

	2005/06	2010/11	2015/16

Recycling Rate	31%	47%	54%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	48%	53%
WS 2000 Recovery	40%	45%	67%

4.1.7 Option 6



Option 6 assumes that the statutory recycling targets are exceeded and a portion of residual waste is disposed of via an EfW plant, introduced in 2009/10. As the years progress, so the proportion of residual waste sent to the EfW increases in order that the landfill directive targets are met for each target year. The remaining proportion of residual waste is disposed of directly to landfill. Option 6 only differs from Option 1 in so far as the increased recycling performance and therefore less residual waste treatment capacity is required.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	31%	45%	52%
Statutory Recycling	30%		

WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	61%	81%
WS 2000 Recovery	40%	45%	67%

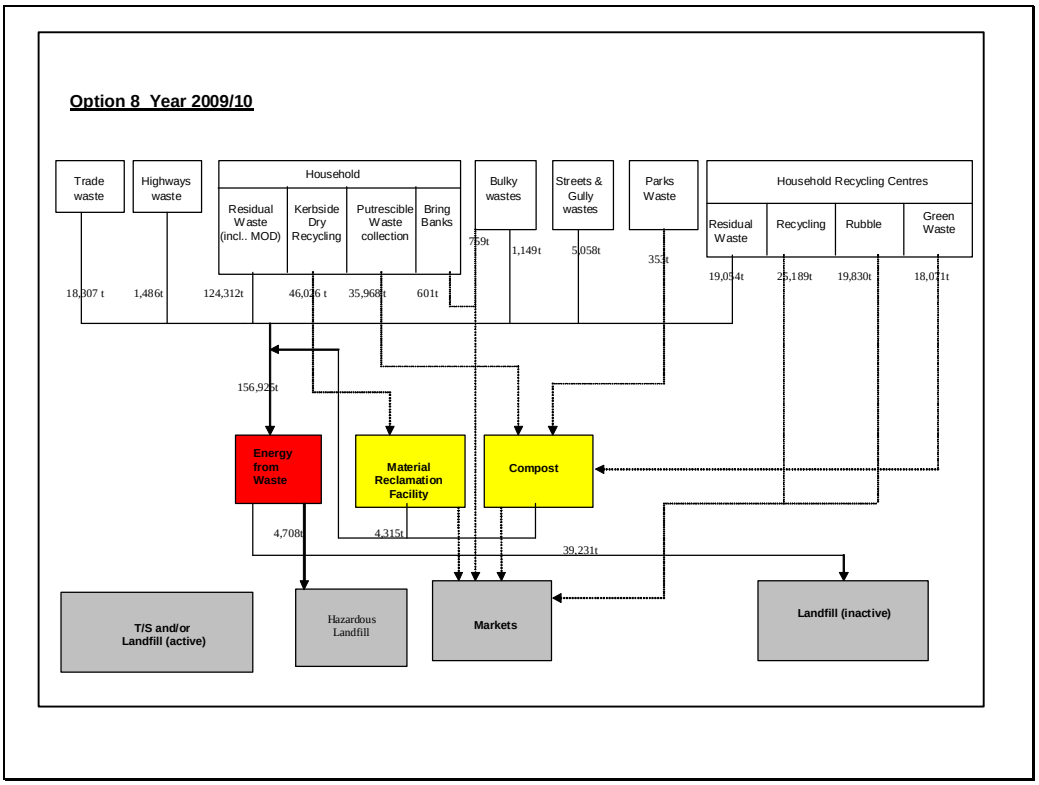
4.1.8 Option 7

Option 7 is not shown as it has the same mass-flow and performance as Option 5. As Option 5 does not meet these critical targets after about 2015, this option was originally developed to test what configuration of bio-stabilising MBT would be required to meet the long-term Landfill Directive targets, without any reliance on RDF outlets.

