Joint Waste Development Plan Document for Greater Manchester – Needs Assessment Report

Greater Manchester Geological Unit (GMGU)

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Report Produced for:
GMGU

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Executive Summary

The Association of Greater Manchester Authorities (AGMA) is in the process of developing a Joint Waste Development Plan Document (JWDPD). Urban Mines was commissioned by GMGU, following a tender process, to provide a sound evidence base via an updated Needs Assessment. A sub group comprising officer and member representatives from Greater Manchester Local Authorities, together with officers from GMGU and project representatives from Urban Mines helped steer the project. The principal aim of this project was to produce a transparent, future-proof, model able to simulate future waste facility requirements under a range of scenarios.

Assembling Baseline Data

The principal waste streams are identified as:

Commercial Waste and Industrial Waste (at sector level) (C&I)
Construction Demolition & Excavation (including mines & quarries) Waste (CD&E)
Hazardous Waste
Municipal Waste
Agricultural Waste
Low Level Radioactive Waste

The most up to date available data has been used within the model drawing on the basic sources available. Prime sources were the survey of C&I waste arisings completed for the NW RTAB 2007, The Municipal Waste Management Strategies of Greater Manchester and Wigan Waste Disposal Authorities together with a NW survey of CD&E waste and the Environment Agency for hazardous and radioactive waste. The small quantities of low level radio active waste are currently adequately provided for and no increase is projected and consequently is not represented in the model.

Agricultural wastes quantities are low; 300,000 tonnes having a 96% land recovery usage with <10% going to treatment and <3,000 tonnes to incineration. Agricultural waste figures are contained within the modelling process.

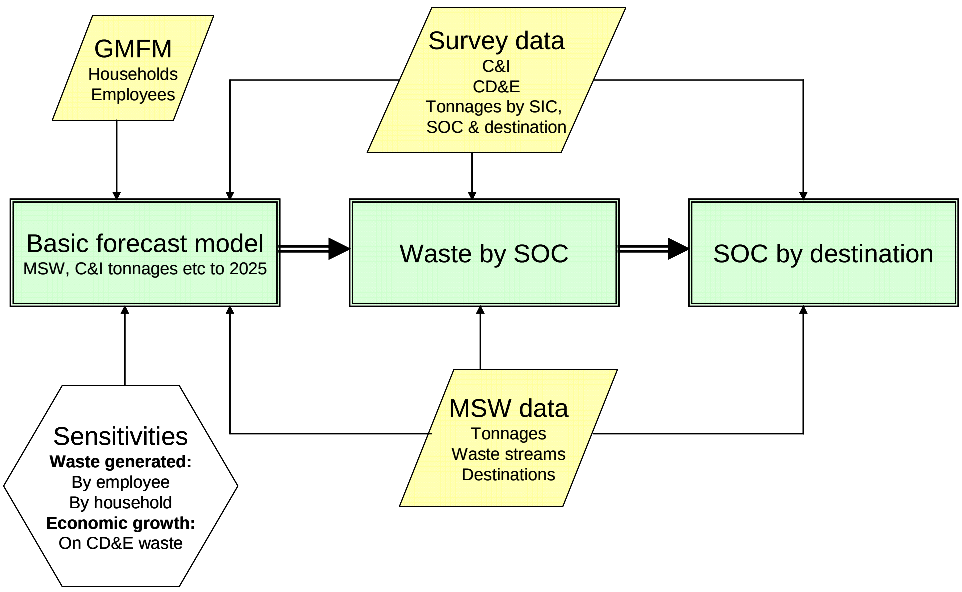
Data on the import and export of waste to and from Greater Manchester is very limited and was of no practical value for the development of the model. The approach taken was therefore to identify the current net gap between waste management throughput at facilities within Greater Manchester and the estimated level of arisings.

An Access Database was created assigning a consistent facility type to each of the sites, determining site status (operational or not), determining the annual capacity of each of the sites (actual and potential) determine the site lifetime (years) and entering the new PFI site data that is then linked to the model.

The Development of the Needs Assessment Model

Building the model as shown in figure 1 allows the gap to be analysed with respect to waste type and source. The sensitivity analysis allows the main causes of the gap to be identified using an Excel add-in software package called Crystal Ball that can describe the relative weights of factors that cause the gap.

Figure 1 Executive Summary The “Shape” of the Model



The model provides an understanding of waste management, in terms of who is producing the waste, the material streams and the waste management destinations. The model also includes data on which materials have the potential for recycling or energy recovery by waste stream and producing sector. Together with the modifiers used provide a forecasting of future arisings and disposal scenarios if the aim of managing waste more sustainably and towards the top of the waste hierarchy is to be achieved. This is important in practical terms as these elements of the modelling

output show where specific changes in waste management practice will have to occur. The GMFM model has been the key to informing the modifiers for the economic and social factors. Both baseline and accelerated growth models have been used. The GMFM model has been outlined and discussed with the Sub Group and it was agreed that this was the best available tool presently available for use within the needs assessment process.
Further reports for the model can be run which will show which commercial and industrial sectors are generating those wastes which could be more productively managed or to explore new scenarios to reflect specific knowledge on sectors response to waste minimisation and changes in businesses competitiveness. The model can accommodate any future updates in the GMFM model as time progresses.
It is recommended that the model is maintained so that new information covering planning and additional capacity once granted is updated and that modifiers are adjusted as appropriate to reflect any policy responses or other factors.

Developing Scenarios

The initial modelling includes scenarios which illustrate the impacts of increasing recovery and recycling of C&I and CD&E waste on future capacity requirements.

The initial modelling has taken three waste management scenarios:

1. Baseline, which reflects the current status and forward planning position
2. Maximised recycling and recovery of C&I and CD&E wastes
3. A median level of increased recycling and recovery

Each of these scenarios has been modelled using the baseline arisings modifier (using the current updated GMFM data as at November 2007).

Scenario 1. Baseline: Baseline

The main apparent capacity gaps at 2025 are for landfill for non-hazardous waste and for landfill for CD&E waste. Composting is also in deficit and will require an additional annual capacity of 121,000 tonnes. Although recycling and treatment are shown as surplus capacity it is not possible to calculate how much of this capacity would be taken by imported wastes and how much remain unused. Recycling and reprocessing facilities are material specific and surplus capacity is not transferable between material types. The projection indicates cumulative landfill capacity for 23 m tonnes of non hazardous waste will be required from 2007 to 2025. The capacity deficit for CD&E waste indicates that 25m tonnes of waste would require landfill disposal from 2007 to 2025.

Scenario 2. Baseline: Maximise Recycling and Recovery

Maximising recycling and recovery will produce some important differences in the capacity requirements for different waste management methods. Under this scenario the non hazardous landfill requirement is reduced to 8.9m tonnes from 2011 to 2025. CD&E landfill requirement also reduces from 2007 to 2025 to 12m tonnes. Under this scenario although there appears to be a net surplus for treatment and recycling capacity the requirement for materials specific capacity is likely to mean there may be significant deficits in capacity for certain materials.

Scenario 3 Baseline: Median levels of increased recycling and recovery are achieved

Scenario 3 assumes an increase in recycling at a median level when the impacts of pricing and policy initiatives have been taken into account. More waste materials are then available for energy recovery. Both scenarios 2 and 3 decrease the requirement for landfill for non-hazardous waste. Scenario 3 has lower levels of recycling and thus more materials are available for energy recovery. Under this scenario, energy recovery requirements are 75% higher than in scenario 2

The three scenarios show a range of different capacity requirements depending upon how waste is managed within the waste management hierarchy. Whilst Scenario 2 illustrates the possibilities for maximising recycling and recovery Scenario 3 adopts the median position and may be more realistic in terms of achieving changes in practice. With maximum recycling and energy recovery the model has indicated that reliance on landfilling could be significantly reduced by increased recycling in particular of mixed ordinary waste and non-metallic waste.

Table 2 Executive Summary
A comparison of the capacity gap at year 2025 across the 3 scenarios

Projected Gap in Capacity Requirement 2025			**000s Tonnes**
Waste Management	**Scenario 1**	**Scenario 3**	**Scenario 2**
Landfill (non-hazardous)	-1,518	-987	-816
Incineration with Energy Recovery	-82	-221	-114
Treatment Plant	995	995	995
Recycling	670	284	12
Composting	-121	-127	-133
Landfill (hazardous)	-124	-124	-124
Landfill (C+D)	-2,028	-1,014	-1,014
Recycling (aggregates, C+D)	381	-633	-633

Accelerated Growth Scenarios 4, 5 and 6

Appendix 6 contains an earlier report which also modelled GMFM Accelerated Growth (AG) scenarios 4, 5 & 6 using data from October 2007. It is known that the GMFM AG data is currently being updated but will not be available to January 2008. It is therefore suggested that updated modelling using the new AG GMFM data should be carried out when this becomes available.

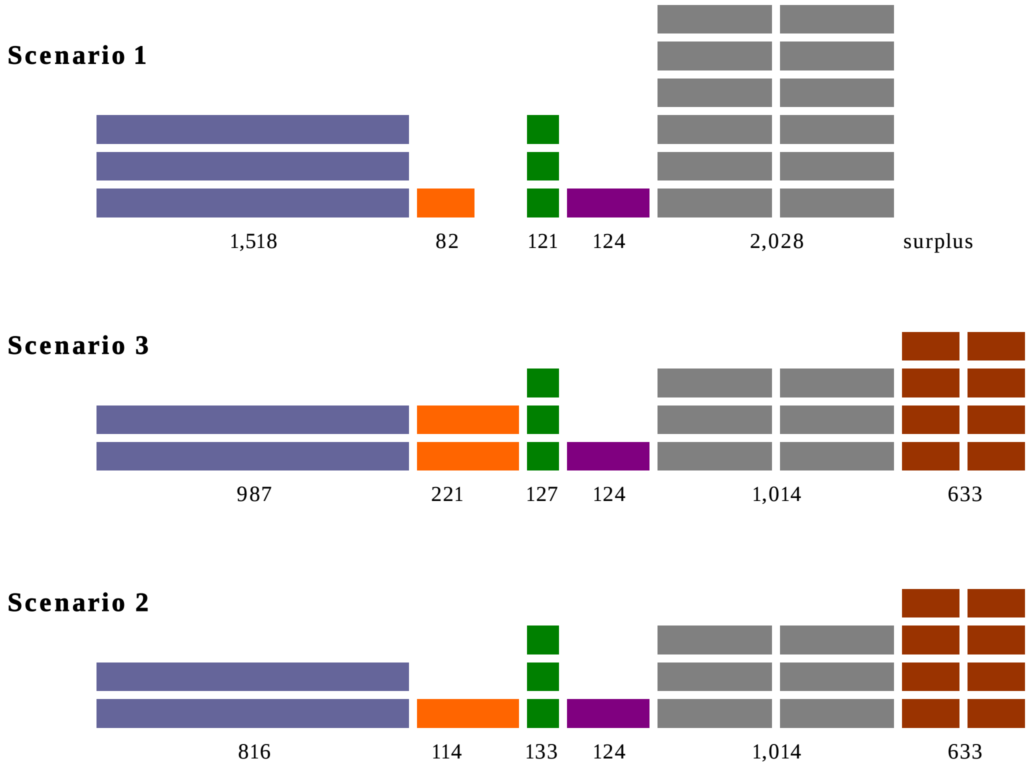
The Accelerated growth scenarios show only a small increase in capacity requirements under each of the comparative scenarios (Scenario 1 compares with Scenario 4, 2 compares with 5 and 3 compares with 6). The most significant change in capacity requirement would be under AG Scenario 4 which would require capacity for an additional 40,000 tonnes of non-hazardous landfill. However under scenarios

AG5 & AG6 with recycling and recovery the additional landfill capacity would be only 4,000 and 5,000 tonnes respectively. This demonstrates that the impact of accelerated economic and social growth under the GMFM models is barely significant in terms of future waste management requirements, based upon the un-updated GMFM AG data.

Translation of Projected need into Facility Options

Table 3 Executive summary gives some indication of the number of new facilities that could be developed in order to meet the gap at nominal year 2020 from the 3 baseline scenarios (1-3). This is produced for illustration purposes, as running other scenarios with alternative assumptions will produce alternative projections.

Table 3 Executive summary Facility requirement results from running the 3 baseline scenarios, indicates number of additional facilities required by 2025 (in 000s tonnes)



Key to facility types	Average capacity (000s tonnes)
Landfill (non-hazardous)	500
Incineration with Energy Recovery	75 or 120
Composting	40
Landfill (hazardous)	120
Landfill (C+D)	170
Recycling (aggregates, C+D)	80

Each block represents 1 facility, while the width of the block indicates the capacity of the facility (based upon average capacity of each facility type).

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Quality Approvals	**Name**	**Signature**
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1 Introduction

Urban Mines was commissioned by GMGU (Greater Manchester Geological Unit), on 5th June 2007, following a tender process to undertake a Needs Assessment for input into the Joint Waste Development Plan Document for Greater Manchester. A sub group was set up comprising officer and member representatives from Greater Manchester Local Authorities, together with officers from GMGU and project representatives from Urban Mines. Three meetings of the sub group were held in June, July and September, together with an update meeting covering the project to the Greater Manchester Joint Waste Planning Committee on the 26th June 2007, 27th September 2007 and 1st November 2007. The role of the sub group was to support the development of the project and influence the model development. Participants in the sub group are shown in **Table 1**.

