Tees Valley Joint Waste Management Strategy

Supporting Document – Options Appraisal

June 2008













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Darlington, Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton on Tees Borough Councils

Tees Valley Joint Waste Managment Strategy

Supporting Document - Options Appraisal

June 2008

Entec UK Limited

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Contents

1. Introduction

1.1 Terms of Reference

In January 2007, the Tees Valley Joint Strategy Unit commissioned Entec to provide technical assistance in the development of its Joint Waste Management Strategy (JWMS), using funding awarded by Defra (Department for the Environment, Farming and Rural Affairs). To support the Headline Strategy, Entec has produced a series of supplementary reports which provide technical waste management information and discuss in further detail the considerations used in developing the Strategy.

This supplementary report describes the options development process which culminated in the selection of a draft Preferred Option which is subject to wider consultation.

2. Options Workshop

2.1 Introduction

Entec invited a selection of stakeholders to the joint strategy workshop on the 23 March. At this time the Strategy process included Hartlepool Borough Council (BC), Middlesbrough BC, Redcar and Cleveland BC and Stockton on Tees BC with Darlington BC joining the process at a later date. However, Darlington BC was part of this process as a stakeholder at this stage.

The stakeholders to this process were identified by the Tees Valley Joint Strategy Unit and included council employees, commercial stakeholders and other individuals who have an interest in the successful delivery of the strategy. Table 2.1 shows the attendees of the stakeholder workshop.

Table 2.1 Stakeholder Delegates – 23 March

Name		Organisation
Mark	Atkinson	SITA Tees Valley
Helen	Birdsall	Tees Valley Joint Strategy Unit
John	Buxton	Darlington Borough Council
James	Campbell	Oneholmes Farm
Alex	Conti	Redcar & Cleveland Borough Council
James	Cook	R. Newcombe and Sons Ltd
Joanne	Cooper	Environment Agency
Andrew	Craig	Tees Valley Joint Strategy Unit
Kevin	Cranney	Owtan Fens Community Association
Colin	Dickinson	Premier Waste Management Ltd
Andrew	Dowd	PD Ports
Jim	French	PD Ports
Ian	Halson	Abitibi Consolidated Recycling

Name		Organisation
Chris	Hayward	Renew Tees Valley Ltd
John	Hill	The Environment Agency
Mark	Howard	Alab Environmental
Vikki	Jackson-Smith	J&B Recycling
Fay	MacKenzie	Tees Valley Joint Strategy Unit
Allan	McPartlin	Owtan Fens Community Association
Laura	Owen	Tees Valley Climate Change Partnership
Sophie	Pauling	Agrivert
Marconi	Rolando	Middlesbrough Council
Dale	Rowbotham	Stockton on Tees Borough Council
Neil	Schneider	Stockton on Tees Borough Council
Phillippa	Scrafton	Darlington Borough Council
Ken	Sherwood	Middlesbrough Council
David	Sowells	SITA Tees Valley
Jonathan	Spruce	Tees Valley Joint Strategy Unit
Fiona	Srogi	Hartlepool Borough Council
Paul	Stiller	Stiller Group
Dave	Stubbs	Hartlepool Borough Council
Paul	Taylor	Redcar & Cleveland Borough Council
Andrew	Thompson	A&E Thompson
Elizabeth	Thompson	A&E Thompson
Simon	Waller	Redcar & Cleveland Borough Council
Janette	Welford	Redcar & Cleveland Borough Council

2.2 Aims and Objectives

As the first key stakeholder event, the aim of the Options Workshop was:

- To inform key stakeholders about the waste management issues in Tees Valley;
- Encourage active discussion about waste management in Tees Valley;
- Receive feedback and refine the Strategic Options;
- To provide sufficient feedback to allow Entec to progress Options Assessment.

A number of Strategic Principles were developed by the Steering Group prior to the workshop and assisted in providing overarching objectives for the study. These Principles are:

- To reduce waste generation;
- To be achievable and affordable;
- To work towards zero landfill;
- To minimise the impact on climate change;
- To have an accountable and deliverable structure;
- To contribute towards economic regeneration.

2.3 Presentations

The first session of the workshop commenced with a series of presentations which outlined the basis for this project, for example various policy and guidance changes including the Landfill Allowance Regulations and new Defra guidance on Joint Municipal Waste Strategies (JMWS) since the development of the previous study in 2002.

The presentation outlined what the new strategy is planned to achieve based on these changes. In summary it is necessary to:

- Review the existing Tees Valley JWMS and Darlington Waste Management Strategy and identify the progress since 2002;
- Assess the assumptions in current strategies e.g. waste growth, waste composition, recycling rates etc. against actual data;

- Develop and assess realistic and achievable options and strategies for meeting and exceeding targets;
- Consider other key documents e.g. Sub-Regional Minerals and Waste Plan and Regional Strategy;
- Consider other local waste strategies;
- Include extensive consultation (voluntary and statutory) with key local, sub-regional and regional stakeholders;
- Provide a strategy that meets the needs of the Councils and allows LATS targets to be met and potentially exceeded by 2020;
- Fit with local and regional planning policies;
- The strategy should form the basis for any future procurement exercises;
- Fit with current and foreseeable development in UK and European sustainable waste management practice.

This presentation was followed by a basic introduction to the current waste management service offered by each Council and a summary of the achievements made since 2002.

2.4 Session 1

2.4.1 Workshop

The first workshop of the day involved the stakeholders being split into four groups, with the facilitators ensuring that each group included stakeholders with mixed expertise. The groups were posed a series of questions designed to provoke discussion within the groups. The main discussion points are highlighted below together with the collated responses:

Do you think the strategy principles outlined in the presentation are appropriate?

- Each of the groups broadly agreed with the strategy principles;
- In particular it was agreed that the Waste Hierarchy is an appropriate model to follow in terms of dealing with waste;
- All the groups highlighted the need for any schemes to be affordable and to demonstrate value for money;

- One of the groups highlighted the lack of a principle statement relating to recycling. It was pointed out that recycling saves raw materials and value. The general consensus within the group was that recycling performance is included in the climate change principle however it could be clarified more and be made more obvious. It was also agreed that recycling performance impacts on other principles as well but could again be made more obvious;

- Accountability was discussed by two of the groups in terms of the lack of a 'public based principle'. It was felt that a principle could be added which refers to "customer satisfaction" or "meeting the needs of the public" for example.

Are the National targets achievable?

- All the groups agreed that national targets are largely achievable, and that it is important to have aspirational targets;

- A few delegates also commented that local targets should be set and enforced so that individual councils can't hide their own failings behind any overall National success in achieving targets;

- Some stakeholders believe the term 'recovery' is not defined well enough for stakeholders to interpret the targets.

Is the current 23% recycling and composting rate for Tees Valley a good performance so far?

- In general the groups agreed that based upon the socio-economic profile of the population, 23% is currently a reasonably good performance. They did all support the view that this achievement should be seen a solid base to build upon;

- It was recognised that some of the Authorities systems make it harder to recycle than they could do, for example by providing residents with a wide range of containers for collecting dry recyclables;

- One of the groups did however comment that if targets are being missed then the 23% level is not good enough;

- The general feeling among the groups was that the local targets set by the strategy should increase, and the aspirations of the councils should be to contribute as much as possible towards national achievement of targets.

Is it sufficient for the Tees Valley Authorities to achieve LATS targets, or should they strive to exceed them and trade the surplus credits?

- General consensus was that achieving LATS targets should be the minimum aspiration of the Authorities and that if it is possible to trade surplus credits than this should also be done;
- One caveat to this view was that the money made from selling surplus Landfill Allowances should be used to improve/fund waste management activities, in recognition of those services striving to improve waste practices and performance across the districts;
- Several joint methods for maximising the LATS surplus were suggested: Could surplus credits be pooled so the Authorities would receive joint benefit? Is there any benefit in the districts pooling their surplus credits prior to selling them, would the sale price increase?
- Some concern was highlighted that if the EfW plant shuts down or breaks down the lack of an income from surplus allowances could impact on services.

What are your experiences/views of the current kerbside services?