The biodegradability of the residual fraction would need to be reduced by over 50% for this option to meet the 2019/20 Landfill Directive targets. Since this landfilled fraction contains the paper-rich RDF component, and the model already assumes that the compost fraction is completely stabilised, we do not consider that this level of stabilisation can be justified at this time.

Option 7 could result in heavy fines under the Landfill Directive if such MBT systems cannot stabilise mixed waste to such a high degree prior to landfill. Therefore, until a decision is made on the degree of stability of waste following an MBT process, this Option has not been considered any further. This uncertainty can be reduced and managed if the RDF fraction is sent for energy recovery, and/or the compost fraction is sent to anaerobic digestion instead of landfill, as modelled in Options 3 and 9.

4.1.9 Option 8

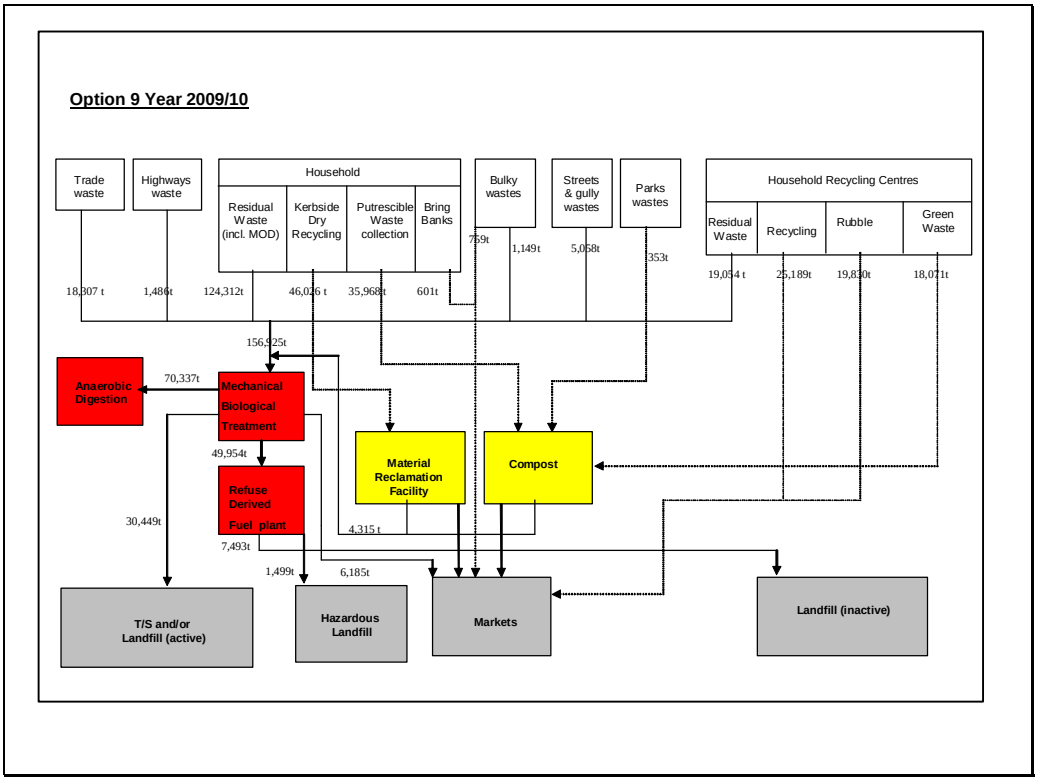


Option 8 assumes that recycling targets are exceeded and introduces an EfW plant in 2009/10 to dispose of all remaining residual waste to ensure that all Landfill directive targets are exceeded.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	31%	45%	52%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	94%	96%
WS 2000 Recovery	40%	45%	67%