Table 1 GM JWPC Needs Assessment Sub Group membership

Authority/Organisation	Representative
Manchester	Cllr Swannick
Manchester	Andrew Short
Manchester WDA	Paul Dunn
Rochdale	Cllr Hobhouse
Rochdale	Paul Simpson
Stockport	Richard Leyshon
Trafford	Cllr Young
Trafford	Colin Moss
Trafford	Dennis Smith
Wigan	Dennis McBride
GMGU	Krista Patrick
GMGU	Carolyn Williams
GMGU	Alethea Faulkner
GMGU	Philippa Hothersall
Urban Mines	Gill Tatum
Urban Mines	Glyn Jones
Urban Mines	Mandy Smith
Griffin Hill	Peter Greifenberg

Definitions used in this report are defined in **Appendix 1**.

1.1 Project Brief

The Association of Greater Manchester Authorities (AGMA) is in the process of developing a Joint Waste Development Plan Document (JWDPD), comprising detailed development control policies and the identification of preferred areas for siting waste management facilities. In order to provide a sound evidence base for developing the JWDPD, a Needs Assessment (now referred to as the Interim Needs Assessment) was commissioned in December 2005. Since the Interim Needs Assessment was produced, in January 2007, there have been a number of developments and more up to date data available regarding waste arisings and there have been a number of policy and strategic developments. The contract was thus to "undertake an update of the Interim Needs Assessment for Municipal, Commercial and Industrial, Construction and Demolition, Hazardous and other Waste Management in Greater Manchester".

The overall aim of the project is:
"To undertake an update of the Interim Needs Assessment for municipal, commercial and industrial, construction and demolition, hazardous and other waste streams, to be used to inform the development of the JWDPD and in particular the requirements for the new waste management facilities in Greater Manchester for the period 2007 – 2025."

The underlying principles of the brief were seeking:

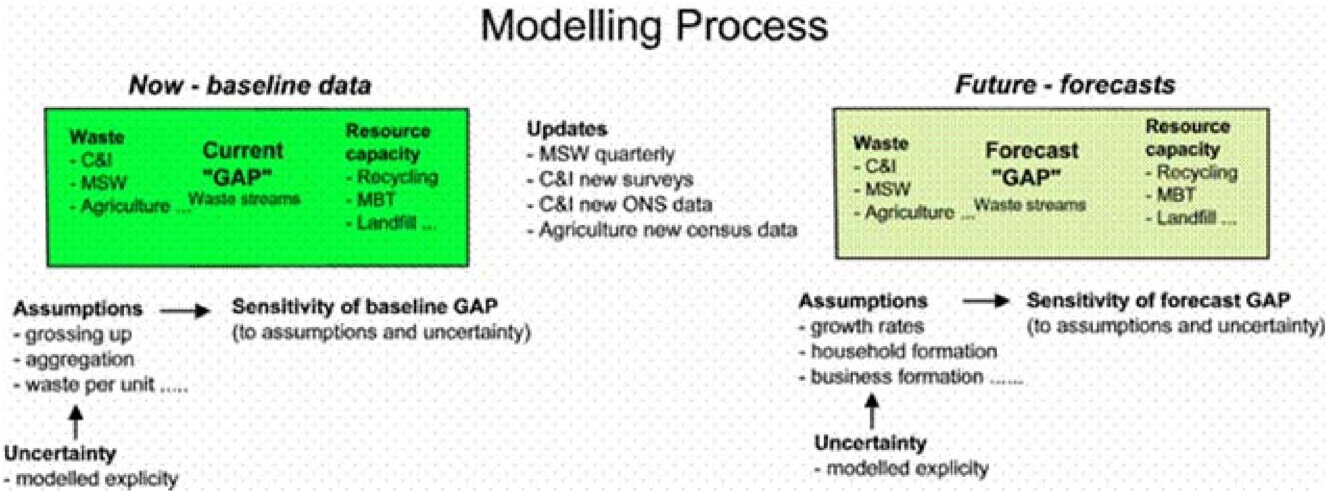
1. To produce a transparent, future-proof, model able to simulate future waste facility requirements under a range of scenarios. There should be a clear process for updating baseline data, ensuring that when newer or better quality data becomes available it can be incorporated quickly and cheaply. This principle should also apply to built-in assumptions derived from current growth forecasts or the existing policy environment.
2. To apply the best currently-available baseline data and growth forecasts to the model, in order to estimate future capacity gaps and facilities required. This should include sensitivity analysis of results and may require running a number of different scenarios.

1.2 Our Approach

1.2.1 Overview

Our primary focus in updating the Interim Needs Assessment was to develop a robust, future-proof, modelling tool able to simulate different scenarios relevant to the development of the JWDPD. An indication of the modelling process is given in the diagram below **Figure 1**, showing the baseline data acted upon by a range of factors - "assumptions" relating to, for example, economic growth and waste arising per employee. The final shape of the model and its fixed and variable assumptions was determined in conjunction with the Sub Group and GMGU. Areas of risk and uncertainty are explicitly modelled and sensitivity analysis provided using a Monte Carlo approach. A straightforward process for the integration of new and updated baseline data has been established, enabling continuous updating for cost effective longer term use. The model design has also been utilised to be user-friendly for internal use by GMGU and members of the AGMA based upon simple Excel layering and structure.

Figure 1 The Modelling Process



The model was developed in 3 stages:

- **Stage 1 Assembling and Updating the Baseline Data**
- **Stage 2 Reviewing legislative, policy and strategic impacts**
- **Stage 3 Development of the needs assessment model**

1.2.2 Stage 1 Assembling and Updating the Baseline Data

Our approach centres on the need for a clear process for updating data sets as more information becomes available and to gather data such that it easily fits into the needs assessment model. We thus chose simple Excel format for baseline data management. At the outset the expectation for sources of updated information for the waste arisings baseline data was based upon the following assumptions:

- C&I - NW Regional Survey completed April 2007 by Urban Mines
- CD&E – NW Regional Survey due for completion May 2007 by Smith Gore (data however may be incomplete)
- MSW – Greater Manchester and Wigan WDAs (most recent available data to be obtained via GMGU 2006/07)
- Hazardous waste – revised hazardous waste data for 2004/2005 from EA
- Agricultural waste – not currently collected. To be estimated using Defra annual agricultural census by region and farm type

- Mines & Quarries – not currently collected, to be estimated using the CD&E survey
- Low Level Radioactive data – information supplied by EA, predominantly based upon 2005 figures but representing annual returns.
- No information available on import and export of materials.

1.2.3 Resource Capacity

We understood originally that the facilities database produced during the Interim Needs Assessment represented the best available data on current resource capacity, to be incorporated into the new model. At subsequent sub group meetings and through discussion with GMGU it was clear that in order to make the data more manageable, to improve its accuracy and application and to enable the database to easily fit into use by the model that some update work was required. This was agreed and subsequently carried out. The approach was therefore to update and improve the current data held by GMGU on waste capacity across Greater Manchester. This was done by creating an Access Database, assigning a consistent facility type to each of the sites, determining site status (operational or not), determining the annual capacity of each of the sites (actual and potential) determine the site lifetime (years) and entering the new PFI site data as available. The scope of the work fell short of a complete review of the capacity database information supplied by GMGU due to time and cost constraints however efforts were made to update the capacity database using the knowledge of the sub-group available as at November 2007 and incorporate as much information as available covering exempt sites and latest permissions at that time.

1.2.4 Stage 2 Legislation and Policy Forecasts

The next stage of our approach was to review the likely impact of recent and anticipated developments in national and regional legislation, policy, strategy and infrastructure. Our aim was to be able to identify impacts which should be reflected in the model. Sensitivity testing has then been used to better understand the effect of these impacts. All fixed and variable assumptions were outlined and discussed with the sub group and GMGU before subsequent inclusion in the model.

1.2.5 Stage 3 Development of the needs assessment model

The principal aim of this project was to produce a transparent, future-proof, model able to simulate future waste facility requirements under a range of scenarios. This analysis therefore also includes running the model for a range of different scenarios which illustrate the potential use of the model in forecasting the need for new capacity and in informing the decision making process in terms of the scale and nature of new capacity requirements.

At the outset we anticipated being able to obtain the following that would act as modifiers within the developed model:

- Population and housing growth forecasts (AGMA data via GMGU)
- MSW historical arisings and future predictions (from the WDAs via GMGU)
- Greater Manchester Forecasting Model (GMFM) results and other reports as listed in tender brief (via GMGU)

The GMFM is an econometric model developed by Oxford Economic Forecasting full details are contained in Appendix 2.

The baseline scenario has the Greater Manchester area performing in relation to the global and national economy. An Accelerated Growth Scenario detaches the Greater Manchester economy by allowing it to grow faster than anticipated from global and national trends.

During the delivery of the project it became evident that the Greater Manchester Forecasting Model could be used to provide such data and it was subsequently agreed through the sub group that we would utilise within the model data from the GMFM forecasting model. Originally data from GMFM was supplied and used covering both baseline and accelerated growth and a report was written modelling 6 scenarios, results from this for the AG scenarios are contained in Appendix 6. In November the GMGF model itself was updated and information provided for the baseline position. This updated information has been used in this report. Unfortunately the GMFM AG updated information has not yet been released and so scenarios 4-6 have not been able to be redone. It is understood that the updated GMFM AG data will be available early in 2008 and it would make sense at that time to input into the model and view results for scenarios 4-6.

1.3 Addressing key issues raised in the JWDPD Stage One issues and options report

Waste planning and waste management is evolving and changing at a rapid pace and consequently planning for new waste management facilitation must reflect this dynamic situation. The needs assessment provides an analysis which provides an applied methodology against waste arisings to ensure that in the future as much waste as possible is dealt with towards the top of the waste hierarchy. In particular the needs assessment identifies opportunities for managing waste towards the top of the waste hierarchy. The modelling process has produced a method for identifying the factors which have the greatest potential for improving the sustainability of their waste management practices. The model supports the aims and strategic objectives under JWDPD Issues 1 and 2 (GM JWDP Stage One issues and options report, May

2007) and identifies the waste streams that need to be managed. The key products of the modelling process provide a mechanism for testing a range of scenarios that may meet future waste management needs as required under JWDPD Issue 4. The model identifies key sectors and materials that identify waste as a resource (JWDPD Issue 5) and enable identification of options for managing future waste and new development (JWDPD Issue 6). The model includes predictions of landfill needs and in particular how this can be minimised through the adoption of more sustainable waste management practices in accordance with JWDPD Issue 7.

2 Model Development Stage 1 Assembling Baseline Data

The prime object of this element of the project was to gather the best currently available baseline data and growth forecasts.

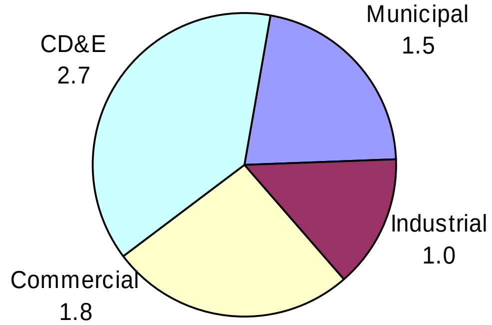
2.1 Waste Arisings Data

A key element of the assessment is to understand current waste arisings generated by the principal waste producers and where data is available to understand the arisings from sub sectors by waste type and destination. This level of detail is essential in order to develop and model options for future waste management projections and exploit policy options on future provision. This assessment has therefore been prepared using the most up to date data available at the time of production. The output from this assessment is a consistent and updatable data set ready for input into model.

The principal waste streams are identified as:
Commercial Waste and Industrial Waste (9 sector levels)
Construction Demolition & Excavation (Including Mines and Quarries Waste)
Hazardous Waste
Municipal Waste
Agricultural Waste
Low Level Radioactive Waste

The proportion of waste generated by the principal waste producers is illustrated in **Figure 2.**

Figure 2: Principal Waste Arisings in Greater Manchester 2007 (million tonnes)



2.1.1 Commercial Waste and Industrial Waste

The prime data source used was the survey of Commercial and Industrial (C&I) waste arisings completed for the NW RTAB 2007[1] together with historic trend data from previous surveys undertaken by the Environment Agency in 1998/9 and 2003. In considering options for future waste management needs it is important to have clear separation of commercial from industrial waste arisings. The survey goes further than this in providing estimates of arisings by 9 sectors and 9 waste material types. Also included in the survey was an estimate of the current management destination and an assessment of the potential to manage waste higher in the waste hierarchy.