- The majority of stakeholders agreed that the current collection systems operated by the Tees Valley Districts are complicated and residents are provided with too many containers. It was however agreed that moving to a single co-mingled option is not popular with residents;
- Stakeholders confirmed that many of the old terraced dwellings in the Tees Valley Districts do not have sufficient space for a wheeled bin and certainly not other individual containers in addition;
- All the workshop groups agreed that provision of information is currently insufficient (limited to a calendar per annum) and needs to improve significantly. Stakeholders agreed that with complicated systems like those operated by the Tees Valley Authorities, it is even more important that they are explained regularly and simply;
- One group introduced the idea of building new-build properties with spaces specifically designed for the storage of recyclables;
- A number of new services were discussed by the groups and whilst all were recognised to have certain pros and cons, the following were agreed to be popular with both officers and stakeholders: The addition of plastics to kerbside collections, cardboard recycling at the kerbside and new recycling systems for high-rise buildings. Kitchen waste collections were discussed and it was generally agreed that

these would be a good addition to local services as long as there is both a facility to take it to and the properties provided with the service are considered based on the socio-demographic need;

- Not all stakeholders agreed that increasing the range of materials collected is necessary, some argued that the systems are currently fairly confusing anyway and a move towards simpler systems might have more impact;

- It was commented that the levels of contamination currently collected by the garden waste kerbside service are high and causing a problem in terms of the public's perception of the service. It was accepted however that this is probably a result of the insufficient information passed to the public;

- Alternate weekly collections were discussed by a number of the groups and all were in favour. Concern was voiced that these schemes could lead to waste being shifted around the waste infrastructure (e.g. to HWRCs) rather than actually being reduced in quantity;

- The current plastic collections were described as being problematic and bottles frequently falling out of sacks and being blown around by the wind.

Do you use the bring sites and/or CA sites? If so how do you rate these services?

- In general it was agreed that the standards of sites are relatively good, it was clear however that the majority of stakeholders didn't believe there are enough sites;

- Fly tipping at bring sites was highlighted as a problem and there was some concern that increasing the number of sites could increase the number of suitable fly-tipping spots;

- Many of the stakeholders viewed planning regulations as a barrier to the optimum network of bring and HWRCs being set-up. It was commented that generally the public would like bring banks and HWRCs to be placed where planning laws won't allow them to be built or sited. It was also agreed that a well operated and maintained HWRC is not an eye-sore.

Is zero landfill achievable?

- The consensus of all the groups was that zero landfill is not achievable. It was agreed however that zero landfill is a good aspirational target to set;

- Most groups accepted that EfW residues are likely to continue to be disposed of to landfill but agreed that as long as all attempts are made to reduce this quantity then this is an appropriate outlet;

- A number of stakeholders pointed out that asbestos will continue to be disposed of to landfill until an alternative outlet is deemed to be appropriate;

Does the current EfW contract stand-up?

- The EfW contract is generally deemed to be a positive factor for waste management in the Tees Valley. However concern was raised that reliance on this facility and a commitment to deliver a minimum tonnage per annum could 'crowd out' recycling;
- The possible inclusion of Darlington to an EfW contract with SITA Tees Valley was considered a positive move for the Tees Valley as it might encourage and support diversion of further recyclable materials from disposal to recovery other than energy;
- The reliability issues with the facility are well-known and most stakeholders believe these should be improved, however the general consensus is that an alternative means of disposal should be sought for any material rejected from the EfW as a result of break-down;
- If emissions legislation is changed or introduced, the Tees Valley Authorities will need to discuss the implications with SITA.

2.5 Session 2

2.5.1 Presentations

The afternoon presentations of the workshop served as both an introduction to some of the waste management techniques which could be used to develop the waste strategy, and also the infrastructure options which will form the basis of the options assessed and recommended by the final strategy as shown in Figure 2.1.

Figure 2.1 Waste Management Techniques

Waste Prevention/ Minimisation	'Front End' recycling	Waste Treatment Technologies	Disposal
Bin Size Restriction **Alternate Weekly Collection's** **Home Composting** **Charging**	**Kerbside Collections** **Materials recovery facilities (MRF)** **Household Waste Recycling Centres (CAS)** **Bring Banks**	**Composting** **Anaerobic digestion** **Autoclave** **MBT** **Incineration** **Advanced thermal treatment**	**Landfill**

2.5.2 Workshop

The second workshop session of the stakeholder day was a chance for stakeholders to narrow a very wide list of initial waste management options, into a shortened list based upon the group's aspirations. This involved breaking out into groups for a further time and discarding options which were deemed to be unacceptable to the stakeholder group in terms of driving the waste strategy forward.

Decisions on General Acceptability

Each group was initially shown the following diagram which represented the five stages of waste management based upon the waste hierarchy.

	Acceptability (a, b or c?)
Waste Prevention and Minimisation	
Front End Recycling	
Residual Waste Treatment	
EfW	
Disposal	

Next to each stage stakeholders were asked to decide whether it was acceptable (or desirable in some cases) for this stage of the current service to:

- a: Stay as it currently operates;
- b: Improve on the current service; or
- c: Requires dramatic changes which almost certainly require redesigning this stage.

Stakeholders were given the option of keeping a number of levels of acceptability if a common consensus couldn't be reached.

Removing the Unacceptable Options

Once the groups were brought back together, the results of this exercise were summarised on a single chart of options. This enabled all stakeholders to see the options which the group had been decided are inappropriate (not acceptable), being removed from the process. Appendix A provides a copy of the table used to summarise these results with the blue sections representing those which were given acceptable ratings for all waste management techniques and the red sections being those which had at least one non-acceptable level of performance.

Results

As can be seen in Appendix A, 8 options were considered to be acceptable and in most cases a positive step towards improving waste management practices for the Tees Valley Authorities. These short listed options are summarised in Table 2.2 below.

Table 2.2 Results of Initial Options Appraisal

Option	Waste Prevention and Minimisation	Front End Recycling	Residual Waste Treatment	EfW	Disposal
13 (B)	b	b	a	a	a
15 (C)	b	b	c	a	a
16 (D)	b	c	a	a	a
18 (E)	b	c	c	a	a
22 (F)	c	b	a	a	a
24 (G)	c	b	c	a	a
25 (H)	c	c	a	a	a
27 (I)	c	c	c	a	a

Table notes: a = stay as it currently operates, b = improve on the current service and c = requires dramatic change.

In addition to the 8 options selected as indicated, it was decided that a 'do nothing' scenario should remain in the evaluation process to benchmark what would happen if the current services don't change at all, effectively a status quo. The do nothing option is:

Option	Waste Prevention and Minimisation	Front End Recycling	Residual Waste Treatment	EfW	Disposal
1 (A)	a	a	a	a	a

The main observation was that the results were consistent with points raised during session one of the workshop. The stakeholders selected options which required as a minimum waste prevention and minimisation to improve. However, the results of the first session indicate that most stakeholders would prefer to see a dramatic change. The same pattern was true based on the options for front-end recycling, with no options being included which result in the schemes continuing as they are.

A number of options included the introduction of additional capacity for the treatment of residual waste. However, it was agreed by almost all of the stakeholders that EfW should remain as the dominant disposal route for residual waste, once recyclables have been removed. The groups acknowledged that the financial and operational implications of changing the EfW contract would make it unlikely the Authorities would re-consider this contract. However some participants considered that improvements are possible in the performance of the plant.

2.6 Methods for Improving/Changing Current Service

2.6.1 Introduction

Following the discussion and identification of options for further consideration, the stakeholders' final task was to consider the methods for improving or completely changing the different service elements. These are discussed below.

Waste Prevention and Minimisation

A number of techniques for waste prevention and minimisation were discussed within the groups. These were informed by the recent Regional Waste Minimisation Project undertaken by MEL Research. They included:

- Educating the public to understand why prevention and minimisation is necessary and what that actually means. Once the level of understanding has been increased, the level of engagement can be raised;

- The councils issuing smaller bins as standard (but considering reasonable requests for larger containers). This was agreed to be a positive minimisation method and could be combined with a “pay as you throw” scheme;
- Alternate weekly collections were supported by most stakeholders as a means for reducing waste arisings;
- The use of enforcement as a method for preventing and minimising waste, for example ensuring that side-waste policies are adhered to and fly tipping discouraged.
- Reusing and recycling items such as bulky waste and electrical items. The recycling village of South Tyneside was discussed as a good practice example along with other re-use initiatives and exchange schemes;
- Raising public awareness of the impact of shopping habits on the waste stream, linked with greater awareness of the possible role of retailers reducing the amount of waste disposed of.

The groups felt that the most effective methods were:

- Alternate weekly collections and/ or the use of smaller bins;
- General publicity and enforcement targeting both the public and retailers;
- The districts working in partnership with each other to deliver a single simple but effective message.

National guidance suggests that effective campaigns can result in reducing the growth in waste arisings towards 0%. The success factors are considered to be:

- Campaign messaging and identity;
- Positioning;
- Establishing appropriate tone and style.