4.1.10 Option 9

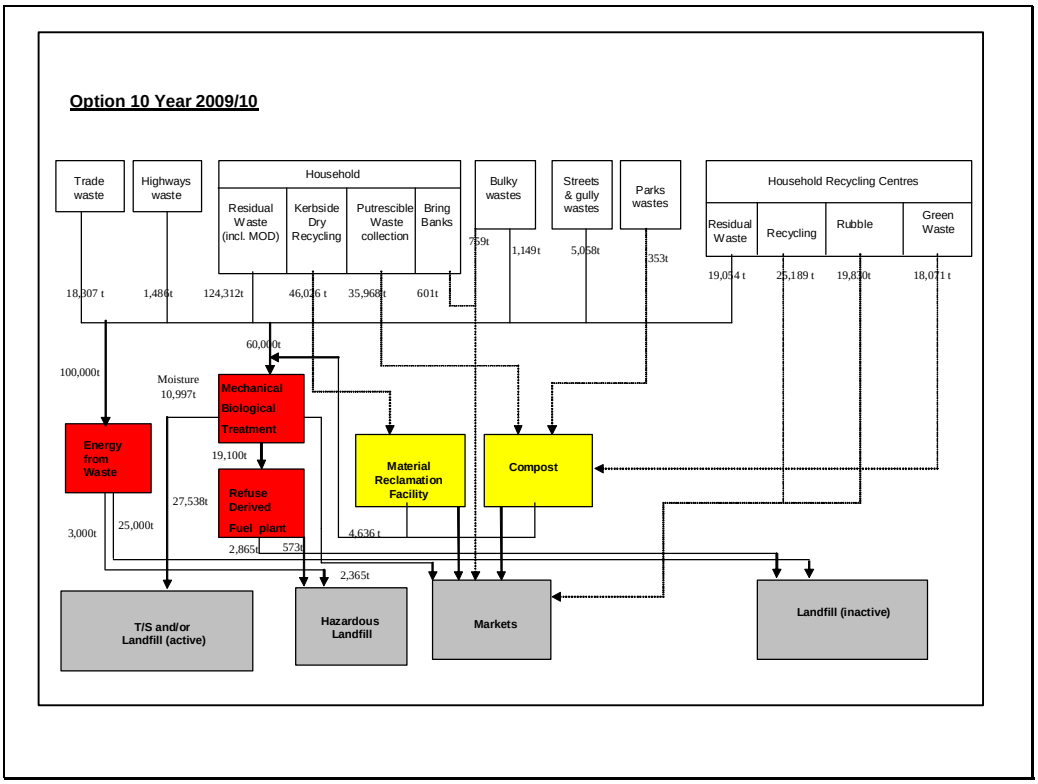


Option 9 assumes that statutory recycling targets are exceeded and employs a range of technologies to treat the remaining residual waste. Firstly, the residual waste is mechanically treated allowing the production of RDF and the separation of materials for recycling and recovery. The organic fraction of the mechanically treated waste is then processed via an Anaerobic digestion (AD) plant, whilst the RDF is combusted in and RDF plant [or industrial process]. The AD plant produces digestate, liquor and biogas, which must all be marketed or landfilled, however the material sent into the AD process counts towards recycling targets.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	36%	68%	71%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	36%	82%	84%
WS 2000 Recovery	40%	45%	67%

4.1.11 Option 10a and 10b



Option 10 assumes that statutory recycling targets are exceeded and employs a hybrid of both Energy from Waste (EfW) and Mechanical-Biological Treatment (MBT).

Firstly, the residual waste is mechanically treated allowing the production of RDF and the separation of materials for recycling and recovery. The compost-like outlet us assumed to be landfilled as a bio-stabilised material together with the other residues from the MBT process.

Two variations on the end use of the RDF have been analysed in the environmental and financial sections of this report; Option 10a assumes that RDF is sent to third party markets out of county and10b assumes RDF is treated in county in an industrial boiler with a combined heat and power outlet.