Data is classified by:
Sector
3 Commercial
6 Industrial

Waste Type
Destination as known by producer
Potential for recycling waste currently sent for disposal
Potential for energy recovery from waste currently sent for disposal

The commercial and industrial sectors included:

[1] The North West Regional Technical Advisory Body and the North West Regional Aggregates Working Party commissioned a survey of commercial and industrial wastes for the North West region of England, to provide regional, sub-regional and local information on the amounts of waste produced and managed (completed April 2007 by Urban Mines)

1. Food, drink and tobacco
2. Textiles/wood/paper/publishing
3. Power & Utilities
4. Chemical/non-metallic minerals manufacturing
5. Metal manufacturing
6. Machinery & equipment (other manufacturing)
7. Retail & wholesale
8. Other services
9. Public sector

Waste material types were classified under:

- Animal and vegetable wastes
- Chemical waste
- Common sludges
- Discarded equipment
- Health care waste
- Metallic waste
- Mineral waste
- Mixed (ordinary) waste
- Non metallic waste

Waste Management destinations included:

- Landfill
- Incineration with Energy Recovery
- Incineration without Energy Recovery
- Transfer station
- Treatment plant
- Recycling
- Composting
- Waste water treatment
- Don't know

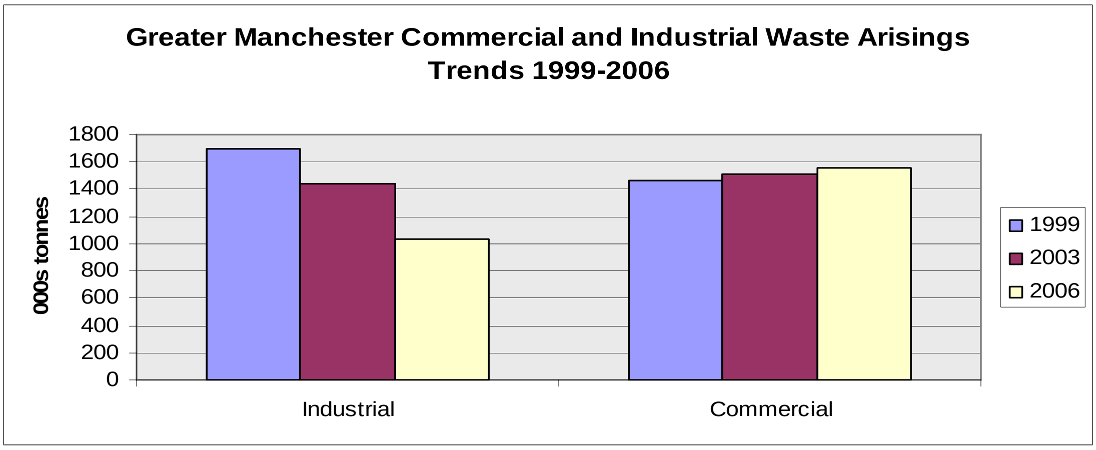
The waste and business sector categories are consistent with the European Waste Catalogue, Standard Industry Classification and methodologies used in Environment Agency survey and reporting of waste management data. Waste management destinations are derived from producer knowledge of where their waste is taken. Inevitably this results in the need to include a category of "Don't Know" where the nature of onward waste management is unknown to the producer. Waste in this "Don't know" category is most likely to be sent to landfill and this assumption is made in the capacity gap calculation element of the model.

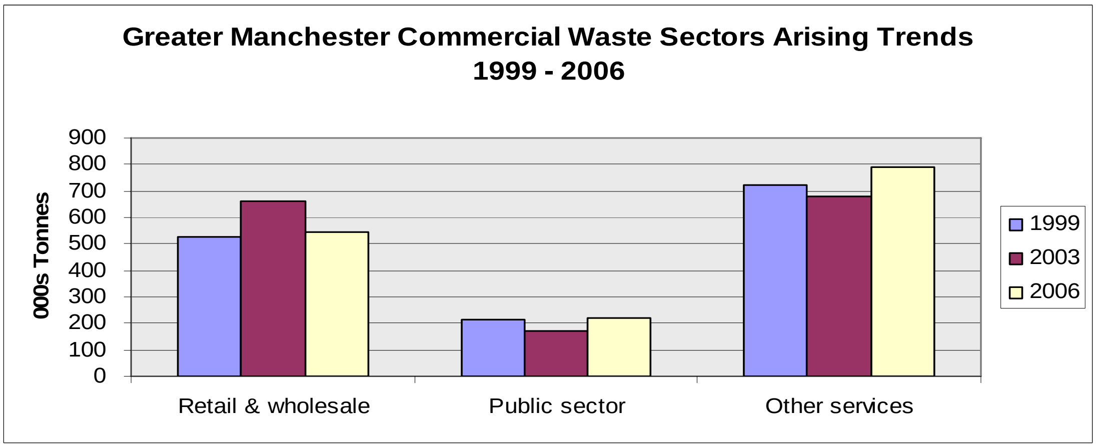
Table 2 overleaf shows the estimated quantities of waste produced by sector, type and destination.

	Waste type (Substance oriented classification)									
	Animal & vegetable wastes	Chemical wastes	Common sludges	Discarded equipment	Health care	Metallic wastes	Mineral wastes	Mixed (ordinary) wastes	Non-metallic wastes	Total
Food, drink and tobacco	84,423	1,695	16,719	19	11	824	629	29,553	25,747	159,620
Textiles/wood/paper/publishing	196	11,293	0	93	0	6,600	0	53,724	200,532	272,439
Power & Utilities	0	15,222	0	47	3	1,800	2	994	686	18,755
Chemical/non-metallic minerals manufacturir	706	169,017	3,159	157	4	8,272	18,910	64,917	37,793	302,935
Metal manufacturing	1	4,903	176	1,034	2	18,323	158,585	5,334	2,763	191,120
Machinery & equipment (other manufacturing	27,514	19,501	3,775	387	2	38,612	80	38,024	48,495	176,390
Retail & wholesale	14,522	3,341	128	6,354	114	114,315	446	160,077	243,831	543,127
Other services	10,996	121,544	42	2,437	278	189,945	885	201,685	260,896	788,707
Public sector	3,211	209	0	3,821	52,231	98	2	138,884	24,013	222,469
Total	141,569	346,726	23,998	14,349	52,644	378,790	179,539	693,191	844,756	2,675,562

Table 2 Greater Manchester Estimate of C&I waste arisings by waste stream and destination (figures in tonnes)

	Destination									
	Composting	Don't know	Incineration with Energy Recovery	Incineration without Energy Recovery	Landfill	Recycling	Transfer station	Treatment plant	Waste water treatment	Total
Food, drink and tobacco	14,455	4,987	2	1,673	27,680	88,012	12,523	10,288	0	159,620
Textiles/wood/paper/publishing	163	2,312	2	0	38,445	205,292	18,707	7,305	212	272,439
Power & Utilities	0	14,999	3	0	954	2,754	0	44	0	18,755
Chemical/non-metallic minerals manufacturir	214	9,465	5,170	2,412	139,088	56,658	17,861	68,722	3,344	302,935
Metal manufacturing	0	1,676	2	141	6,171	180,031	1,154	1,945	0	191,120
Machinery & equipment (other manufacturing	0	5,523	174	114	60,057	91,847	16,448	2,227	0	176,390
Retail & wholesale	1,155	61,173	109	17,790	85,812	341,673	33,115	2,301	0	543,127
Other services	0	34,860	94	2,119	157,112	438,262	38,922	117,297	42	788,707
Public sector	0	10,430	2,411	35,654	137,083	16,041	13,923	6,927	0	222,469
Total	15,987	145,424	7,967	59,903	652,403	1,420,570	152,654	217,057	3,597	2,675,562


Greater Manchester Commercial and Industrial Waste Arisings Trends 1999-2006
000s tonnes
1800
1600
1400
1200
1000
800
600
400
200
0
Industrial
Commercial
1999
2003
2006


Greater Manchester Commercial Waste Sectors Arising Trends 1999 - 2006
000s Tonnes
900
800
700
600
500
400
300
200
100
0
Retail & wholesale
Public sector
Other services
1999
2003
2006

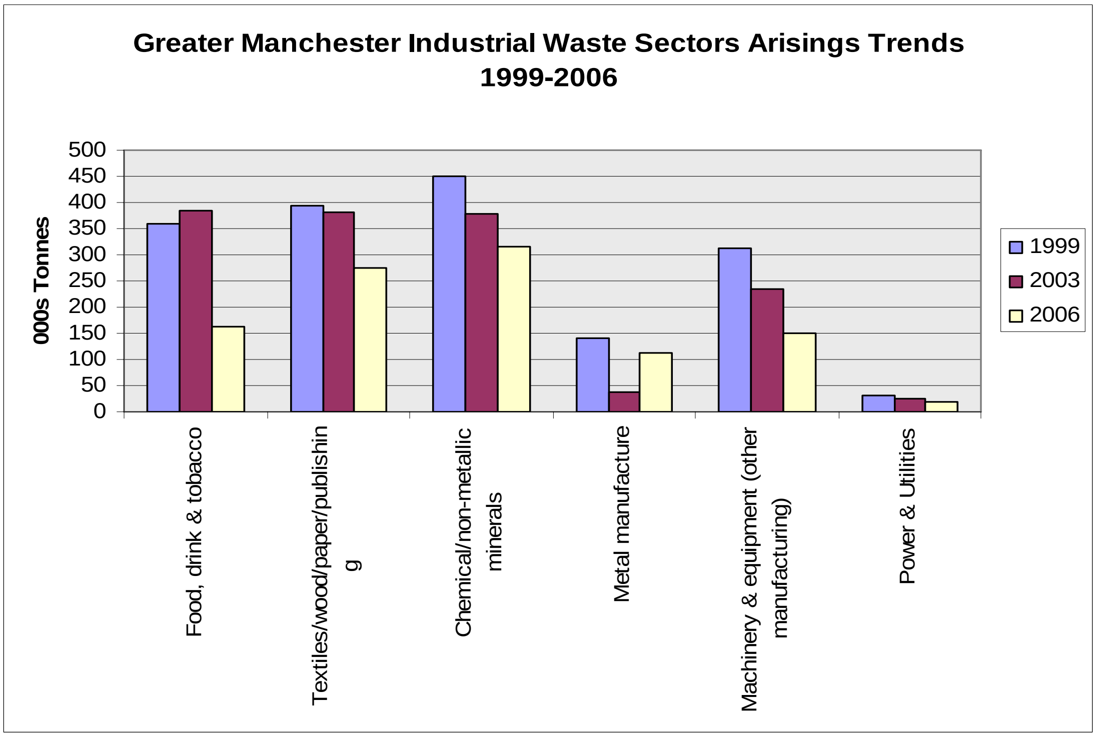

Greater Manchester Industrial Waste Sectors Arisings Trends 1999-2006
000s Tonnes
500
450
400
350
300
250
200
150
100
50
0
Food, drink & tobacco
Textiles/wood/paper/publishing
Chemical/non-metallic minerals
Metal manufacture
Machinery & equipment (other manufacturing)
Power & Utilities
1999
2003
2006

Figure 3 The above graphs display the current Greater Manchester Waste trends by sectors for commercial and industrial wastes.

2.1.2 Hazardous Waste

The key data source is from the Environment Agency for year 2004/5 based on Special Waste Regulations. In July 2005 the Hazardous Waste (England and Wales) Regulations and the List of Wastes (England and Wales) Regulations come fully into force. The new regulations replaced the Special Waste Regulations 1996. The new regulations set out what is defined as hazardous waste and introduced a new system of categorisation. The impact of reclassification has increased the number and types of wastes defined as 'hazardous' including common items such as TVs, computer monitors and fluorescent tubes.

Reliable data on 2005 Hazardous Waste Regulations was not available at the time that this report was compiled. Therefore the data contained in this report does not indicate any change in arisings or management that may have occurred as a result of the new regulations and definitions. Whilst the information provided is the best that is available it should be treated with caution.

Whilst reliable and detailed data on waste classified under the old Special Waste Regulations is available there is no ready way of relating any specific waste arising to a facility type or location other than CD&E contaminated waste and asbestos which can only be disposed of by landfill. Even in this case it is not possible to determine how much of this waste was deposited at sites outside of Greater Manchester and how much was imported from other sub regions. It should also be noted that the commercial and industrial waste totals given in the section above are inclusive of wastes that are also classified as hazardous waste.

2.1.3 Construction Demolition and Excavation Waste (CD&E)

The primary data source is the study to fill the evidence gaps for construction, demolition and excavation waste streams in the North West region[2]. Data from the Environment Agency for landfill site deposits from 2001 through to 2005 was also used. A wide range of types of operator / operation was surveyed to generate as complete picture of waste arisings, processing and disposal as possible. The survey was conducted by postal survey and return rates were much less than desirable in order to produce robust estimates across all sectors producing, processing and using CD&E waste. Some data is available at Greater Manchester level. However, the report does not cover data for key CD&E sectors including skip hire, demolition contractors and building maintenance and house renovation and repairs.

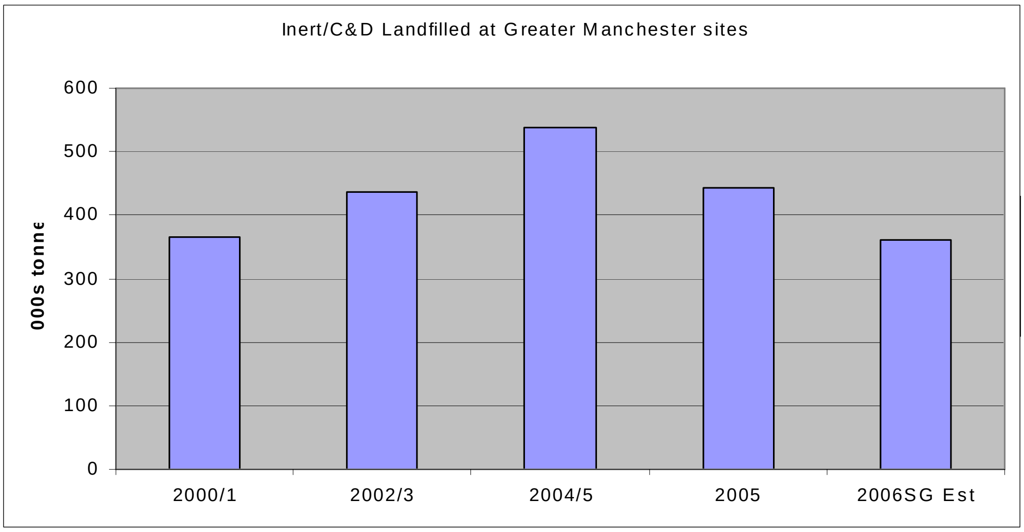
Some of the sectors which have completed returns such as pre-cast concrete manufacturers and quarries who report that they reuse or recycle almost all the waste they produce. The estimated waste arisings from the CD&E sector that are not landfill is in the order of 1.4m tonnes per annum. Almost 1m tonnes of aggregate crushing capacity is registered as based in Greater Manchester.