Given the current campaign set up, it is considered that a reasonable target for a waste prevention and minimisation campaign would reduce waste growth to 1% over the next 5 years.

2.6.2 Front End Recycling

The groups identified the following methods of recycling that may assist with meeting targets:

- Simplifying the kerbside collection systems to make them more ‘user-friendly’;

- Introduction of new materials, in particular kitchen waste;
- Increasing the number of bring banks and therefore increasing the availability;
- Co-mingled collections. However this was not a preferred option for dry recyclables;
- Alternate weekly collections.

UK Best Practice suggests that effective kerbside collection schemes can result in recycling/composting rates of up to 50%. This relies upon:

- Fortnightly collection of residual waste via wheeled bin;
- Weekly collection of recyclates through the use of a box system, or fortnightly for a bin;
- Collection of kitchen & garden waste weekly or fortnightly.

2.6.3 Residual Waste Treatment

The groups identified the following options and considerations for additional treatment capacity:

- Development of an alternative to sending un-treated waste directly to landfill even if this is due to plant break-down;
- Consideration of options for temporarily storing instead of sending it to landfill when the EfW breaks down, and could this be combined with a process which reduces the biodegradability?
- Reducing the moisture content and biodegradability of waste prior to landfill must be positive;
- The necessity of maintaining a minimum of 180,000 tonnes to EfW under the current contract.

2.6.4 Energy from Waste

The stakeholders were asked to consider the options associated with the EfW contract, and it was agreed that:

- The EfW contract should continue;

- The Authorities should work with the EfW operator to reduce the amount of down-time and increases plant availability;
- 180,000 tonnes pa is the amount contracted to be sent to EfW, however waste from Darlington could be considered for inclusion, in negotiation with the EfW operator.

2.6.5 Landfill

Landfill was recognised as the final disposal method for all options. The groups agreed that zero landfill is unlikely to be unachievable and that an element of material will need to be disposed of to landfill eventually.

2.7 The Shortlisted Options

The following tables describe the characteristics of the options selected by stakeholders:

Option B DO NOTHING APPROACH	**Characteristics**
	• Waste will probably increase • Limited investment in waste awareness and minimisation initiatives • Current collection service with numerous containers and variety of materials and residual collection frequencies • All residual waste is either sent to EfW or landfill
Option B	**Characteristics**
	• Publicity material promoting awareness/minimisation will be improved so waste growth should reduce as the level of awareness increases • Improving the current collection systems should increase the level of recycling as residents find schemes more accessible, resulting in an increased recycling performance • Further materials could be collected (e.g. plastics) or changes made to the residual waste collection frequencies • All residual waste is either sent to EfW or landfill
Option C	**Characteristics**
	• Publicity material promoting awareness/minimisation will be improved so waste growth should reduce as the level of awareness increases • Improving the current collection systems should increase the level of recycling as residents find schemes more accessible, resulting in an increased recycling performance • Further materials could be collected (e.g. plastics) or changes

	made to the residual waste collection frequencies • The building of a further waste treatment facility could enable the Authorities to have an alternative method of treatment and allow increased recycling and recovery, and reduce some transfer times • Residual waste to EfW in line with contract with residue going for final disposal
Option D	**Characteristics**
	• Publicity material promoting awareness/minimisation will be improved so waste growth should reduce as the level of awareness increases • Revise the kerbside collection schemes, bring bank networks and HWRC provision for optimum performance, resulting in greatly improved recycling rate • Additional HWRCs could be provided and increased recycling from the bulky waste collections • Further materials likely to be collected (e.g. kitchen waste) • All residual waste is either sent to EfW or landfill
Option E	**Characteristics**
	• Publicity material promoting awareness/minimisation will be improved so waste growth should reduce as the level of awareness increases • Revise the kerbside collection schemes and bring bank networks for optimum performance, resulting in greatly improved recycling rate • Additional HWRCs could be provided and increased recycling from the bulky waste collections • Further materials likely to be collected (e.g. kitchen waste) • The building of a further waste treatment facility could enable the Authorities to have an alternative method of treatment and allow increased recycling and recovery, and reduce some transfer times

	• Residual waste to EfW in line with contract with residue going for final disposal
Option F	**Characteristics**
	• Authorities will implement a new waste awareness and minimisation strategy which will focus on simple, coordinated campaigns. This should have the maximum impact on the waste growth rate. • Improving the current collection systems should increase the level of recycling as residents find schemes more accessible, resulting in an increased recycling performance • Further materials could be collected (e.g. kitchen waste) • All residual waste is either sent to EfW or landfill
Option G	**Characteristics**
	• Authorities will implement a new waste awareness and minimisation strategy which will focus on simple, coordinated campaigns. This should have the maximum impact on the waste growth rate. • Improving the current collection systems and bring banks should increase the level of recycling as residents find schemes more accessible, resulting in an increased recycling performance • Further materials could be collected (e.g. kitchen waste) • The building of a further waste treatment facility could enable the Authorities to have an alternative method of treatment and allow increased recycling and recovery, and reduce some transfer times • Residual waste to EfW in line with contract with residue going for final disposal

Option H	Characteristics
	• Authorities will implement a new waste awareness and minimisation strategy which will focus on simple, coordinated campaigns. This should have the maximum impact on the waste growth rate. • Entirely re-designing the kerbside collection schemes and bring bank networks for optimum performance, resulting in greatly improved recycling rate • Further materials likely to be collected (e.g. kitchen waste) • All residual waste is either sent to EfW or landfill
Option I	**Characteristics**
	• Authorities will implement a new waste awareness and minimisation strategy which will focus on simple, coordinated campaigns. This should have the maximum impact on the waste growth rate. • Entirely redesigning the kerbside collection schemes and bring bank networks for optimum performance, resulting in greatly improved recycling rate • Additional HWRCs could be provided with increased recycling from the bulky waste collections • Further materials likely to be collected (e.g. kitchen waste) • The building of a further waste treatment facility could enable the Authorities to have an alternative method of treatment and allow increased recycling and recovery, and reduce some transfer times • Residual waste to EfW in line with contract with residue going for final disposal

2.8 Conclusions

The workshop succeeded in narrowing the options for further consideration from 81 to 9 (including the baseline “no change” option). This shortlist can now be considered against qualitative and quantitative criteria which will determine the most best or “preferred” option for the new strategy.

3. Further Options Development

3.1 Introduction

As a major public sector plan, the new Joint Waste Management Strategy is required to meet the requirements of the Strategic Environmental Appraisal (SEA) Regulations. Alongside the early strategy development, Entec has produced a SEA Scoping Report which was available for public consultation for 5 weeks ending on the 23 March 2007 for the Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton Authorities and for the Darlington Authority from early September.

This Scoping Report introduced a number of Sustainability Criteria against which strategic decisions, such as the determination of a Preferred Option, should be assessed. To ensure the strategy meets with the requirements of the SEA Regulations, the Sustainability Criteria have been developed to allow for the appraisal of options and have been used to determine the "Preferred" Option. These criteria are:

- To reduce waste generation;
- To support the beneficial re-use and recycling of waste;
- To divert waste away from landfill;
- To reduce the movement of waste and increase choice of transport mode;
- Access to waste facilities;
- To make better use of all resources;
- To maintain good air and environmental quality for all;
- To protect and enhance the quality of the sub region's controlled waters;
- To protect and enhance the sub-region's biodiversity and geodiversity;
- To protect and enhance the quality and diversity of the rural land and landscapes;
- To reduce the causes and impacts of climate change;
- To reduce crime;

- To ensure high and stable levels of employment and economic growth;
- To raise awareness of waste management generally and contribute towards a wider understanding of the waste hierarchy and more widespread acceptance of its practical implications.

Feeding into this process is the performance of each option against statutory targets and quantitative assessment using Best Practice Guidance, Entec's experience of the technologies involved and through the use of 'WRATE'. WRATE (The Waste and Resources Assessment Tool for the Environment) is a new life cycle analysis tool developed by the Environment Agency to allow the assessment of options against environmental criteria such as Carbon dioxide emissions, emissions to air, land and water. In particular the following objectives and default outputs were considered to correspond:

- To maintain or improve good air and environmental quality for all was informed by the Default Impact for Human Toxicity;
- To protect and enhance the sub-regions's controlled waters was informed by the Default Impacts for Aquatic Ecotoxicity, Eutrophication and Acidification;
- To protect and enhance the sub-region's biodiversity and geodiversity was also informed by the Default Impacts for Aquatic Ecotoxicity, Eutrophication and Acidification.