Key Target Indicators

	2005/06	2010/11	2015/16
Recycling Rate	31%	45%	53%
Statutory Recycling	30%		
WS 2000 Recycling	25%	30%	33%
Recovery Rate	33%	83%	85%
WS 2000 Recovery	40%	45%	67%

5. Performance Against Targets

1. A summary table (5.1) is shown below to illustrate which options perform well against various targets. It is obvious that the options which use landfill as the only disposal route (baseline and option 4) will not meet any of the Landfill Directive targets. Whilst this is influenced by the underlying waste growth assumptions, even raising the recycling rates to 51%, does not remove sufficient biodegradable waste. Achieving such a high recycling rate would be a very ambitious undertaking, particularly given the fact that the current top twenty performing council in England currently achieve an average of 31% BVPI recycling.

2. Options 2 and 5 meet the Landfill directive targets for 2010 and 2013 only, which demonstrates that MBT without combustion of RDF will not divert enough biodegradable waste from landfill. However, a sensitivity analysis has been undertaken to understand how differing levels of stability of MBT residues can affect whether the technology will allow Wiltshire to meet Landfill Directive targets (see section 5.5).

3. Only the options which involve combustion of waste in some form will meet all of the Landfill directive targets. All options meet the National Recycling targets and the statutory target for 2005/06, but only options 4 to 10 meet the local recycling target of 51% by 2020 (meeting the South West Regional Assembly's aspiration to divert 80% of waste from landfill by 2020). However the sensitivity analysis on MBT residues must also be taken into account, as well as environmental performance and overall cost implications.

4. Option 3, whilst meeting the Landfill Directive requirements, only recovers value from about 55% of municipal waste. It is possible that the performance of the

option could be improved if more of the compost type fraction were turned into RDF. However it would eventually become questionable whether this system has any benefits over sending the waste direct to an energy from waste facility. It may also be possible that part of the moisture-loss in the MBT process could be counted with the RDF as contributing to recovery targets (as it comparable to the drying that occurs in conventional energy from waste systems).

5. The MBT systems can work in concert with EfW, by preparing a specialised refuse-derived fuel, which is then sent to smaller energy from waste facilities or industrial boilers. Option 10 also examines the use of both systems, using fixed capacity contracts for the whole period.

6. The use of Anaerobic Digestion in Option 9 to treat the compost-like outputs from the MBT process would dramatically improve the recycling rates, and reduce the reliance on landfill. If marketable compost can be produced, this would reduce the possibility of failing the Landfill Directive targets compared to the other MBT options.

7. When considering performance against targets, Options 6, 8, 9 and 10 are the most favourable options, however the sensitivity analysis on MBT residues in the next section must also be taken into account, as well as environmental performance and overall cost implications.

5.1 Summary Analysis - Performance Against Targets

	Landfill Directive Targets			National Recovery Targets			National Recycling Targets			Statutory/ Regional Targets	
	2010	2013	2020	2005	2010	2015	2005	2010	2015	2005	2020
Baseline	×	×	×	×	×	×	✓	✓	✓	✓	×
Option 1	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	×
Option 2	✓	✓	×	×	×	×	✓	✓	✓	✓	×

Option 3	✓	✓	✓	×	✓	×	✓	✓	✓	✓	×
Option 4	×	×	×	×	×	×	✓	✓	✓	✓	✓
Option 5	✓	✓	×	×	✓	×	✓	✓	✓	✓	✓
Option 6	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
Option 8	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
Option 9	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
Option 10	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓

5.2 Sensitivity analysis on MBT treatment

1. In the model for options 2 and 5, the MBT residues are assumed to be 50% stabilised, whereas for option 3 and 10 they are assumed to be 85% stabilised[1]. A sensitivity analysis has been conducted on the extent of stabilisation provided by MBT technology in order to understand the implications of greater stability on meeting the landfill directive targets. It is understood that the Environment Agency will announce their decision on the degree of waste stabilisation achieved from MBT processes, in the near future. It must be understood that MBT processes and technologies can differ greatly and will result in different levels of stability. The sensitivity analysis was conducted on options 2, 3 and 5 and used 25%, 50% and 85% as levels of residue stability. The results are summarised in Table 5.3.