[2] The Survey was commissioned by North West Regional Technical Advisory Body for Waste and the North West Minerals and Waste Planning Authorities and was completed by Smiths Gore

The report does provide an estimate of total CD&E waste produced, landfilled and used on exempt sites. However, the estimates for the amounts landfilled including estimates of the totals landfilled in Greater Manchester and exports do not correlate with the EA landfill deposit data.

The EA deposit data is taken from submissions from licensed sites and show actual deposits (mostly based on weighbridge data) for each year from 2001 to 2005. These returns show significant year on year fluctuations. The returns do not take into account that mixed waste from maintenance and refurbishment such as skip hire waste may be included in general industrial and commercial waste rather than inert construction and demolition waste.

Figure 4 Environment Agency landfill site deposit data 2001 through to 2005 (2006 estimate –Smith Gore report)



Environment Agency data for inert construction and demolition waste for 2004/5 shows that 537,000 tonnes was landfilled whilst 485,000 tonnes was managed through transfer facilities in Greater Manchester**.**

Taking all of the data and factors referred to above the estimate for construction, demolition and excavation waste for disposal including deposits at exempt sites is;

- Arisings in order of 1,400,000 tonnes pa
- Landfill in Greater Manchester 500,000 tonnes pa
- Exports for landfill 500,000 tonnes pa
- Disposals at Exempt sites 400,000 tonnes pa

These totals include inert materials from skip hire, house building, building renovation and repairs, land regeneration/remediation.

2.1.4 Municipal Waste

Data sources used are from the Greater Manchester Waste Disposal Authority Municipal Waste Management Strategy Review 2006/7 (GMWDA MWMS) and from the Wigan Waste Disposal Authority Municipal Waste Management Strategy together with updated arisings data from 2006/7.

Detailed analysis of GMWDA arisings and management methods are available from the GMWDA MWMS review 2007 Baseline Report including projections and sensitivity analysis. Comparable information for modelling purposes is also available from Wigan's MWMS.

Following the award of contracts under the PFI procurement process plans to implement the MWMS are now progressing to a stage where planning applications are in process or timetabled and an announcement has been made concerning the treatment of residual waste treatment products, these additional capacities have also been built into the developed model.

Secondary products of waste treatment in particular the solid recover fuel (SRF) produced from the treatment of residual municipal waste have been estimated at 275,000 tonnes per annum. However, with the exception of this particular arising there is insufficient data available on the potential products of future treatment processes and therefore the model does not factor in secondary treatment products at this stage. Contractual arrangements have been announced with respect to the use of this municipal SRF material outside of Greater Manchester and therefore future capacity does not show as a gap.

2.1.5 Agricultural Waste

The estimates have been made based on generic agricultural waste estimates and persons employed. With regard to agricultural waste in Greater Manchester the quantities are relatively small; 300,000 tonnes.

2.1.6 Low Level Radio Active Waste

Data sources used are supplied by the EA. The arisings data is based upon 2005 real data and we have been advised by the EA that it reflects a typical annual discharge pattern and are shown in Figure 5. With regard to disposal for low level radio active waste, it is understood that the disposal is either in-house or to external facilities of which some could be external to Greater Manchester. There is no reliable data source for information on export out of the Greater Manchester Region available at the time of the development of the model.

Figure 5 Low level radio active waste arisings in Greater Manchester (source: Environment Agency)

Site	Annual Quantity (2005)
Manchester Royal Infirmary	13.9 MBq beta/gamma activity
Pendlebury Children hospital	1.88 MBq beta/gamma activity
Christie Hospital	12.3 MBq beta/gamma activity
North Manchester General Hospital	1.66 MBq beta/gamma activity
Hope Hospital	51.12 MBq beta/gamma activity 8 MBq Tritium
University of Salford	148 MBq beta/gamma activity

2.1.7 Import/Export

Data on the import and export of waste to and from Greater Manchester is very limited and unfortunately is of no practical value for the development and immediate incorporation into the model.

The approach taken is therefore to identify the current net gap between waste management throughput at facilities within Greater Manchester and the estimated level of arisings. For the accuracy of the model it has been developed to show the net gap situation within Greater Manchester. However, the identification of the current net gap will provide a basis for understanding what level of new facility could in theory be provided to treat or dispose of waste within Greater Manchester rather than rely on external provision of facilities.

From the results that the model then provides one can then apply additional understanding of the import and export situation. For this approach must recognise that wastes will currently be both imported and exported from the sub-region.

All Data set information covering arisings information and sources are listed in full in Appendix 3.

2.2 Existing and Planned Capacity

2.2.1 Overview

Prime data sources for understanding existing capacity include:

- Waste Disposal Authority MWMSs and Planned capacity under PFI Contract
- Environment Agency Licensed Site Data 2005
- Capacity data by inert/non inert only - Deposit data on waste categories (but limited)
- GMGU – Data on planning status capacity and operational status

Data was supplied on 430 waste sites, plus 57 licensed sites without planning information, plus 19 recent planning applications, however some of this data was duplicated and so now applies to sites that no longer have any capacity. Capacity information of some kind is present for all but 45 of the 430 core sites, but this is spread across 13 fields. However, there was no simple way of extracting systematic and consistent data suitable for entry into a database that can be interrogated by programmed reports. It was therefore necessary to validate and develop a formal database that could be used as a direct input to model the capacity gap.

It was therefore necessary to go through the data line by line and:

- Assign a consistent facility type to each site
- Determine site status
  - Operational
  - No longer operational
  - Not yet operational
  - Unknown
- Determine annual permitted capacity of each site (and expected/actual usage where possible)
- Determine annual throughput of each site
- Determine site lifetime
- Enter new PFI sites
- Establish any new capacity planned – what can the site take each year?
  - Data based upon Primary source E Permits totals - also WDA 2005/06 Landfill information, plus data provided from GMGU
- New current throughput – How much actually processed/landfilled etc?
  - Data based upon RATS 2004 (EA) & WDA 2005/06 data taking into account permit & planning restrictions

This process has therefore resulted in the production of an Access database that can easily be updated as new information becomes available and provides capacity figures by waste management option on a year on year basis from 2007 to 2030. From this database there are now 304 entries that are relevant for use by the model (ie/ those sites that currently have capacity, or will provide capacity up to 2050).

2.2.2 Landfill Site Data

Landfill sites that are suitable for non hazardous commercial and industrial waste together with municipal waste have historically formed the core element of disposal capacity. Landfill void estimates have been taken largely from returns to the Environment Agency from landfill operators of their remaining void space in 2005 supplemented by known additional planned capacity and the historic rate of usage of landfill capacity at each site. The void projection is therefore only at a best-estimate. There is also some uncertainty over the planning and permitting status of some sites which may or may not eventually become available as fully authorised capacity. Simple projections of capacity and life expectancy based on inputs as nominal average relationships between tonnes input and void capacity must be treated with great caution and can be subject to wide variation.

It should be noted that deposits at non-hazardous landfill will include CD&E waste essential for landfill operation and engineering which may account for in the order of 20% of void capacity.

2.2.3 Hazardous Landfill

One landfill site in Greater Manchester includes a cell for the disposal of hazardous asbestos waste capacity that is included with the overall total for the site. Annual disposal of hazardous asbestos, contaminated construction, demolition and excavation waste is estimated at 103,000 tonnes.

2.2.4 Construction Demolition and Excavation Waste Landfills

The estimated fully authorised capacity is currently for 3.02 million m^3 with capacity at sites currently in planning process 2.2 million m^3. However, no consistent data is available on the rate of void usage.

Estimates based on Smith Gore and Environment Agency data indicates:

- Arisings in order of 1,400,000 tonnes pa
- Landfill in Greater Manchester 500,000 tonnes pa
- Exports for landfill 500,000 tonnes pa
- Disposals at Exempt sites 400,000 tonnes pa

2.2.5 Capacity Data Expressed in the Model

Utilising the latest data, as at mid September 2007, undertaking the data management improvements (as described in 2.2.1) the following capacity information was assembled and collated in **Table 3**. This table can of course be updated as more information comes live and will enable updates for the model to be produced as appropriate.

Table 3 shows the Summary of Waste Management Site Capacity 2007 as collated and updated by this project (November 2007).

Waste Management site capacity 2007 as collated & updated by this project (Nov 07)

Waste Management	**No. sites operational**	**Current Throughput**	**Current Capacity**	**000s Tonnes Void space 2007**
Landfill (non-hazardous)	5	1,497	1,497	8,417
Incineration with Energy Recovery	1	120	120	
Treatment Plant	15	216	650	
Recycling	109	1,191	2,131	
Composting	2	1	95	
Landfill (hazardous)	1	103	103	1,030
Landfill (C+D)	4	123	297	3,591
Recycling (aggregates, C+D)	8	0	529	
Transfer Station	156	2,877	11,312	
Waste Water Treatment	3	114	315	

3 Stage 2 Legislation and Policy Forecasts

The National Waste Strategy for England was recently published in May 2007 and this draws together both National and European legislative, policy and strategic imperatives, targets and impacts. Details of legislation analysed for the model is contained in Appendix 4.

3.1 Reviewing legislative, policy and strategic impacts

The needs assessment takes into account the National Waste Strategy (NWS) and also the policies included in the draft North West Regional Spatial Strategy (NW RSS) and Regional Waste Strategy (RWS). **Appendix 4** sets out the legislation, policy and strategy that have been considered such that they may have impacts on the modifiers applied to the model. In addition in **Appendix 4** the key impacts of the NWS in terms of objectives, targets and proposed initiative are set out, including where appropriate any variance as included in the NW RSS and RWS.

Table 4 Summarises the Potential Impacts of the NWS and its initiatives

Statutory Requirements	Potential Impacts
Pre-treatment requirements - The Landfill Regulations 2002 require waste to be treated prior to disposal to landfill.	Encourages movement of waste up the waste hierarchy and away from landfill
Legislation which applies to waste from consumer goods: • Packaging and packaging waste; • Disposal of spent batteries and accumulators; • Disposal of waste oil; • End-of-life vehicles; • Environmental problems of PVC; • Waste electrical and electronic equipment.	Encourages waste reduction movement of waste up the waste hierarchy. Impacts on waste arisings and material type in commercial, industrial (C&I) and municipal wastes (MSW)
Simplifying the regulatory system and making it more proportionate and risk based through: • waste protocols that clarify when waste ceases to be waste (and so not subject to regulation) • reforms of the permitting and exemption systems and the controls on handling, transfer and transport of waste, (with cost savings to business and regulator of, e.g. on permitting reforms, at least £90 million) – better communication with stakeholders • implementing actions which will reduce fly-tipping	May reduce costs in downstream recycling and reprocessing
Site Waste Management Plans a mandatory requirement for construction projects over a certain value (subject to consultation), and extend to other parts of the supply chain	Promotes minimisation and recycling of CD&E waste
Tax Incentives	**Potential Impacts**
Landfill tax escalator to reduce, re-use and recycle waste (from £24 now to £48 in 2010)	Sharp reduction in cost advantage of landfill and other waste management options
NWS Targets	**Potential Impacts**
New national target for the reduction of commercial and industrial waste	Target likely to be exceeded through reduction in total quantity of industrial

going to landfill - levels of commercial and industrial waste landfilled are expected to fall by 20% by 2010 compared to 2004.	waste arisings
Annual greenhouse gas emissions target: 2020: reduction of 10 million tonnes of CO_2 equivalents	No quantitative projections yet available
A target to halve the amount of construction, demolition and excavation wastes going to landfill by 2012 as a result of waste reduction, re-use and recycling.	CD&E Surveys indicate that most CD&E waste going to landfill is from the large number smaller scale operators in building demolition and renovation. Impact of quasi landfill in exempt sites is not addressed
Government Departments to reduce their total waste arisings by 25% by 2020 relative to 2004/05 levels Departments to increase their recycling figures to 75% of their total waste arisings by 2020	The public sector as a whole shows low levels of recycling – this initiative would have a significant impact if replicated across all of the public sector
NWS Initiatives	**Potential Impacts**
Key waste materials where diversion from landfill could realise significant further environmental benefits. The Government is taking action on paper, food, glass, aluminium, wood, plastic and textiles	Impact of waste reduction and recycling/reprocessing mainly in industrial sectors
Incentives for excellence in sustainable waste management through a zero waste places initiative to develop innovative and exemplary practice	Promotes waste hierarchy but no specific outcome
Taking forward voluntary agreements with the relevant producers in order to increase separate collection, recycling and recovery of potentially hazardous household wastes	Potential to increase requirement for hazardous waste handling and disposal facilities as this waste is removed from the residual waste stream
Defra is working to further improve the outcomes from the BREW programme	Any impact will be to reduce waste or move waste up the hierarchy
Encouragement for local authorities to take a 'wider' role in 'partnerships' to help local businesses reduce and recycle their waste with 'more integrated' management.	Potential for minimisation and recycling but local authorities do not generally have the resources to support the commercial sector.
Proposals	**Potential Impacts**
Proposed consultation on further	This could significantly reduce the

restrictions on the landfilling of biodegradable wastes and recyclable material.	landfill option statutory limit to the types of non-hazardous wastes that can go to landfill, especially food waste
Producer responsibility proposals for statutory higher packaging recycling targets, the Government is seeking further voluntary action, but is prepared to regulate if this does not deliver - introducing measures to: • reduce excess packaging, for example by setting optimal packaging standards for a product class; • support development of a joint protocol to ensure that local government and industry both identify the best systems for cost effective collection of packaging waste • extend WRAP's Courtauld Commitment to non-food retailers to increase the total commitments by retailers to reductions in packaging, food and other post-consumer waste;	Impacts should be to reduce packaging waste and increase recycling in Commercial, Industrial and Municipal sectors