3.2 Performance Against Targets

It is important for the options to be assessed against their ability to meet targets since the Authorities will be judged against these and in the case of the LATS, could be fined should the targets not be met.

The following national targets have been set in the Waste Strategy for England 2007:

- Reduce the amount of household waste not re-used, recycled or composted by 45% by 2020;
- Recycling and Composting of Household Waste – at least 40% by 2010, 45% by 2015 and 50% by 2020;
- Recovery of Municipal Waste – 53% by 2010, 67% by 2015 and 75% by 2020.

National targets may be implemented in different ways throughout the UK, taking into account regional differences and baseline recycling levels. Individual authority targets will continue to be

set through the Best Value Performance Indicators (BVPIs) process, the Local Area Agreements (LAA) and the Comprehensive Area Assessments (CAA).

The assessment of options to meet targets has been undertaken using;

- Best Practice Guidance and Entec's experience of the technologies involved;
- Assessment of options to improve kerbside recycling and composting through modelling using the Kerbside Analysis Tool (KAT);
- The ability of options to meet targets using Entec's mass flow model.

Entec has reviewed other local authorities waste collection services to identify the potential effectiveness at policy measures of meeting targets. The findings of this research is available in the supporting documents "Supporting Document - Waste Collections" and "Supporting Document - Waste Awareness and Minimisation".

The Kerbside Analysis Tool (KAT) has been developed by WRAP (The Waste and Resources Action Programme) to enable authorities to model the potential costs and recycling rates achievable through the introduction of new kerbside recycling schemes. Further details of the KAT model and the findings of this exercise are contained within the 'Supporting Document - Waste Collections'.

The model enables the user to input baseline kerbside collection systems and waste composition data and use this to determine the potential success of new collection schemes. The high level result of this modelling exercise was that through encouraging increased participation in current schemes using waste awareness and prevention methods the current services may achieve kerbside recycling and composting rates of around 25% from kerbside collections.

The introduction of an Alternate Weekly Collection scheme will increase levels of participation in kerbside recycling schemes. This is currently witnessed by Hartlepool and Redcar and Cleveland BC where a rate of nearly 100% participation in recycling and composting services is being achieved in parts of the council areas, contrasting with average participation rates of around 35% where weekly residual waste collection services are retained. These high levels of participation have allowed Redcar and Cleveland BC to maintain a household kerbside collected recycling rate of 32% (BVPI 82a & 82b is 36% this includes the total household waste stream).

KAT was also utilised to model an improved recycling collection scheme. This was assumed to include a food waste collection, either as a separate weekly food waste collection or as a combined fortnightly green and food waste collection. The results of the KAT modelling exercise indicated that a recycling rate of 43% may be achieved through the introduction of such a service.

Contrasting the output of the KAT modelling exercise with the findings of the good practice identified through 'Supporting Documents - Waste Collections' review demonstrates that KAT is likely to underestimate the potential success of kerbside recycling schemes, as KAT is significantly affected by the quality and accuracy of the waste composition data used. Good Practice from other Authorities indicates that the Authorities may achieve higher levels of recycling and composting than those indicated by KAT. It is important to note that the high levels of recycling achieved by other authorities are significantly affected by local factors. These local factors may include high levels of green waste available for composting owing to high ownership of large gardens in semi-rural and affluent areas and high levels of participation in recycling schemes. Examples are:

- A recycling rate of 37% is being achieved by one Authority through improved dry recyclable and green waste collections whilst retaining a weekly residual collection;
- A recycling rate of 49% is being achieved by an Authority through improved dry recyclable and green waste collections with an alternate weekly residual collection;
- Recycling rate of up to 51% has been achieved by Authorities through the introduction of food waste collections, improved dry recyclable and green waste collections with alternate weekly residual collections.

Comparing the options against the targets now provides:

Table 3.1 Options Performance Against Targets

Option	Meets 40% Recycling & Composting by 2010	Meets 45% Recycling & Composting by 2015	Meets 50% Recycling & Composting by 2020	Meets Landfill Diversion Targets
A - Baseline	N	N	N	Y
B – Improve current Waste Awareness and Minimisation,	Y/N*	N	N	Y

Option	Meets 40% Recycling & Composting by 2010	Meets 45% Recycling & Composting by 2015	Meets 50% Recycling & Composting by 2020	Meets Landfill Diversion Targets
Improve current collection systems, build no further treatment capacity and all residual material sent to EfW and landfill				
C - Improve current Waste Awareness and Minimisation, Improve current collection system and waste treatment facility built to reduce the amount of residual waste sent for final disposal	Y/N*	N	N	Y
D - Improve current Waste Awareness and Minimisation, a new approach to collection systems, build no further treatment capacity and all residual material sent to EfW and landfill	Y	Y	Y/N	Y
E - Improve current Waste Awareness and Minimisation, a new approach to collection systems and waste treatment facility built to reduce the amount of residual waste sent for final disposal	Y	Y	Y/N	Y
F – A new approach to Waste Awareness and Minimisation, Improve current collection systems, build no further treatment capacity and all residual material sent to EfW and landfill	Y/N*	N	N	Y
G - A new approach to Waste Awareness and Minimisation, Improve current collection system and waste treatment facility built to reduce the amount of residual waste sent for final disposal	Y/N*	N	N	Y

Option	Meets 40% Recycling & Composting by 2010	Meets 45% Recycling & Composting by 2015	Meets 50% Recycling & Composting by 2020	Meets Landfill Diversion Targets
H - A new approach to Waste Awareness and Minimisation, A new approach to collection systems, build no further treatment capacity and all residual material sent to EfW and landfill	Y	Y	Y	Y
I - A new approach to Waste Awareness and Minimisation, A new approach to collection systems and waste treatment facility built to reduce the amount of residual waste sent for final disposal	Y	Y	Y	Y

Table notes: * Improving current collection system is unlikely to attain targets for Darlington, Middlesbrough and Stockton. Redcar and Cleveland and Hartlepool are likely to attain targets with current systems due to the introduction of fortnightly residual waste collections that encourage high levels of participation in recycling services.

Table 3.1 shows that Options D, E, H, and I have the greatest potential to meet the statutory targets, based upon the diversion levels considered possible individually or jointly. These options all require revisions to the collection regime to capture further materials including potentially food waste.

3.3 WRATE Modelling

3.3.1 Introduction to WRATE

WRATE is a new life cycle analysis tool developed by the Environment Agency to allow the assessment of options against environmental criteria including Global Warming Potential, emissions to air, land and water and potential effect on human health to assist with the decision making process.

Using WRATE requires the baseline waste services to be inputted, including details relating to the collection, transportation, recycling and disposal of the waste stream. As a life cycle tool WRATE considers the movement of waste streams either to the point when a recycled or

recovered material re-enters the materials stream or until it reaches the final point of disposal, incorporating a 'Cradle to Grave' approach. This approach ensures that the impact of the full service is considered allowing Authorities to distinguish between where real savings can be made in terms of environmental impact and where impacts are simply moved elsewhere (either to other media or other geographic areas).

In addition to assessing the potential impacts of waste services from 'Cradle to Grave' WRATE also incorporates the potential for the recycling or recovery of materials to off-set the impacts associated with material production. For example, the recycling of materials reduces the requirements to extract raw materials and process these for material use, in addition the generation of energy from an Energy from Waste facility reduces the requirement to use fossil fuels or other renewable sources and therefore offsets the environmental burden associated with the energy generation.

The Default Impacts available within the WRATE Model are:

- **Abiotic Resource Depletion (kg antimony equivalent)** – Use of non-renewable and renewable resources. Abitotic resources are non-living things, including land, water, air and minerals;
- **Global Warming Potential (kg CO2 equivalent)** – Measure of how much Greenhouse Gases are released contributing to global warming, as carbon dioxide equivalent emissions;
- **Human Toxicity (kg 1,4-dichlorobenzene equivalent)** – This covers a number of different effects: acute toxicity, irritation/corrosive effects, allergenic effects, irreversible damage/organ damage, genotoxicity, carcinogenic effects, toxicity to reproductive system/teratogenic effects, and neurotoxicity. The equivalence factors are determined for emission to different compartments: air, water, and soil and exposure via different media: air water, and soil;
- **Freshwater Aquatic Ecotoxicity (kg 1,4-dichlorobenze equivalent)** – Toxicity towards ecosystems can be regarded as either chronic (causing long lasting illness) or acute (short term/ immediate effects);
- **Acidification (kg SO2 equivalent)** – Emissions of acidifying compounds such as sulphur dioxide and nitrous oxides attack trees and acidify the soil which can result to changes in the ecosystem;
- **Eutrophication (kg PO4 equivalent)** - is caused by the increase of chemical nutrients, typically compounds containing nitrogen or phosphorus in surface waters.