2. The 25% level would become relevant if the landfilled compost fraction were not counted as completely stabilised in Option 2 and 5, which use bio-stabilising MBT, without use of the RDF. In this case Options 2 and 5 would also fail the 2012/13 targets. Similarly the stabilisation in Option 3 and 10 could drop from 85% to 50% if the compost were not completely stabilised. In this case Option 3 would fail the longer term 2019/20 target onwards. This analysis highlights the need to resolve the stabilisation issue, and to examine this key uncertainty closely when contracting for any technology.

3. Option 9 is capable of reducing this uncertainty by treating the compost in an anaerobic digestion system, which we consider could produce a marketable product.

[1] This difference in the level of residue stabilisation is due the landfilling of RDF in options 2 and 5. Option 3 and 10 send RDF for energy recovery. RDF contains biodegradable material and therefore if it is not landfilled with the residue then the stabilisation is decreased.

Option 10 would continue to meet the Landfill Directive targets under all three tests, due to the twin use of RDF outlets and an EfW facility.

4. The sensitivity analysis shows that if it is agreed by the Environment Agency that MBT processes can stabilise residues by 85% or more then the landfill directive targets will be met for all Options. However, we consider this to be unachievable for bio-stabilising MBT systems, where the RDF fraction is also sent to landfill (Options 2 and 5). Uncertainties over the degree of stabilisation of the compost fraction could be managed through using anaerobic digestion, as modelled in Option 9. Alternatively more of the compost fraction to be combusted with the RDF, as it is relatively dry and stable.

5. Those options including Energy from waste facilities do not encounter this issue, as all the biodegradable content of the waste is destroyed through the combustion process. Similarly sending the RDF fraction for energy recovery, as in Option 3, 9 and 10, dramatically increases certainty of compliance with the Landfill Directive.

5.3 Sensitivity analysis on stability of MBT residues and performance against landfill directive targets

	Residue (25% stable)			Residue (50% stable)			Residue (85% stable)		
	2009/10	2012/13	2019/20	2009/10	2012/13	2019/20	2009/10	2012/13	2019/20
Option 2	✓	×	×	✓	7	×	✓	✓	✓
Option 3	✓	×	×	✓	✓	×	✓	✓	✓
Option 5	✓	×	×	✓	✓	×	✓	✓	✓
Option 10	✓	✓	✓	✓	✓	✓	✓	✓	✓

5.4 Processing and treatment capacities

1. The table below sets out the anticipated treatment and processing capacities required in 2009/10 for each option. The MRF/Bulking Station will be required to process all dry recyclables and therefore the capacity of the facility is calculated by adding the kerbside dry recyclables, the bring banks materials and the bulky waste

recyclables. The windrow composting plant accepts the garden waste collected at the kerbside as well as the garden waste collected at the HRCs and the parks waste. The in-vessel composting plant is required to compost kitchen waste under the Animal By Products Regulations.

2. Residual waste is sent directly to active landfill in various options and the MBT residues are also sent to active landfill. The bottom ash from EfW technologies attracts the lower rate of landfill tax and can therefore be sent to an inert landfill. Inert landfill has not been accounted for in Table 5.5.

3. Table 5.5 illustrates that if residual waste is treated then only half the landfill capacity is required compared to that which is needed if landfill is the only disposal option. It is assumed that treatment plants will become operational in 2009/10 and therefore the table shows the minimum capacities required as annual waste growth rates will mean extra capacity is required for the years to follow 2009/10.

5.5a Summary of Processing and Treatment Capacities required for 2009/10 (tonnes per annum) (rounded figures)