4 Stage 3 The Development of the Needs Assessment Model

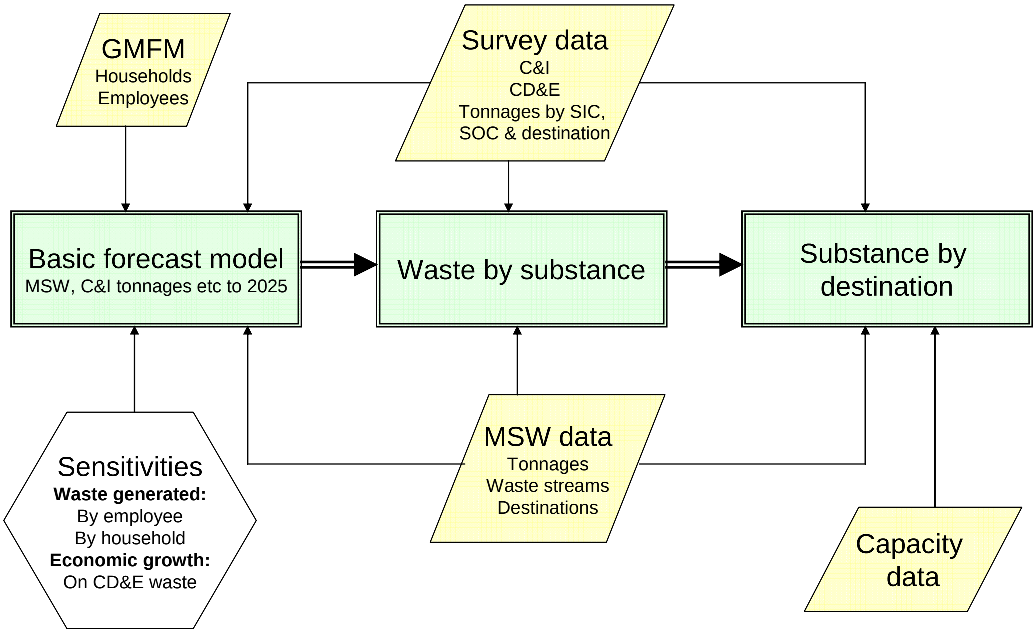
4.1 Building the Model

The principal aim of this project was to produce a transparent, future-proof, model able to simulate future waste facility requirements under a range of scenarios. This analysis therefore also includes running the model for a range of different scenarios which illustrate the potential use of the model in forecasting the need for new capacity and in informing the decision making process in terms of the scale and nature of new capacity requirements.

4.2 Model Structure

The diagram (**Figure 6**) shows the basic structure of the Excel based model. The Basic Forecast Model component utilises data from the Greater Manchester Forecast Model (GMFM) in the form of the forecast number of households and employees by sector through to 2025. These inputs are then used to forecast waste arisings using further data from Local Authorities (MSW data) and other survey data (the recent North West surveys on commercial and industrial and construction, demolition, and extraction arisings). For commercial and industrial forecasts the number of employees per sector (GMFM) was combined with the arisings per employee of that sector (C&I survey) to provide an estimate of arisings for each sector for each year. The CD&E survey data was less detailed and an estimate for total CD&E arisings was agreed and forecast to grow by the same rate as the Greater Manchester economy as forecast in the GMFM.

Figure 6 The "Shape" of the Model



SIC (Standard Industrial Classification, defined by Office of National Statistics)

For household waste arisings, the number of households from the GMFM model is multiplied by a waste per household figure. The initial data point for waste per household is derived from 2006 actual figures. The model allows this figure to reduce over time by assumption. The initial assumption is that waste per household falls by 0.5% per annum. Non-household waste is initially assumed to grow from its 2006 base by 1% per annum until 2010 from which point it remains static.

For C&I arisings, waste arisings per employee were calculated from the 2006 survey and applied to the GMFM output of employees per sector. Over time there are two main forces at work that may affect this figure. One would expect that as companies get more efficient less waste per employee would be produced. However, one might also expect companies to be more productive with respect to output. Given the lack of empirical evidence as to the relative strength of these effects it was decided to leave the waste per employee figure as fixed through time. Future iterations of the model should seek to adapt this element of the model appropriately.

Total waste arisings by source are then converted to waste by substance oriented classification. This categorisation splits waste arisings for MSW and C&I into nine waste streams using MSW waste composition data and the C&I survey.

Using MSW BVPI data and the C&I survey, waste arisings by SOC are then split into first destination. Hence the model moves from source to type to destination. It is this final element, SOC by destination that is then compared to the capacity data to calculate the capacity gap.

Building the model in this way allows the gap to be analysed with respect to waste type and source. The sensitivity analysis allows the main causes of the gap to be identified using an Excel add-in software package called Crystal Ball that can describe the relative weights of factors that cause the gap. This is described in more detail below.

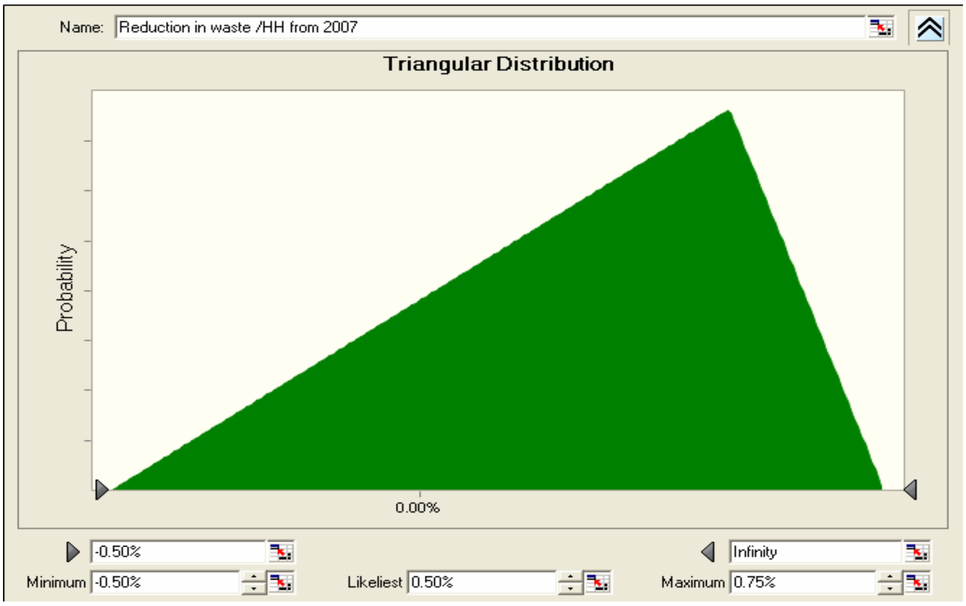
There are two facets of waste management which cannot be fully factored into the model at this stage due to lack of baseline information. Transfer operations are important to the logistics of both public and private sector waste management and will form a necessary step in the collection and transport of waste. However, there is insufficient information available to allocate specific waste arisings and their primary management options (recycling, treatment or disposal) to the requirement for specific transfer capacity. There would appear to be a significant current surplus capacity. The second issue is that of the products of waste treatment processes. There is currently insufficient information on the products of existing treatment processes to gain a clear understanding of the treatment products and their disposal requirements. With the exception of information from the MWMS and PFI developments there is also no current basis for estimating treatment products from future treatment or recyclate processing, in particular as these products and further management requirements may be expected to be highly materials specific.

4.3 Sensitivity assumptions

A thorough sensitivity analysis should include result sensitivity to the structure of the model (model sensitivity) itself and the potential variability of assumptions within the model (uncertainty). The model is constructed to allow the analysis of the sensitivity of the capacity gap to both these elements. Particular variables in the model have been described using appropriate probability distributions and the software used in the modelling accounts for both model sensitivity and uncertainty.

Sensitivity charts show the influence each assumption has on a particular forecast. During a simulation, the software used (Crystal Ball) ranks the assumptions according to their importance to each forecast. The sensitivity chart displays these rankings as a bar chart, indicating which assumptions are the most important or least important in the model.

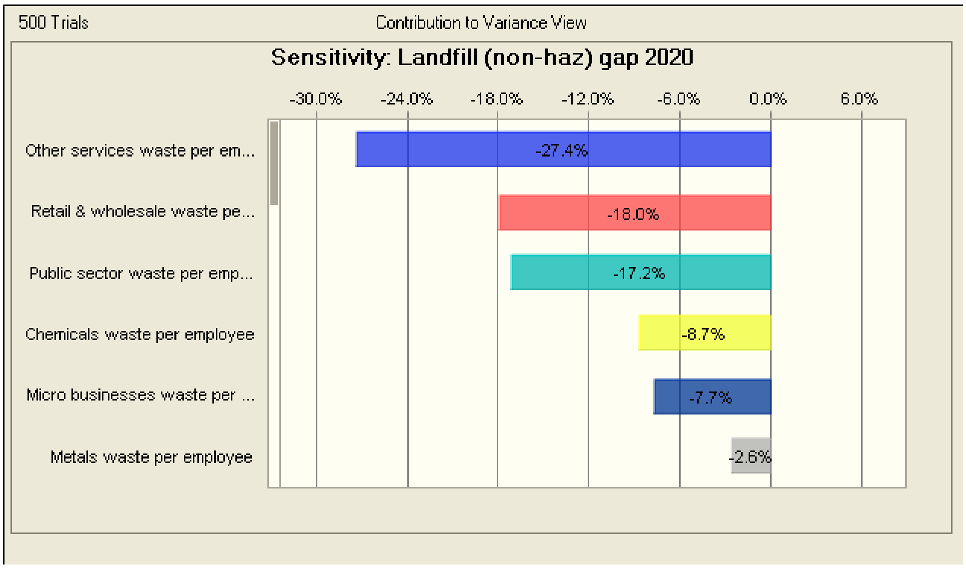
Figure 7 Sensitivity Chart. Example showing the distribution covering household waste



This particular example shows the reduction in household waste from 2007. The likeliest reduction in any one year was assumed to be a reduction of 0.5% with a maximum reduction of 0.75% and a minimum reduction of -0.5% (i.e. an increase).

An example of the output from the sensitivity analysis is given below. The chart overleaf shows that the most important parameters in the variation in the non-hazardous landfill capacity gap are the waste per employee figures used for the Other Services, Retail & Wholesale, and Public Sectors. That is, the commercial sectors that are predicted to expand the most in terms of jobs will have the biggest impact on the size of the landfill gap.

Figure 8 Examples of output from Sensitivity Analysis



This basic result will not vary greatly between scenarios. Future enhancements to the model should consider the nature of the variability for those parameters modelled this way as well as including other parameters to which a degree of risk and uncertainty is attached.

Details of the parameters defined in this way are provided for in **Appendix 5.**

4.4 Reviewing the modifiers and developing scenarios

In developing model scenarios that effectively illustrate the issues on which key decisions can be made it is helpful to initially run a small number of options that define the envelope of scenarios within a range of practical scenario options. The scenarios should provide examples of key issues as identified in the earlier work during the model development covering issues and options that can be addressed through this modelling analysis.

In order to develop such scenarios it is necessary to make certain assumptions in particular about how the various categories of waste arisings will be managed through the categories of potential waste management methods. This requires that waste arisings and management options are modelled at the finest level of detail provided for by the model and its supporting database.

The modelling analysis can be made more useful by factoring into the scenarios modelled a key structural difference in the way that municipal waste is managed compared with wastes from the commercial and industrial waste sectors. In theory municipal and commercial and industrial waste are competing for the same available capacity. However, in practice this is not the case as the WDA has or is in the process of tying up long term contracts for its capacity requirements as predicted by the MWMS (these contracts are supported by both existing and planned for infrastructure) for treatment and disposal. The capacity that will be added by the PFI contracts have been included in the capacity database for the model with predicted dates of when these come on stream.

Commercial and industrial waste is rarely managed or disposed of under long term contract. Contracts for management and disposal are often annual or on the spot. C&I wastes are therefore much more vulnerable to any capacity gaps that may develop in the future.

Sensitivity modelling will demonstrate where capacity issues may arise with municipal waste. However, for municipal waste it is clear that capacity issues will only arise in situations where waste arisings modifier assumptions vary significantly from the capacity predictions underpinning the PFI capital programme.

It is with respect to wastes generated by the commercial and industrial waste sectors that gaps in future waste management provision are most vulnerable.

The initial scenarios modelled therefore include the assumption that requirements for municipal waste take up all existing or planned capacity that it requires. This means that the model therefore essentially provides an assessment capacity and capacity gaps that relate primarily to commercial and industrial waste sector arisings with respect to treatment and disposal management methods.

Construction, demolition and excavation waste (CD&E) and management capacity is also modelled. Whilst municipal waste arisings do generate waste in this category (80,000 tonnes per annum) the quantity is small with respect to the total CD&E arisings and is of low significance with respect to overall management and disposal capacity.

The model not only provides the opportunities to examine different factors with respect to the modifiers on the projected quantities of waste arisings such as population and economic growth but also included factoring in data which allows consideration of options for management of waste materials at a higher level in the waste hierarchy than would otherwise be the case. The database feeding the model not only includes an assessment of the potential for recycling and energy recovery of those wastes currently sent only for disposal (this includes transferred waste and waste whose destination is not known to the producer) but also highlights the waste producing sectors with the most recycling or recovery potential. The initial modelling therefore includes scenarios which illustrate the impacts of increasing recovery and recycling on future capacity requirements.