For ease of comparison, the Default Impacts can be displayed as normalised measuring all of the Default Impacts in reference to European Person Equivalents. Normalisation is the number of 'average' European people who would cause the same impact over the course of a year. This also allows for the relative effect of impacts of to be assessed.

The Default Impacts are generated by the model based on real data collected by the Environment Agency (EA) through the model development process. In this way, the data relating to the impacts from Energy from Waste facilities may be modelled based on the data collected from the Haverton Hill facility. The data contained within the model for alternative residual treatment facilities have been collected by the EA's new technologies group.

3.3.2 Options Modelling in WRATE

The process of options evaluation requires details to be added to the model to develop new waste services, including information on types of collection, potential tonnages, transportation and recycling and treatment facilities.

The options modelling process was designed to test the Environmental Impacts of changes to service in reference to the short listed options as shown again in Table 3.2 below. As WRATE is used to model a snapshot of time it cannot consider the improvements that may be made over time in respect of waste growth as affected by the introduction of waste awareness and minimisation measures. Options B-E are therefore the same as Options F-I as these simply add 'Implement new waste awareness and minimisation'.

Table 3.2 Generic Options Process

Option	Description
Option A	Baseline
Options B and F	Improve current collection systems, build no further treatment capacity and all residual material sent to EfW and landfill
Options C and G	Improve current collection system and waste treatment facility built to reduce the amount of residual waste sent for final disposal

Option	Description
Options D and H	A new approach to collection systems, build no further treatment capacity and all residual material sent to EfW and landfill
Options E and I	A new approach to collection systems and waste treatment facility built to reduce the amount of residual waste sent for final disposal

The baseline scenario is the current waste service provided in terms of the amount of recycling and the facilities used for the recycling, reprocessing and disposal of the final waste stream.

The modelling of options with improved collection systems included the consideration of Alternate Weekly Collections (AWCs) and the addition of more recyclate materials. A new approach to waste collections would be built on improved collection systems and added organic waste collections which for the purposes of modelling were assumed to be treated in a sub-regional Anaerobic Digestion facility. The tonnages of material available for the improved and revised collections have been informed by the Kerbside Analysis Tool (KAT) output.

Options that include an alternative residual waste treatment facility are assumed to treat the fraction of the waste stream that is currently sent for disposal to landfill. The facility type chosen for the purposes of modelling was an autoclave facility. The autoclave facility allows for recovery of additional recyclate in terms of glass, plastics, ferrous and non-ferrous metals. The facility also produces a fibre output that has a range of uses and either as a recycled material or as a Refuse Derived Fuel (RDF). The autoclave facility chosen for modelling purposes was assumed to produce an RDF output. RDF may be combusted within a range of facilities. Unfortunately the options for final recovery of this material is rather limited within WRATE. For modelling purposes the RDF has been assumed to be combusted within a Cement Kiln process. This process has a very high thermal efficiency and may therefore be comparable to the combustion of RDF within an RDF burner that allows for the recovery of heat as well through a Combined Heat and Power function. Other options may result in a less efficient conversion of RDF into energy.

Table 3.2 describes the details of the options modelled in WRATE for the Tees Valley Authorities. The modelling process differed slightly for those Authorities that currently utilise the Energy from Waste facility TV Authorities (excluding Darlington) and Darlington BC that currently utilises landfill as their main disposal route as shown in the Table.

Table 3.3 Options Modelled Using WRATE

Option	TV (excluding Darlington) Model Description	Darlington Model Description
Option A	Baseline Scenario	Baseline Scenario
Options B and F	Improved Recycling – Improved participation and in recycling schemes, increased availability of green waste kerbside collection and fortnightly residual waste collection. Continued disposal to EfW and Landfill at current rates	Improved Recycling – Improved participation in recycling schemes and fortnightly residual waste collection. Continued disposal to Landfill
Options C and G	Improved Recycling – Improved participation in recycling schemes, increased availability of green waste kerbside collection and fortnightly residual waste collection. Additional facility constructed for the treatment of the waste stream currently disposed of to landfill. For modelling purposes this was assumed to be an Autoclave facility that produces RDF for combustion in a Cement Kiln type facility	Improved Recycling – Improved participation in recycling schemes and fortnightly residual waste collection in wheeled bins. Additional facility constructed for the treatment of the residual waste stream. For modelling purposes this was assumed to be an Autoclave facility that produces RDF for combustion in a Cement Kiln type facility
Options D and H	Revised Recycling – Improved participation in recycling schemes, increased availability of green waste kerbside collection, with fortnightly residual waste collection and a weekly food waste collection with the material sent to an Anaerobic Digester within the Tees Valley for recovery. Continued disposal to EfW and Landfill at current rates.	Revised Recycling – Improved participation in recycling schemes, with fortnightly residual waste collection in wheeled bins and an organics waste collection with the material sent to an Anaerobic Digester within the Tees Valley for recovery. Continued disposal to Landfill
Options E and I	Revised Recycling – Improved participation in recycling schemes, increased availability of green waste kerbside collection, with fortnightly residual waste collection and a weekly food waste collection with the	Revised Recycling- Improved participation in recycling schemes, with fortnightly residual waste collection in wheeled bins and an organics waste collection with the material sent to an Anaerobic

Option	TV (excluding Darlington) Model Description	Darlington Model Description
	material sent to an Anaerobic Digester within the Tees Valley for recovery. For modelling purposes this was assumed to be an Autoclave facility that produces RDF for combustion in a Cement Kiln type facility.	Digester within the Tees Valley for recovery. For modelling purposes this was assumed to be an Autoclave facility that produces RDF for combustion in a Cement Kiln type facility.

In addition to the differences between Darlington and the other Tees Valley Authorities, the distinction between baseline and improved recycling for Hartlepool BC and Redcar and Cleveland BC is rather limited as these Authorities currently implement a high standard of front end kerbside recycling with:

- Provision of kerbside recycling for a wide variety of dry recyclates (including paper, cardboard, plastics, glass, cans and tins) to a large number of properties;
- Fortnightly collections of residual waste;
- Provision of green waste collections to all suitable properties.

The continued provision of these services constitutes an 'Improved Service' and the success of these current schemes in terms of recycling rates achieved and reducing the overall Environmental Impact of the Waste Services should not be taken for granted. The options modelling for Hartlepool BC and Redcar and Cleveland BC has therefore been concentrated on the addition of residual treatment facilities and the development of a new approach to recycling.

3.3.3 Outcome of WRATE Modelling Process

TV Authorities (excluding Darlington)

WRATE modelling was carried out for all of the partner Authorities. The results of the modelling process for the Authorities are contained within Appendix B.

For simplicity this section considers the results of the modelling process for Middlesbrough BC in detail. Middlesbrough BC has been selected as a representative Authority where it is straightforward to identify what constitutes an 'Improved' and a 'New Approach' to recycling

process. Middlesbrough BC was chosen as a representative Authority of the partner Authorities that currently send the majority of their residual waste stream to the Haverton Hill EfW. In addition, Middlesbrough BC has not implemented Alternate Weekly Collections and is on the process of rolling out green waste collections within the Authority boundary and therefore options for improving current recycling services were easily identified. The results of the modelling process for Middlesbrough BC are shown in Figure 3.1 below. A table of the output from this process, alongside that of the other Authorities, is provided in Appendix B.

Figure 3.1 Normalised Output of WRATE Modelling on Middlesbrough Borough Council

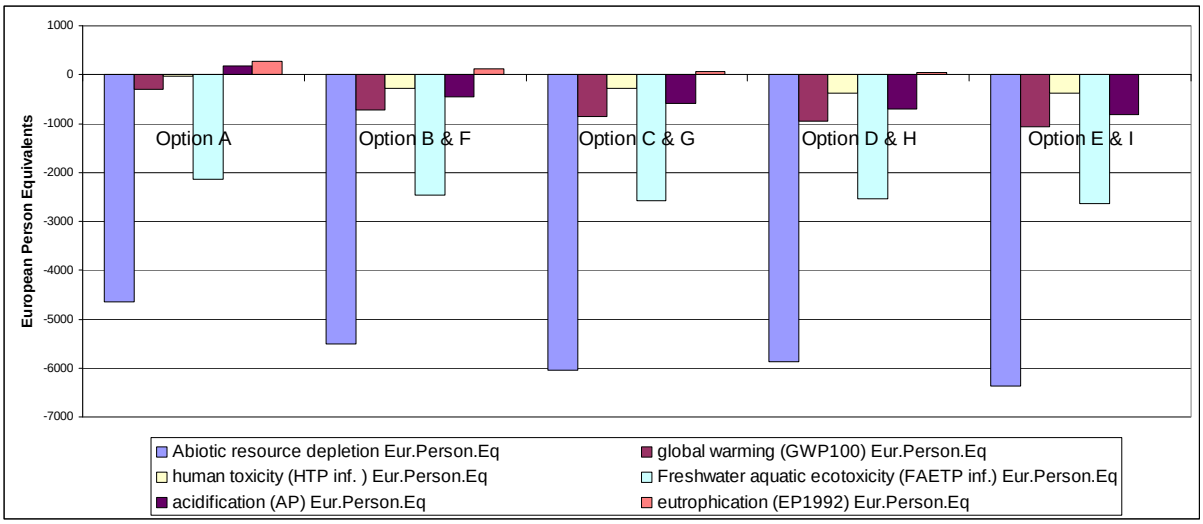

Figure notes: A negative figure represents a benefit in terms of environmental impact, the more negative the result the better.