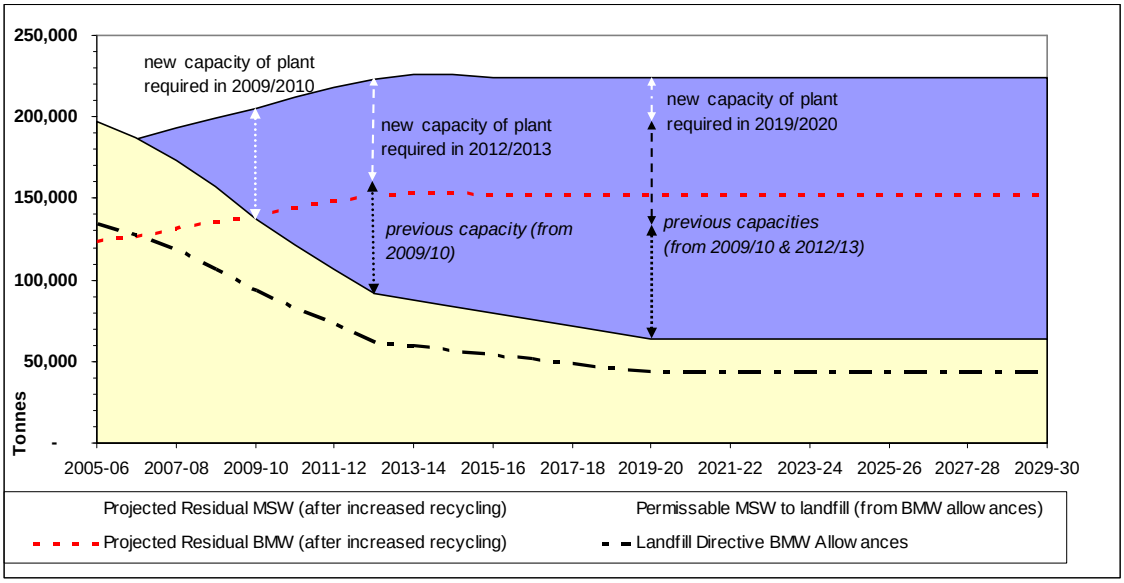
Options	MRF/ Bulking Station	Windrow	In-vessel	EfW	MBT	RDF	AD	Active Landfill
Baseline	40,000	33,000	Nil	Nil	Nil	Nil	Nil	205,000
Option 1	40,000	33,000	Nil	103,000	Nil	Nil	Nil	131,000
Option 2	40,000	33,000	Nil	Nil	185,000	Nil	Nil	162,000
Option 3	40,000	33,000	Nil	Nil	185,000	54,000	Nil	110,000
Option 4	46,000	35,000	20,000	Nil	Nil	Nil	Nil	174,000
Option 5	46,000	35,000	20,000	Nil	157,000	Nil	Nil	139,000
Option 6	46,000	35,000	20,000	70,000	Nil	Nil	Nil	124,000
Option 8	46,000	35,000	20,000	157,000	Nil	Ni	Nil	61,000
Option 9	46,000	35,000	20,000	Nil	157,000	50,000	72,00	49,000
Option 10	46,000	35,000	20,000	100,000	60,000	19,000	0 Nil	49,000

5.5b Summary of Processing and Treatment Capacities required for 2019/20 onwards (tonnes per annum, rounded figures)

Options	MRF/ Bulking Station	Windrow	In-vessel	EfW	MBT	RDF	AD	Active Landfill
Baseline	53,000	43,000	Nil	Nil	Nil	Nil	Nil	224,000
Option 1	53,000	43,000	Nil	219,000	Nil	Nil	Nil	103,000
Option 2	53,000	43,000	Nil	Nil	246,000	Nil	Nil	177,000
Option 3	53,000	43,000	Nil	Nil	246,000	73,000	Nil	120,000
Option 4	64,000	48,000	30,000	Nil	Nil	Nil	Nil	175,000
Option 5	64,000	48,000	30,000	Nil	192,000	Nil	Nil	140,000
Option 6	64,000	48,000	30,000	160,000	Nil	Nil	Nil	93,000
Option 8	64,000	48,000	30,000	192,000	Nil	Nil	Nil	
Option 9	64,000	48,000	30,000	Nil			81,000	
Option 10	64,000	48,000	30,000				Nil	