The initial modelling has taken three waste management scenarios:

1. Baseline, which reflects the current status and forward planning position
2. Maximised recycling and recovery of C&I and CD&E wastes
3. A median level of increased recycling and recovery

Each of these scenarios has been modelled using the baseline arisings modifier and the accelerated growth modifier producing six scenarios in total.

4.5 Running the Model - Scenarios Modelled

1). Baseline: Baseline

This assumes that:

- MWMS targets for recycling and diversion from landfill are achieved
- C&I and CD&E waste arisings are managed by destination in the same ratio as in the data available from year 2006/7.

2). Baseline: Maximise Recycling and Recovery

This assumes that:

- MWMS targets for recycling and diversion from landfill are achieved
- C&I and CD&E waste arisings are managed
  by 2010 75% recyclable 25% possibly recyclable and 50% of remaining material used for energy recovery
  by 2015 100% recyclable 50% possibly recyclable and 50% of remaining material used for energy recovery
- CD&E waste arisings achieve a 50% landfill diversion 2012 (NWS target achieved)

3). Baseline: Median levels of increased recycling and recovery are achieved

This assumes that:

- MWMS targets for recycling and diversion from landfill are achieved
- C&I and CD&E waste arisings are managed
  by 2010 50% recyclable 10% possibly recyclable and 50% of remaining material used for energy recovery
  by 2015 75% recyclable 25% possibly recyclable and 50% of remaining material used for energy recovery
- CD&E 50% landfill diversion 2012

Key model run outputs covered are for dates of 2010, 2015, 2020 and 2025.

4.6 Validating the Model

As it stands the model produces intuitively correct results in that the gaps change in the way that would be expected as the scenarios change. Historic data from which to begin the forecast comes from the best sources available which are linked to economic forecasts from the Oxford Economic Forecasting methodology. The model is in effect though a first iteration of what it could become. This report outlines some of the areas where the model can be improved or extended. These include:

- First destination and secondary destinations
- More accurate descriptions of how C&I waste varies as productivity changes and jobs increase/decrease
- More accurate and detailed data on CD&E arisings

The model has the ability to increase its robustness as more data becomes available to meet the areas highlighted above and as it is applied for Greater Manchester.

5 Stage 4 Analysis of Results

Initial Interpretation of Modelled Scenarios

5.1 Baseline

The primary outputs from the model include the projected total arisings expressed in terms of their management route.

NB Interpretation of this modelling output must take account of the following caveats (this applies to all data within the equivalent elements of each scenario report):

- "Don't know" refers to waste for which the producer did not know the destination from the C&I survey 2006/7. It is probable that most, if not all, of this waste will be disposed of by landfill. In the model therefore data under the "Don't Know category" (100%) has all gone into the category of Landfill.
- A significant proportion of waste managed through transfer stations (75% classified as mixed ordinary waste) estimated at 80% is disposed of by landfill. In the model therefore, the data under the Transfer Station category has been split such that 80% goes to Landfill with the remainder 20% to recycling.
- From our capacity information there is only details of incineration with energy recovery. In normal circumstances waste that is incinerated without energy recovery tends to be specialist generated wastes. Within the model it has been assumed that all additional incineration capacity will include energy recovery.

Table 5 Projected Total Annual Waste Management Requirements by Management Method (000s Tonnes)

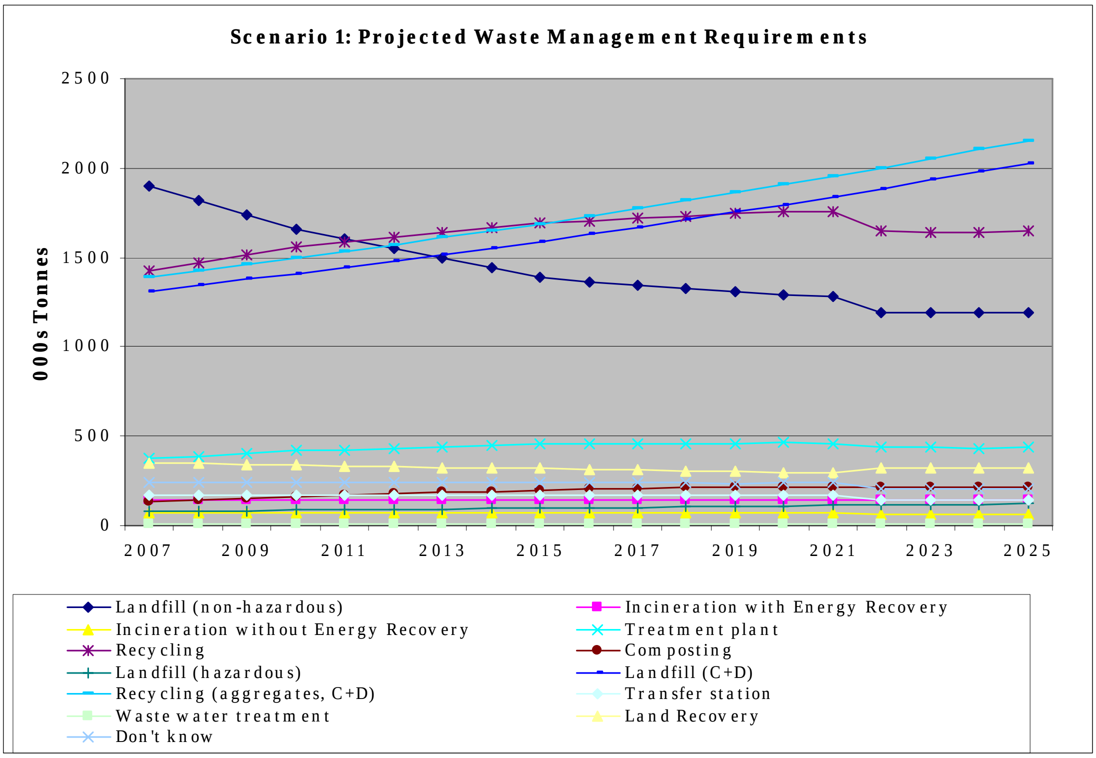
Table 5 (Scenario 1)
Projected Total Annual Waste Management Requirements by Management Method
(000s Tonnes)

Waste Management	**2007**	**2010**	**2015**	**2020**	**2025**
Landfill (non-hazardous)	1,900	1,660	1,387	1,286	1,193
Incineration with Energy Recovery	140	141	141	142	140
Incineration without Energy Recovery	73	73	72	73	61
Treatment plant	375	419	459	463	435
Recycling	1,421	1,557	1,696	1,757	1,645
Composting	135	160	201	217	216
Landfill (hazardous)	80	86	97	110	124
Landfill (C+D)	1,309	1,411	1,590	1,796	2,028
Recycling (aggregates, C+D)	1,390	1,493	1,689	1,907	2,153
Transfer station	171	170	168	169	147
Waste water treatment	7	6	6	6	5
Land Recovery	354	340	319	300	320
Don't know	244	242	238	237	207
Total Arisings	**7,597**	**7,757**	**8,063**	**8,463**	**8,676**

5.1.1 Baseline – Projected total annual waste management requirements by waste management method

At this Baseline; Baseline projection (figure 9) the total landfill requirement will fall due to MSW diversion from landfill. A rising trend at least until 2021, is seen in recycling requirements (largely through the increasing levels of MSW recycling) together with increased recycling of CD&E waste through to 2025 and increased treatment (again through planned MSW treatment).

Figure 9 Scenario 1 (Baseline: Baseline)



Scenario 1 (Baseline): Annual Capacity Gap
000s Tonnes

Waste Management	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Landfill (non-hazardous)	-783	47	-288	-456	-748	-1092	-1036	-981	-1278	-1256	-1236	-1698	-1678	-1658	-1658	-1521	-1513	-1514	-1518
Incineration	-92	-93	-93	-93	-93	-93	-93	-94	-94	-94	-94	-95	-95	-95	-96	-81	-81	-81	-82
Treatment plant	285	271	256	1011	1005	997	989	980	971	971	970	970	969	967	970	988	995	996	995
Recycling	720	674	629	754	726	698	670	643	615	604	592	579	566	553	553	670	675	675	670
Composting	-40	-28	-37	-45	-53	-61	-69	-77	-106	-109	-112	-116	-119	-122	-123	-121	-121	-121	-121
Landfill (hazardous)	23	21	19	17	15	13	10	8	6	3	1	-104	-107	-110	-112	-115	-118	-121	-124
Landfill (C+D)	-1012	-726	-760	-822	-861	-1009	-1045	-1082	-1440	-1480	-1520	-1561	-1603	-1646	-1690	-1735	-1782	-1979	-2028
Recycling (aggregates, C+D)	1144	1212	1178	1142	1104	1065	1026	987	846	804	762	718	674	628	581	533	484	433	381

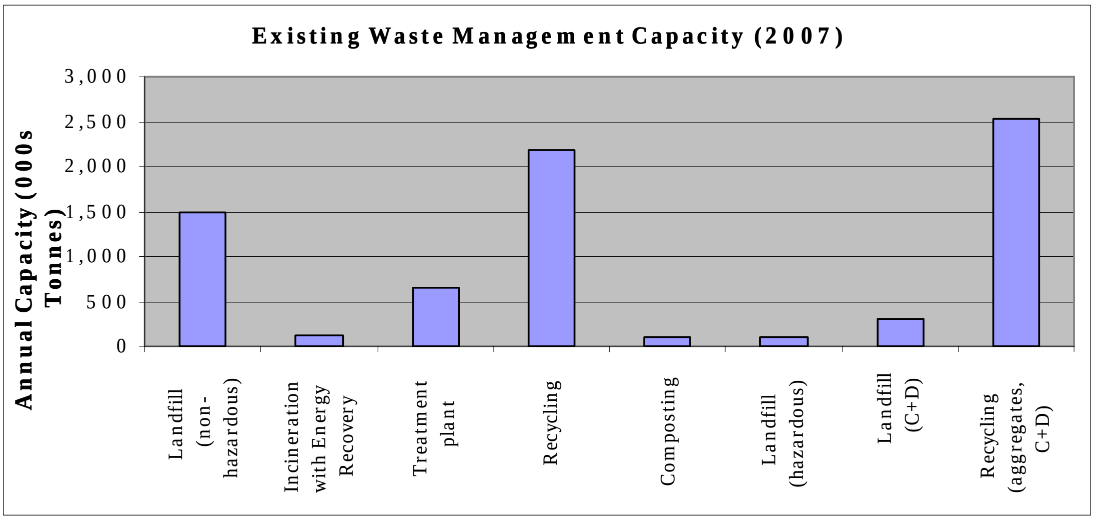
Table 6 Annual Capacity Gap (Greater Manchester Provision minus waste arisings) Scenario 1 Baseline: Baseline (000s tonnes)

This table shows the annual capacity (1000's tonnes) from the Capacity database that is, or is predicted to be, available in Greater Manchester at each year from present (2007) to 2025 minus the waste arisings in Greater Manchester over the same period based upon the model, here showing Scenario 1. It shows the relationship whether the provision of management capacity within Greater Manchester is greater (surplus shown in black) or less than the arisings (negative shown in red).

5.1.2 Baseline Scenario – projected existing and planned capacity

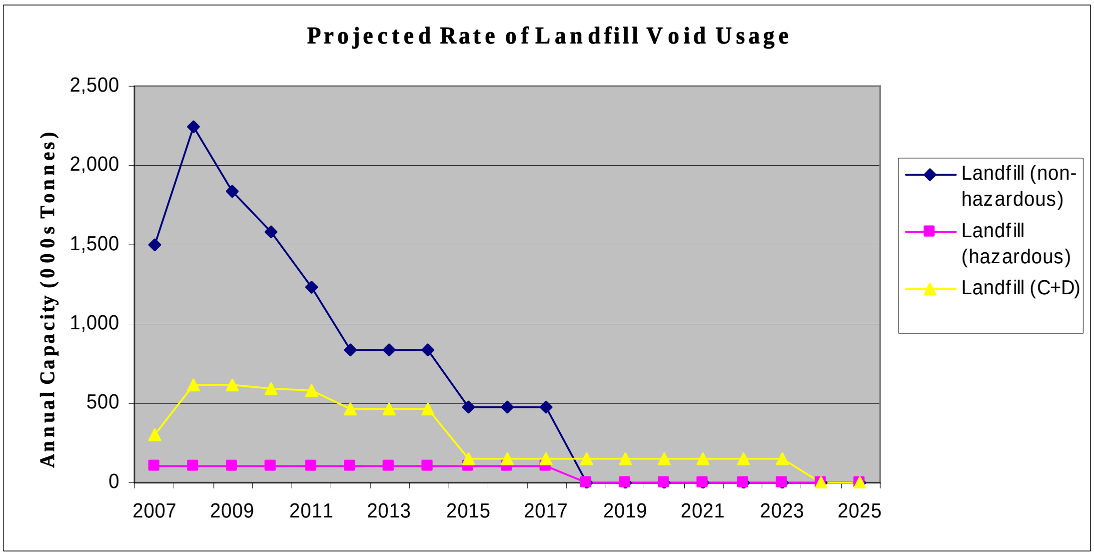
The second output from the model is the projected existing and planned capacity. The current existing waste management capacity is as illustrated in **Figure 10.**

Figure 10



Additional capacity is anticipated for landfill and through the infrastructure that will support the GMWDA PFI programme. Projections of existing capacity have been made on the basis of annual permitted capacity or when this data is unavailable recorded average throughput. This rule has been applied to all sites including landfill. However, as landfill sites have both annual restrictions on permitted quantities and a finite capacity it is also necessary to evaluate projections of void capacity and the rate that it is used.

Figure 11 illustrates the rate that existing and planned void within Greater Manchester may be used.