It is recognised that the Authorities are particularly concerned with the implications of new services on the Global Warming Potential of the full Waste Service. As such Figure 3.2 below shows the relative Global Warming Potential in terms of Carbon Dioxide equivalents for each of the Options relative to Option A.

Figure 3.2 Global Warming Potential of Options for Middlesbrough Borough Council

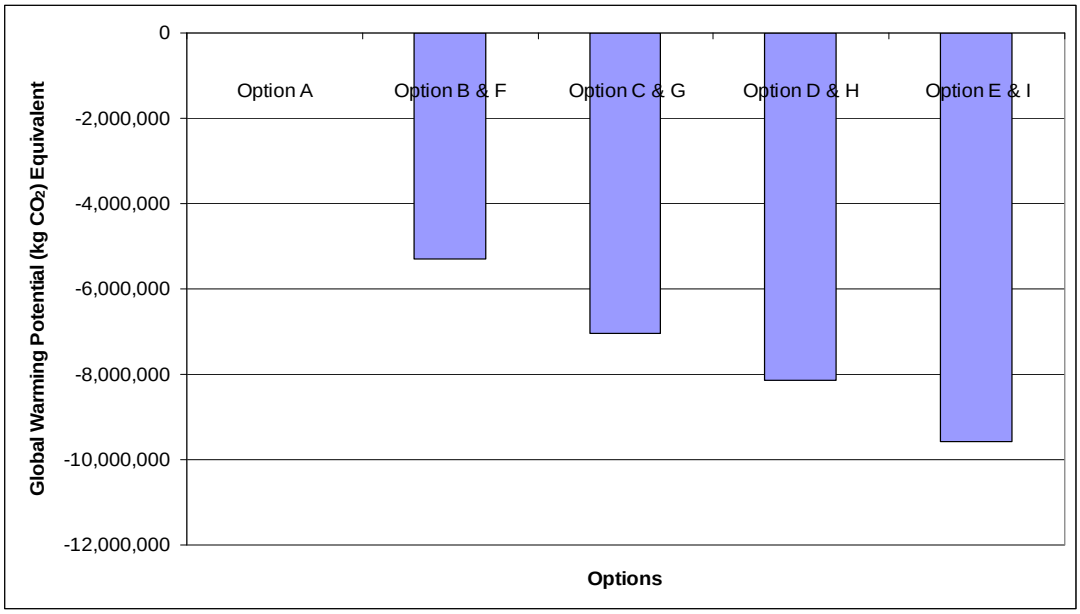

Figure notes: A negative figure represents a benefit in terms of environmental impact, the more negative the result the better.

The results for the other Tees Valley Authorities are included within Appendix B for completeness. The results of this modelling agree with the findings provided for Middlesbrough BC above.

Darlington Borough Council

The results of this process are shown in Figure 3.3 below. A table of the output from this process is provided in Appendix B.

Figure 3.3 Normalised Output of WRATE Modelling on Darlington Borough Council

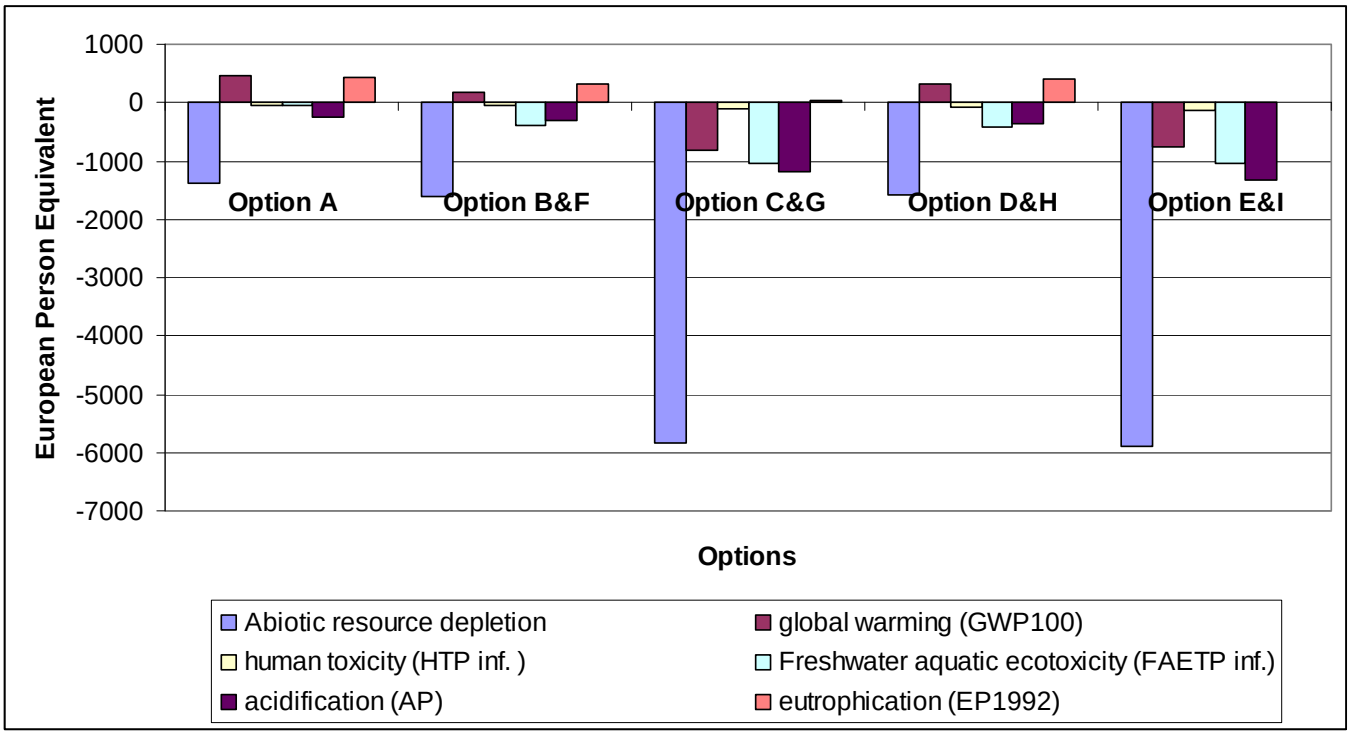

Figure notes: A negative figure represents a benefit in terms of environmental impact, the more negative the result the better.

The effects of waste management options on Climate Change is given in Figure 3.4 below which shows the relative Global Warming Potential in terms of Carbon Dioxide equivalents for each of the Options relative to Option A.