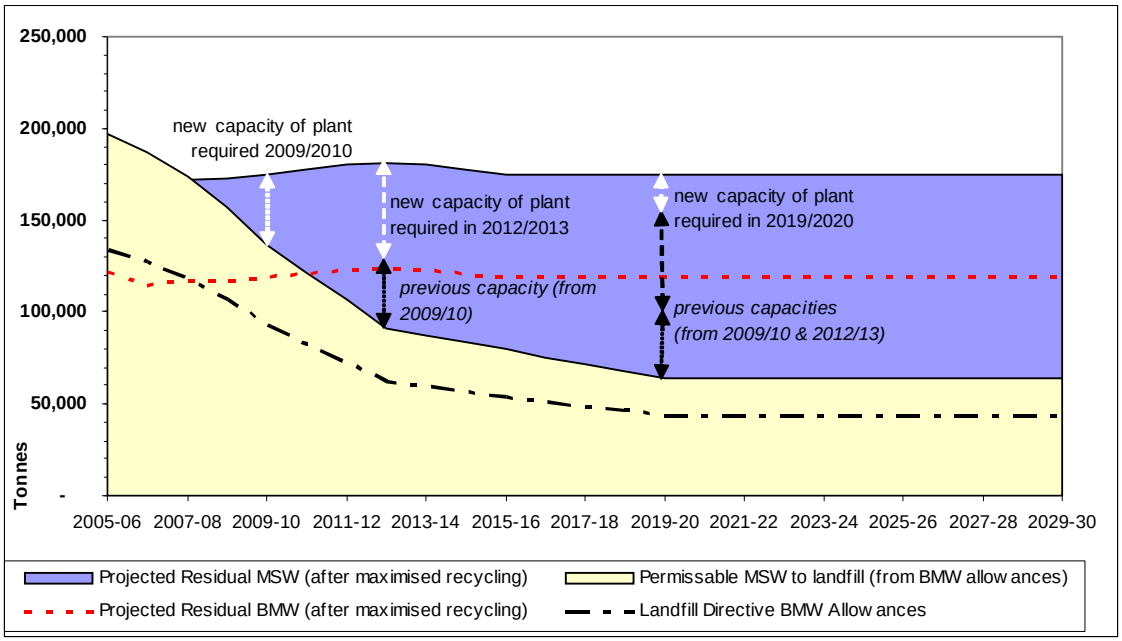
6. Identification of long term residual waste treatment capacity

6.1 New Residual waste treatment capacity required for Landfill Directive target years (after increased recycling)



1. Figures 6.1 and 6.2 illustrate the residual waste treatment capacity required in order meet the Landfill Directive targets. The figures above illustrate the predicted quantity of BMW landfill allowances. It is assumed that the BMW constitutes 68% of the waste and therefore the quantity of MSW that can be landfilled has also been represented. It is evident from the modelling exercise that, even after recycling has taken place, there is a considerable quantity of residual waste that requires treatment or disposal. The gap between the allowable and the actual MSW to landfill is represented on each chart with a white arrow. The approximate capacity of plant required is then calculated for each Landfill Directive target year. It is assumed that for the intervening years extra capacity may be developed or landfill permits may be purchased. The figures are summarised in the table below.

6.2 New residual waste treatment capacity required for Landfill Directive Target Years (after maximised recycling performance)



2. It should be stressed that the capacities shown in Table 4.5 are for illustrative purposes and the actual capacity of treatment systems will depend upon the type of process and waste streams being targeted. For example it may be that smaller facilities are required if only certain biodegradable fractions (such as kitchen waste) were targeted for treatment. Alternatively, larger facilities (e.g. MBT) would be needed if they are not 100% efficient at removing the biodegradable portion of the waste prior to landfill.

Table 1: Residual waste treatment capacities required for Landfill Directive target years (tonnes per annum)

	2009/10	2012/13	2019/20	Cumulative Total
Residual treatment capacity required if **meet** statutory recycling targets	68,000	64,000	28,000	160,000
Residual treatment capacity required if **exceed** statutory recycling targets and source segregation implementation	3,000	57,000	28,000	88,000