5.1.3 Estimates of the capacity gap for scenario 1 Baseline:

The gap in waste management capacity is taken by subtracting the existing capacity as expressed as annual capacity (**Figure 10**) from the projected required capacity (**Figure 9**) as shown in Table 6. A positive number indicates that there is a surplus capacity, whilst a negative number indicates that there is inadequate capacity within Greater Manchester. It must be taken into account that there will be imports and exports of waste to and from Greater Manchester and therefore the result is a net capacity surplus or gap with respect to waste arisings in Greater Manchester.

Indications of apparent surplus capacity may indicate that this capacity is currently taken by imports of waste from outside of the Greater Manchester Area. The capacity database is not currently populated with sufficient information on both current throughput and permitted capacity to enable this calculation to be made. However the database and model can be readily adapted when more updated information becomes available.

The capacity trends are shown as positive and negative for a number of the waste management methods and therefore for clarity it is necessary to consider each method individually.

The main apparent capacity gaps are for landfill capacity for non-hazardous waste and for landfill of CD&E waste. Composting is also in deficit and will require an annual treatment capacity of some 45,000 tonnes in 2010, 106,000 tonnes in 2015, in 2020 122,000 tonnes and in 2025 121,000 tonnes.

Although recycling and treatment are shown as “in surplus capacity” it is not possible to evaluate how much of this capacity is taken by “imported” wastes and how much is unused capacity. With recycling capacity it must also be considered that whilst MRF facilities may be multi-material many recycling facilities and reprocessors are materials specific and thus surplus capacity is not transferable. Detailed consideration should therefore be made on a material specific basis.

Figure 12 Landfill Capacity Gap (non-hazardous)

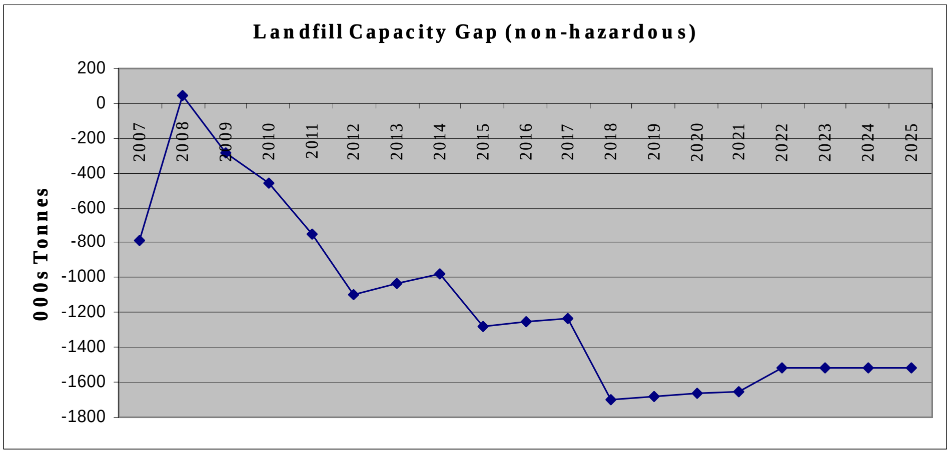
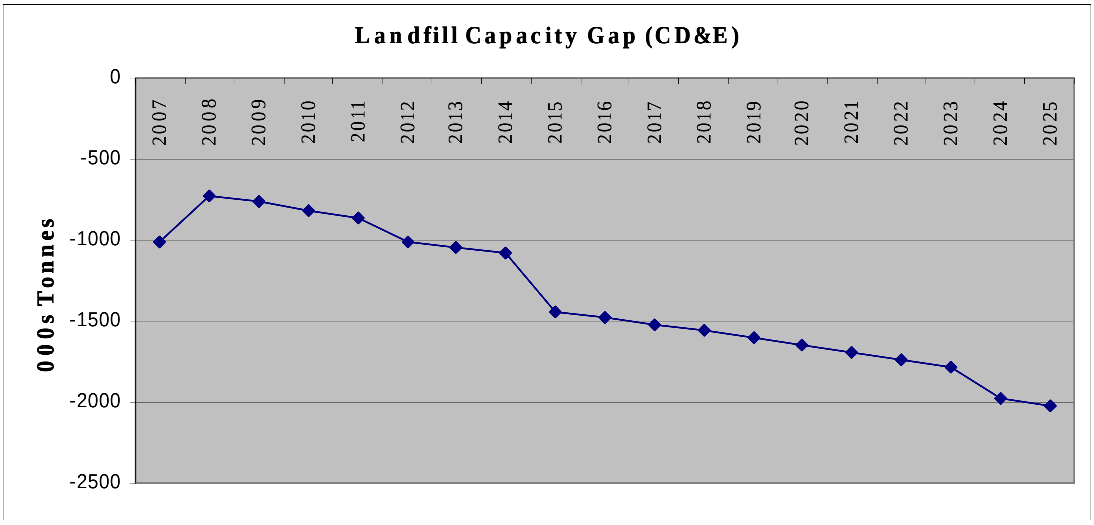


Figure 12 illustrates that despite the reduction in annual landfill capacity requirements for MSW within the baseline; baseline scenario there will be a significant net gap in landfill capacity with respect of the quantity (expressed in tonnes) from 2010. The step changes reflect the end of life of specific sites within Greater Manchester.

The projection indicates that cumulative landfill capacity for 8.7 million tonnes of waste will be required from 2010 to 2020. The translation of the requirement for the disposal of a specific tonnage of waste into landfill capacity is not a straight forward tonnes per cubic metre, capacity requirements can vary significantly according to waste type, emplacement methods and the characteristics and engineering requirements of specific sites. Taking into account an average emplaced waste density of 0.8 for predominantly commercial and industrial waste and the requirement for landfill engineering capacity the total void required (estimated at nominal 20%) for this quantity of waste would be in the order of 13 million cubic metres.

The capacity requirement for landfilling of CD&E waste is shown in **Figure 13.**

Figure 13 The Capacity requirement for landfill CD&E waste under Scenario 1 is shown below



This indicated that over 22 million tonnes of CD&E waste under scenario 1 will require landfill disposal from 2007 until 2025.

5.2 Scenario 2. Baseline: Maximise Recycling and Recovery

5.2.1 Scenario 2 Capacity requirements

Maximising recycling and recovery will produce some important differences in the capacity requirements for waste management methods. This is illustrated in **Table 7** below. This shows that by 2025 with maximised recycling and recovery there will be a need for an additional recycling capacity just under 1 million tonnes compared with the existing capacity in 2007. At the same time the annual landfill capacity would drop to 25% of the current annual requirement (491,000 tonnes 2025 as compared to 1,900,000 tonnes in 2007). There will also be a substantial need for additional recycling of construction, demolition and excavation wastes (over 1700,000 tonnes).

Table 7 Projected Total Annual Waste Management Requirements by Management Method Baseline; Baseline and Baseline Maximised Recycling and Recovery (000s Tonnes)

Table 7 (Scenarios 1 and 2 compared)
Projected Total Annual Waste Management Requirements by Management Method
(000s Tonnes)

Waste Management	**2007**	**Scenario 1 (Baseline) 2025**	**Scenario 2 (Maximum Recycling & Recovery) 2025**
Landfill (non-hazardous)	1,900	1,193	491
Incineration with Energy Recovery	140	140	173
Incineration without Energy Recovery	73	61	61
Treatment plant	375	435	435
Recycling	1,421	1,645	2,303
Composting	135	216	228
Landfill (hazardous)	80	124	124
Landfill (C+D)	1,309	2,028	1,014
Recycling (aggregates, C+D)	1,390	2,153	3,167
Transfer station	171	147	147
Waste water treatment	7	5	5
Land Recovery	354	320	320
Don't know	244	207	207
Total Arisings	**7,597**	**8,676**	**8,676**

Scenario 2 (Maximum Recycling and Recovery): Annual Capacity Gap
000s Tonnes

Waste Management	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Landfill (non-hazardous)	-783	253	125	164	-92	-399	-306	-214	-473	-454	-435	-898	-879	-860	-861	-816	-814	-815	-816
Incineration	-92	-147	-201	-256	-231	-206	-181	-156	-131	-132	-132	-132	-133	-133	-134	-114	-113	-114	-114
Treatment plant	285	271	256	1011	1005	997	989	980	971	971	970	970	969	967	970	988	995	996	995
Recycling	720	524	329	304	216	127	39	-49	-138	-147	-158	-169	-181	-193	-193	9	20	19	12
Composting	-40	-31	-42	-52	-62	-71	-81	-90	-119	-123	-126	-129	-133	-136	-136	-133	-132	-133	-133
Landfill (hazardous)	23	21	19	17	15	13	10	8	6	3	1	-104	-107	-110	-112	-115	-118	-121	-124
Landfill (C+D)	-1012	-578	-464	-378	-269	-269	-287	-306	-645	-665	-685	-705	-726	-748	-770	-793	-816	-990	-1014
Recycling (aggregates, C+D)	1144	1064	882	698	513	325	269	210	51	-10	-73	-137	-203	-270	-339	-410	-482	-557	-633

Table 8 Annual Capacity Gap (GM provision minus Arisings) Scenario 2 (Maximum Recycling and Recovery) (000's tonnes)

This table shows the annual capacity (1000's tonnes) from the Capacity database that is, or is predicted to be, available in Greater Manchester at each year from present (2007) to 2025 minus the waste arisings in Greater Manchester over the same period based upon the model, here showing Scenario 2. It shows the relationship whether the provision of management capacity within Greater Manchester is greater (surplus shown in black) or less than the arisings (negative shown in red).

An important product of the model is that it also allows waste arisings to be analysed by material types and projected destinations. This is important in practical terms as these elements of the modelling output show where specific changes in waste management practice will have to occur if the aim of managing waste more sustainably and towards the top of the waste hierarchy is to be achieved. **Table 9** provides an illustration of this more detailed approach and shows projected arisings and destinations for three key categories of commercial and industrial waste (the model also allows for the separation of commercial and industrial waste by sub sector) for Scenario 1 against Scenario 2 (Baseline: Baseline against Maximum Recycling and Recovery.

With respect to **Table 9**, under Scenario 2 with maximum recycling and energy recovery the model has indicated that reliance on landfilling could be significantly reduced by increased recycling in particular of mixed ordinary waste and non-metallic waste. Energy recovery could be deployed with respect to some 32,000 tonnes of mixed ordinary waste. Further reports for the model can be run which will show which commercial and industrial waste sectors are generating these wastes which could be more productively managed.

Table 9 (Scenarios 1 and 2 compared)
Projected arisings and destinations for three key categories of Commercial and Industrial waste
(000s Tonnes)

Material (SOC) and destination	2007	Scenario 1 2015	Scenario 2 2015	Scenario 1 2025	Scenario 2 2025
Animal & vegetable wastes	**144.2**	**133.7**	**133.7**	**111.4**	**111.4**
Composting	13.3	12.6	26.4	10.5	22.0
Don't know	8.8	8.2	8.2	6.8	6.8
Incineration with Energy Recovery	0.6	0.6	6.3	0.5	5.3
Incineration without Energy Recovery	1.0	0.9	0.9	0.8	0.8
Land Recovery	1.1	1.0	1.0	0.8	0.8
Landfill	58.5	53.3	5.7	44.4	4.8
Recycling	26.8	25.5	53.4	21.2	44.5
Transfer Station	2.9	2.7	2.7	2.2	2.2
Treatment Plant	31.2	28.9	28.9	24.1	24.1
Mixed (ordinary) wastes	**842.8**	**838.4**	**838.4**	**730.1**	**730.1**
Composting	0.0	0.0	0.0	0.0	0.0
Don't know	180.8	179.8	179.8	156.6	156.6
Incineration with Energy Recovery	0.7	0.7	36.3	0.6	31.6
Incineration without Energy Recovery	0.4	0.4	0.4	0.4	0.4
Land Recovery	0.0	0.0	0.0	0.0	0.0
Landfill	494.8	492.1	35.5	428.6	30.9
Recycling	19.8	19.8	440.8	17.2	383.9
Transfer Station	142.0	141.3	141.3	123.0	123.0
Treatment Plant	4.3	4.3	4.3	3.7	3.7
Non-metallic wastes	**942.1**	**919.5**	**919.5**	**821.1**	**821.1**
Composting	4.0	3.9	3.9	3.5	3.5
Don't know	25.0	24.4	24.4	21.8	21.8
Incineration with Energy Recovery	0.2	0.2	0.2	0.2	0.2
Incineration without Energy Recovery	27.8	27.2	27.2	24.3	24.3
Land Recovery	45.9	44.8	44.8	40.0	40.0
Landfill	130.6	79.2	0.0	70.7	0.0
Recycling	655.0	687.7	766.8	614.0	684.7
Transfer Station	15.7	15.4	15.4	13.7	13.7
Treatment Plant	37.8	36.9	36.9	32.9	32.9

5.2.2 Estimated capacity gap for scenario 2

Maximising recycling and recovery also produces significant change in the capacity gaps.

Under this scenario 2 additional annual capacity will be required by 2020 in order to satisfy the capacity gap for all waste management methods except “Treatment Plan” as shown in **Table 10**:

Table 10 Capacity Gaps as at 2010, 2015, 2020 and 2025 for Scenario 2

Table 10 (Scenario 2)
Capacity Gaps for Scenario 2 (Maximum Recycling & Recovery)
(000s Tonnes)

Waste Management	2007	2010	2015	2020	2025
Landfill (non-hazardous)	-783	-92	-454	-861	-816
Incineration with Energy Recovery	-92	-231	-132	-134	-114
Treatment plant	no net gap	no net gap	no net gap	no net gap	no net gap
Recycling	no net gap	no net gap	-147	-193	no net gap
Composting	-40	-62	-123	-136	-133
Landfill (hazardous)	no net gap	no net gap	no net gap	-112	-124
Landfill (C+D)	-1,012	-269	-665	-770	-1,014
Recycling (aggregates, C+D)	no net gap	no net gap	-10	-339	-633

Maximising recycling and recovery will require significant input to capacity at least from 2015 however, detailed information on material types and process specific information was not available for incorporation into the model so that recycling capacity for individual waste stream may be required before then. There are significant gaps in capacity for landfill through to 2025. With maximising recovery there is also a significant gap from present until 2025.