Figure 3.4 Global Warming Potential of Options for Darlington Borough Council

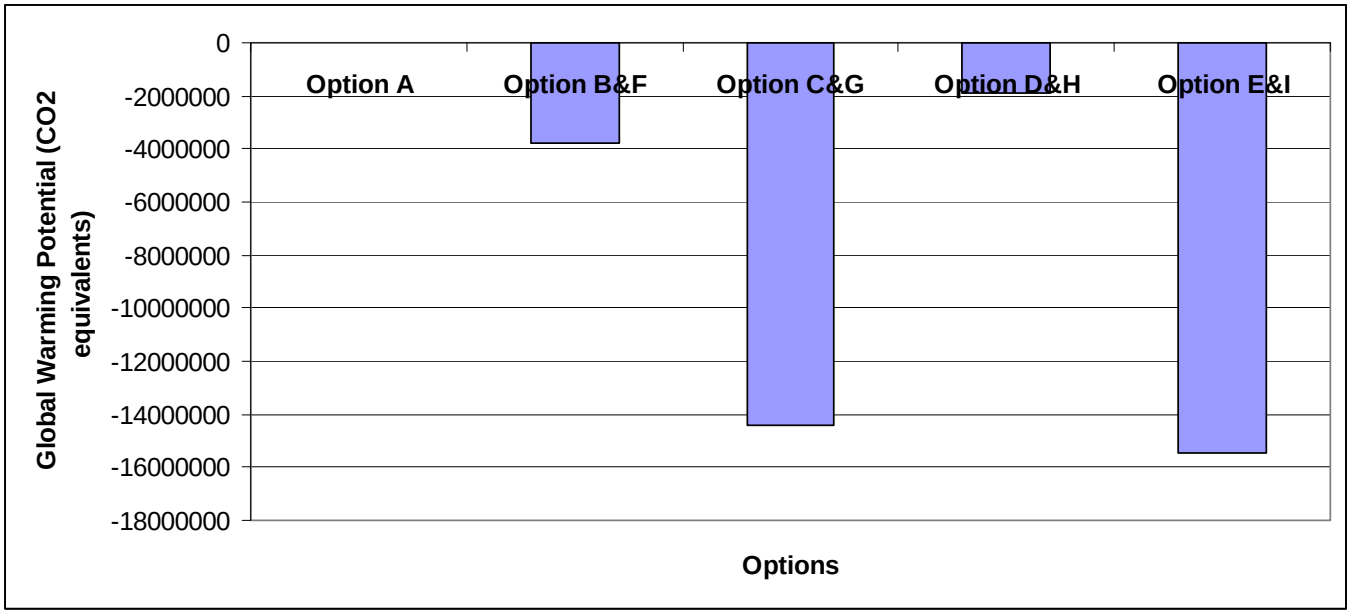

Figure notes: A negative figure represents a benefit in terms of environmental impact, the more negative the result the better.

3.4 Conclusions

3.4.1 Tees Valley (excluding Darlington) Conclusions

The options modelling process using WRATE identified that all options perform better than baseline for nearly all of the Default Impacts. In particular it is recognised that Options D & H and E & I are strongly performing options. Each of these options include revised collection systems, which improve performance compared with the current recycling provided in terms of participation and dry materials collected and a weekly food waste collection with materials treated in an Anaerobic Digestion facility with a fortnightly residual waste collection.

Options E&I also include an additional residual waste treatment facility for treatment of the waste stream that is currently sent to landfill. This is shown to provide benefits in relation to the baseline and indeed compared to other options. There is a potential for additional alternative treatment facilities to reduce vehicle movements associated with haulage to the EfW facility. This is of particular importance to those Authorities that are currently located at some distance from the current disposal and treatment facilities although this impact is difficult to assess until the location of an additional facility is known.

3.4.2 Darlington Conclusions

The outcomes of the Darlington BC modelling differ from the other Tees Valley Authorities owing to the significant differences in the current disposal route. In particular the continued reliance by Darlington BC on landfill has a significant environmental impact compared with alternative treatment options. The WRATE modelling process clearly demonstrates the potential benefits that may be gained in terms of the environmental impact of the service with the diversion of waste from landfill and therefore Options C&G and E&I are the strongest performing options. The effect of diverting this residual waste stream from landfill clearly outweighs the benefits that may be attained through the provision of additional recycling services. However, the potential for additional recycling and composting services in addition to the diversion of residual waste from landfill provides the best option in the terms of Environmental Impacts.

3.5 Outcome of Appraisal Process

The options have been subjected to a full assessment using the SA Framework. The performance of each option against the finalised range of environmental, economic and social criteria was discussed at length and agreed by the JWMS Key Stakeholders Group at a workshop on 20th April 2007. Present at the meeting were:

- Dave Stubbs (HBC)
- Denise Ogden (HBC)
- Simon Waller (R&CBC)
- Tom Punton (MBC)
- Ken Sherwood (MBC)
- Jamie McCann (SBC)
- Stuart Bargewell (SBC)
- Helen Birdsall (JSU) scribe
- Andrew Craig (JSU)
- Ross McLaughlin (Entec)
- Matt Sellwood (Entec)
- Mark Atkinson (Sita)
- John Hill (Environment Agency)
- Viki Jackson Smith (J&B Recycling)
- James Campbell (One Holmes Farm)
- Andrew Thompson (A&E Thomspon)

The assessment used the following scoring mechanism:

Table 3.4 Possible Alignment Between the Options and the SA Objectives

Alignment	Description	Symbol
Major Positive Impact	The proposed option contributes significantly to the achievement of the objective.	++
Minor Positive Impact	The proposed option contributes to the achievement of the objective but not significantly.	+
Neutral	The proposed option does not have any effect on the achievement of the objective	0
Minor Negative Impact	The proposed option detracts from the achievement of the objective but not significantly.	-
Major Negative Impact	The proposed option detracts significantly from the achievement of the objective.	--
No Relationship	There is no clear relationship between the proposed option and the achievement of the objective or the relationship is negligible.	X
Uncertain	The proposed option has an uncertain relationship to the objective or the relationship is dependant on the way in which the aspect is managed. In addition, insufficient information may be available to enable an assessment to be made.	?

The output from the workshop on 20 April is summarised below combined with the results of the WRATE modelling output and performance against targets. Full details are provided within the supporting document "SEA Environmental Report." At the time, the WRATE software had not been released by Defra and therefore required a further group assessment in June 2007.

Table 3.5 Appraisal Sheet Informed by WRATE and Target Performance Output

Proposed SA Objectives	Options								
	A	B	C	D	E	F	G	H	I
1. Will it reduce waste generation	--	+	+	+	+	+	+	++	++
2. Will it support the beneficial re-use and recycling of waste	--	++	+	++	++	+	+	++	++
3. Will it divert materials away from landfill?	0	+	++	+	++	+	++	+	++
4. To reduce the movement of waste and increase choice of transport mode	0	0	0	-	-	0	0	-	-
5. Access to waste facilities	0	+	+	++	++	+	+	++	++
6. To make better use of all resources	0	+	+	+	++	+	+	+	++
7. To maintain or improve good air and environmental quality for all	0	+	+	+	+	+	+	+	+
8. To protect and enhance the quality of the sub region's controlled waters?	0	+	+	+	+	+	+	+	+
9. To protect and enhance the sub-region's biodiversity	0	+	+	+	+	+	+	+	+

Proposed SA Objectives	Options								
	A	B	C	D	E	F	G	H	I
and geodiversity									
10. To protect and enhance the quality and diversity of the rural and urban land and landscapes	0	0	+	0	+	0	+	0	+
11. To reduce the causes and impacts of climate change	0	+	+	+	+	+	+	+	+
12. To reduce crime	0	0	0	0	0	+	+	+	+
13. To ensure high and stable levels of employment and economic growth in the Tees Valley	0	+	++	++	++	+	++	+	++
14. To raise awareness of waste management generally and contribute towards a social acceptance of the waste hierarchy	0	+	+	+	+	++	++	++	++

4. The Preferred Option

The output of the full options development and appraisal process has shown that the option that provides the preferred option for future waste management in the Tees Valley is Option I which requires:

- Revised Waste Awareness and Minimisation;
- Revised Waste Collections;
- Additional Waste Treatment Facilities to divert additional waste from landfill;
- Continued use of the EfW facility for waste recovery.

The focus for the Tees Valley Authorities is therefore on increasing and improving Waste Awareness and Minimisation measures, investing in collection services through revision of current collection services, potentially including food waste collections and identifying opportunities to divert additional waste from landfill. It should be recognised that the provision of any food waste collection service will require the introduction of a suitable facility to treat such a waste stream. This facility would either take the form of an Anaerobic Digester or an In Vessel Composting facility and may either be a merchant plant or a plant funded by the partner Authoritie

Appendix A
Summary Table of Acceptable Options from Options Workshop

Option	Waste Prevention and Minimisation	Front End Recycling	Residual Waste Treatment	EfW	Disposal	Option
1	a	a	a	a	a	1
2	a	a	b	a	a	2
3	a	a	c	a	a	3
4	a	b	a	a	a	4
5	a	b	b	a	a	5
6	a	b	c	a	a	6
7	a	c	a	a	a	7
8	a	c	b	a	a	8
9	a	c	c	a	a	9
10	b	a	a	a	a	10
11	b	a	b	a	a	11
12	b	a	c	a	a	12
13	b	b	a	a	a	13
14	b	b	b	a	a	14
15	b	b	c	a	a	15
16	b	c	a	a	a	16
17	b	c	b	a	a	17
18	b	c	c	a	a	18
19	c	a	a	a	a	19
20	c	a	b	a	a	20
21	c	a	c	a	a	21
22	c	b	a	a	a	22
23	c	b	b	a	a	23
24	c	b	c	a	a	24
25	c	c	a	a	a	25
26	c	c	b	a	a	26
27	c	c	c	a	a	27
28	a	a	a	a	b	28
29	a	a	b	a	b	29
30	a	a	c	a	b	30
31	a	b	a	a	b	31
32	a	b	b	a	b	32
33	a	b	c	a	b	33
34	a	c	a	a	b	34
35	a	c	b	a	b	35
36	a	c	c	a	b	36

37	b	a	a	a	b	37
38	b	a	b	a	b	38
39	b	a	c	a	b	39
40	b	b	a	a	b	40
41	b	b	b	a	b	41
42	b	b	c	a	b	42
43	b	c	a	a	b	43
44	b	c	b	a	b	44
45	b	c	c	a	b	45
46	c	a	a	a	b	46
47	c	a	b	a	b	47
48	c	a	c	a	b	48
49	c	b	a	a	b	49
50	c	b	b	a	b	50
51	c	b	c	a	b	51
52	c	c	a	a	b	52
53	c	c	b	a	b	53
54	c	c	c	a	b	54
55	a	a	a	a	c	55
56	a	a	b	a	c	56
57	a	a	c	a	c	57
58	a	b	a	a	c	58
59	a	b	b	a	c	59
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62	a	c	b	a	c	62
63	a	c	c	a	c	63
64	b	a	a	a	c	64
65	b	a	b	a	c	65
66	b	a	c	a	c	66
67	b	b	a	a	c	67
68	b	b	b	a	c	68
69	b	b	c	a	c	69
70	b	c	a	a	c	70
71	b	c	b	a	c	71
72	b	c	c	a	c	72
73	c	a	a	a	c	73
74	c	a	b	a	c	74
75	c	a	c	a	c	75
76	c	b	a	a	c	76
77	c	b	b	a	c	77
78	c	b	c	a	c	78
79	c	c	a	a	c	79

Appendix A

80	c	c	b	a	c	80
81	c	c	c	a	c	81

Appendix B
WRATE Output

Table B.1 WRATE Output Default Impacts for Darlington

Environmental Impact	Option A	Option B & F	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-53154	-62338	-172176	-61326	-228483
global warming (GWP100)	5873180	2067094	-8569299	3983406	-9607469
human toxicity (HTP inf.)	-791156	-1185344	-3045588	-1355310	-2444326
Freshwater aquatic ecotoxicity (FAETP inf.)	-71228	-522232	-1203910	-534634	-1359881
acidification (AP)	-17437	-21973	-70965	-26744	-94204
eutrophication (EP1992)	14158	10392	372.4	13475	304

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline.

Table B.2 WRATE Output Default Impacts (Normalised) for Darlington

Environmental Impact	Option A	Option B & F	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-1371	-1608	-5835	-1582	-5894
global warming (GWP100)	467	164.3	-804	317	-764
human toxicity (HTP inf.)	-40	-59.8	-119.2	-68.8	-124.2
Freshwater aquatic ecotoxicity (FAETP inf.)	-54.1	-396.3	-1045	-405.3	-1032
acidification (AP)	-244.5	-307.5	-1197	-374.5	-1319
eutrophication (EP1992)	434.6	318.6	31.2	413.6	9.3

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline.

Table B.3 WRATE Output Default Impacts for Hartlepool Borough Council

Environmental Impact	Option A	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-148766	-172476	-151916	-193373
global warming (GWP100)	-3348645	-7411163	-4515998	-8967939
human toxicity (HTP inf.)	223904	-4056574	-26377	-4286244
Freshwater aquatic ecotoxicity (FAETP inf.)	-1898689	-2206579	-2161916	-2421239
acidification (AP)	6379	-18108	2775	-25908
eutrophication (EP1992)	6220	3119	5102	2496

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline. The current baseline recycling system is assumed to constitute an improved recycling collection system.

Table B.4 WRATE Output Default Impacts (Normalised) for Hartlepool Borough Council

Environmental Impact	Option A	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-3838	-4449	-3919	-4988
global warming (GWP100)	-266	-589	-359	-713
human toxicity (HTP inf.)	11.3	-205	-1.34	-217
Freshwater aquatic ecotoxicity (FAETP inf.)	-1441	-1674	-1640	-1837
acidification (AP)	89.3	-254	38.9	-363
eutrophication (EP1992)	191	95.8	157	76.6

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline. The current baseline recycling system is assumed to constitute an improved recycling collection system.

Table B.5 WRATE Output Default Impacts for Middlesbrough

Environmental Impact	Option A	Option B & F	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-179728	-213771	-234530	-227416	-246592
global warming (GWP100)	-3828879	-9132418	-10868314	-11964994	-13407386
human toxicity (HTP inf.)	-545407	-5422873	-5598350	-7352334	-7516777
Freshwater aquatic ecotoxicity (FAETP inf.)	-2818320	-3239051	-3396719	-3337789	-3476814
acidification (AP)	12257	-32925	-42682	-50233	-58937
eutrophication (EP1992)	9040	3854	2080	1484	210

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline.

Table B.6 WRATE Output Default Impacts (Normalised) for Middlesbrough

Environmental Impact	Option A	Option B & F	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-4637	-5515	-6050	-5867	-6361
global warming (GWP100)	-304	-726	-864	-951	-1066
human toxicity (HTP inf.)	-27.6	-274	-283	-372	-380
Freshwater aquatic ecotoxicity (FAETP inf.)	-2139	-2458	-2577	-2533	-2638
acidification (AP)	172	-461	-598	-703	-825
eutrophication (EP1992)	278	118	63.9	45.6	6.46

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline.

Table B.7 WRATE Output Default Impacts for Redcar and Cleveland

Environmental Impact	Option A	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-181009	-234683	-181517	-234962
global warming (GWP100)	-4398863	-6261418	-5123045	-6875000
human toxicity (HTP inf.)	1387141	1230698	1460910	1297800
Freshwater aquatic ecotoxicity (FAETP inf.)	-1996844	-2188266	-1914065	-2107929
acidification (AP)	-4751	-13199	-4104	-12246
eutrophication (EP1992)	6407	6569	6170	6637

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline. The current baseline recycling system is assumed to constitute an improved recycling collection system. The relatively reduced benefit from the alternative options appears to be a result of the current system maximising recycling and recovery.

Table B.8 WRATE Output Default Impacts (Normalised) for Redcar and Cleveland

Environmental Impact	Option A	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-4670	-6054	-4683	-6061
global warming (GWP100)	-350	-498	-407	-547
human toxicity (HTP inf.)	70.2	62.3	73.9	65.7
Freshwater aquatic ecotoxicity (FAETP inf.)	-1515	-1660	-1452	-1600
acidification (AP)	-66.5	-185	-57.5	-171
eutrophication (EP1992)	197	202	189	204

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline. The current baseline recycling system is assumed to constitute an improved recycling collection system. The relatively reduced benefit from the alternative options appears to be a result of the current system maximising recycling and recovery.

Table B.9 WRATE Output Default Impacts for Stockton Borough Council

Environmental Impact	Option A	Option B & F	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-234063	-258006	-294534	-258171	-293831
global warming (GWP100)	-5259191	-7691645	-10596753	-8920974	-11499098
human toxicity (HTP inf.)	65143	-389171	-684861	-252853	-564018
Freshwater aquatic ecotoxicity (FAETP inf.)	-2599812	-2436140	-2708730	-2286684	-2563537
acidification (AP)	11268	-15869	-29327	-13832	-26197
eutrophication (EP1992)	10737	8890	7019	8305	7331

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baseline.

Table B.10 WRATE Output Default Impacts (Normalised) for Stockton Borough Council

Environmental Impact	Option A	Option B & F	Option C & G	Option D & H	Option E & I
Abiotic resource depletion	-6038	-6656	-7598	-6660	-7580
global warming (GWP100)	-418	-612	-843	-709	-914
human toxicity (HTP inf.)	3.3	-19.7	-34.7	-12.8	-28.5
Freshwater aquatic ecotoxicity (FAETP inf.)	-1973	-1849	-2055	-1735	-1945
acidification (AP)	158	-222	-411	-194	-367
eutrophication (EP1992)	330	273	216	255	225

Table notes: Green colour coding shows indicator has at least half of the impact associated with the baseline. Amber shows an improvement on the baseline up to at least half. Red shows an increased impact compared to the baselin