There is a significant fall in the cumulative non-hazardous landfill requirement under scenario 2 compared with Scenario 1. Scenario 2 approximates to requiring only 50% of landfill capacity compared with Scenario 1.

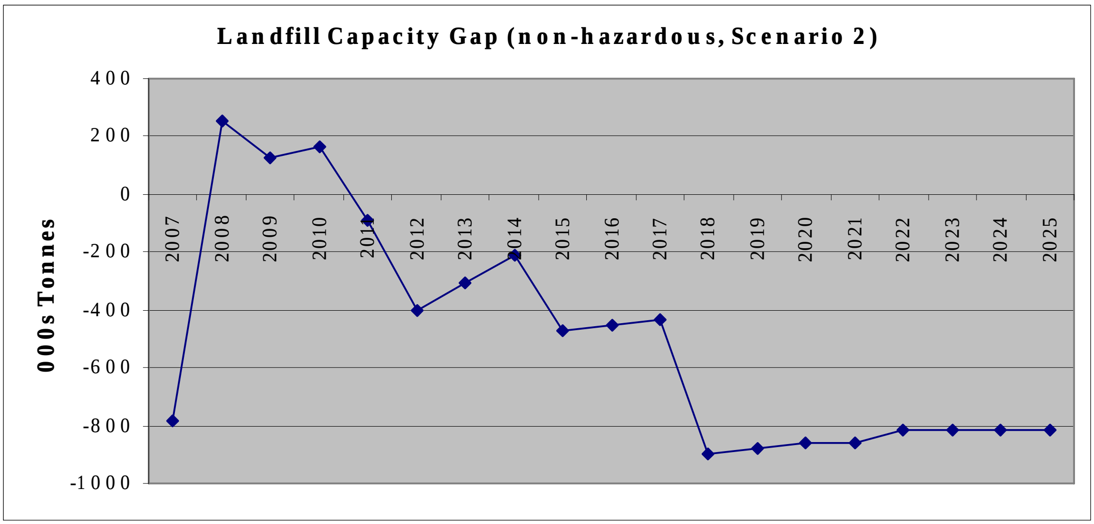
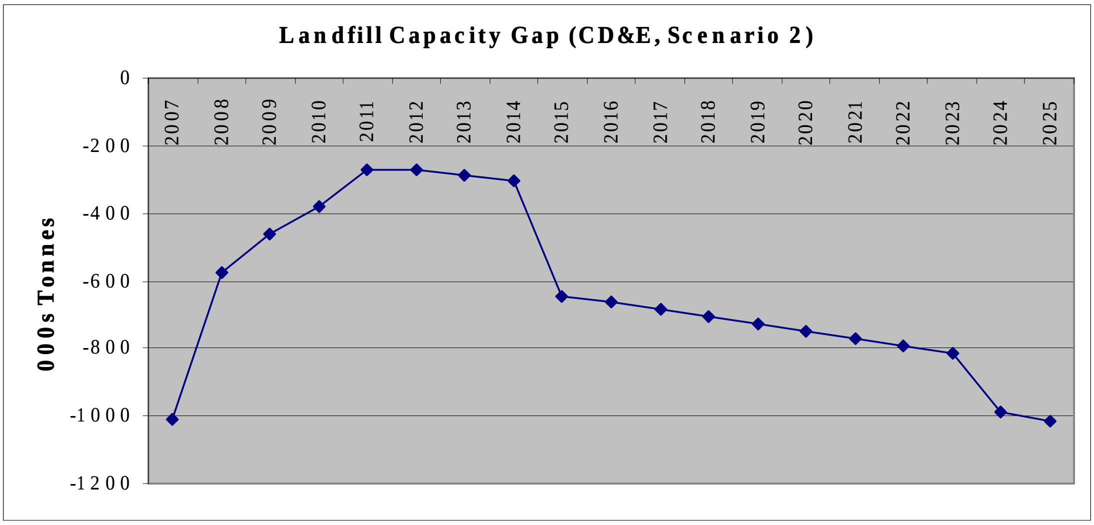


Figure 14 Scenario 2 Non-hazardous landfill capacity gap.

Under this scenario there is also a fall in the requirement of CD&E landfill although this remains at a significant annual level by 2025 and gives a total cumulative capacity requirement from 2007 to 2025 for 12m tonnes of waste. The annual capacity requirement is illustrated in **Figure 15.** The assumptions for CD&E waste are the same for Scenarios 2 and 3.

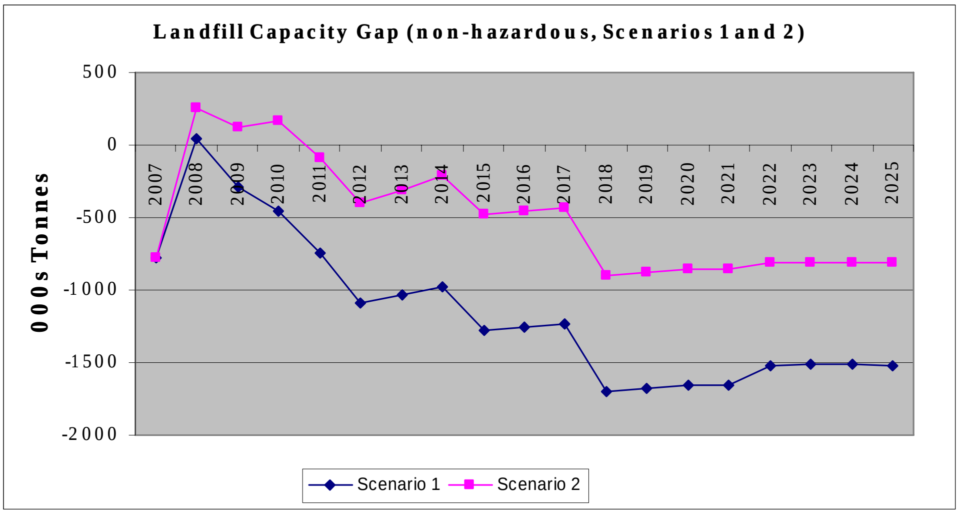
Figure 15 Scenario 2 Landfill Capacity Gap for CD&E



5.2.3 Illustration of differences between scenarios

The model allows a clear illustration of the differences between scenarios. Below are two charts showing results from scenarios 1 and 2 that nicely illustrates the "consequences" of a reduced gap in one management option (landfill) leading to an increased gap in another (recycling).

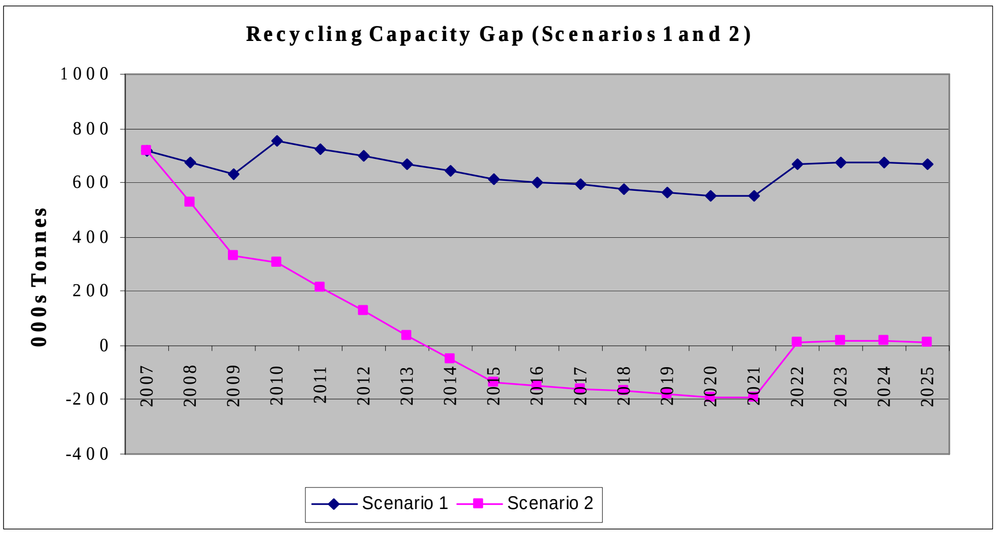
Figure 16: Landfill (non-hazardous) gap scenarios 1 and 2



This first chart shows that, as one would expect, the negative capacity gap for landfill would be much reduced if the C&I sectors aggressively divert waste. In this case (scenario 2), the landfill option is available for 3 years longer.

The flip side of the C&I sector responding in such a way is that the apparent positive gap for recycling ("apparent" since it does not include arisings resulting from MBT treatment plants) is significantly reduced, and approaching zero at 2014. It the additional recycling capacity required for the material coming out of the MBT plant were included, under scenario 2, it is likely that the gap would be even greater.

Figure 17: Recycling gap scenarios 1 and 2



5.3 Scenario 3. Baseline: Median levels of increased recycling and recovery are achieved.

5.3.1 Estimated Capacity Gap for Scenario 3

The results from running the model with Scenario 3 which assumes a major increase in recycling and recovery but at a level which may be practicable when the impacts of policy and pricing initiatives are taken into account. The projected total capacity requirements for Scenario 3 can be compared with the outputs from Scenarios 1 and 2.

Table 11 Scenarios 1, 2 and 3 compared at 2025
Projected Total Annual Waste Management Requirements by Management Method
(000s Tonnes)

Waste Management	**2007**	**Scenario 1 (Baseline) 2025**	**Scenario 3 (Median Recycling & Recovery) 2025**	**Scenario 2 (Maximum Recycling & Recovery) 2025**
Landfill (non-hazardous)	1,900	1,193	662	491
Incineration with Energy Recovery	140	140	280	173
Incineration without Energy Recovery	73	61	61	61
Treatment plant	375	435	435	435
Recycling	1,421	1,645	2,031	2,303
Composting	135	216	222	228
Landfill (hazardous)	80	124	124	124
Landfill (C+D)	1,309	2,028	1,014	1,014
Recycling (aggregates, C+D)	1,390	2,153	3,167	3,167
Transfer station	171	147	147	147
Waste water treatment	7	5	5	5
Land Recovery	354	320	320	320
Don't know	244	207	207	207
Total Arisings	**7,597**	**8,676**	**8,676**	**8,676**

With regard to **Table 11**, both Scenarios 3 and 2 decrease the requirement for landfill of non hazardous waste. However, given that Scenario 3 has lower levels of recycling more waste materials are then available for energy recovery. Thus the energy recovery requirement from Scenario 3 is approx. 75% higher than Scenario 2. Recycling capacity requirement is also greater for scenarios 3 and 2 compared with baseline scenario 1.

5.3.2 Scenario 3 Estimated Capacity Gap

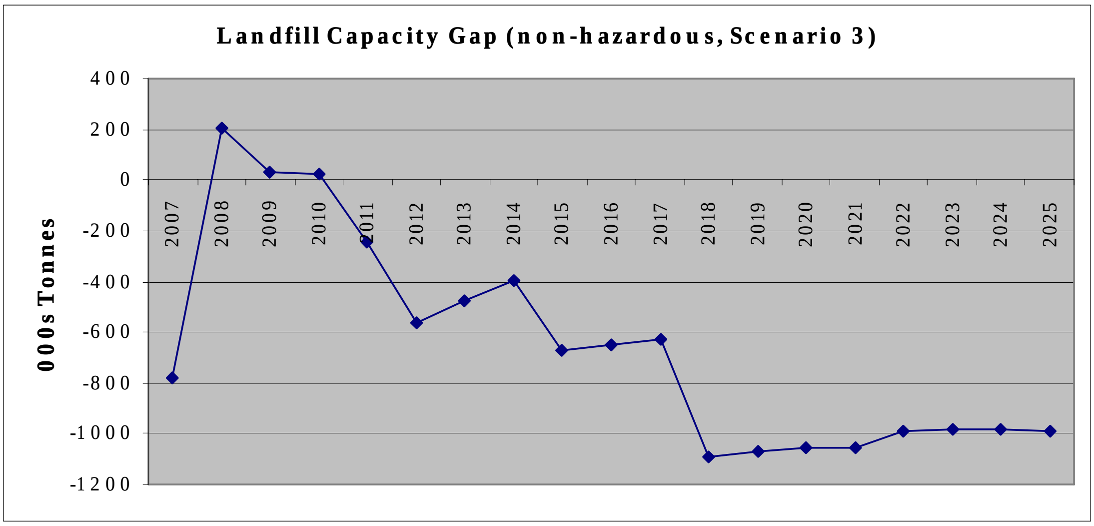
A comparison of the capacity gap at year 2025 is shown in **Table 12**. Again the main variation between Scenarios 2 and 3 are in the requirements for non-hazardous landfill and energy recovery capacity. Whilst Scenario 3 indicates a higher surplus recycling capacity as noted in discussion of Scenario 2 this capacity may not reflect true capacity requirements for material specific streams and processes (because of individual waste stream requirements). The composting capacity deficit is only slightly lower in Scenario 3 than in 2.

Table 12 A comparison of the capacity gap at year 2025 across the 3 scenarios

Table 12
A comparison of the capacity gap at year 2025 across the 3 scenarios

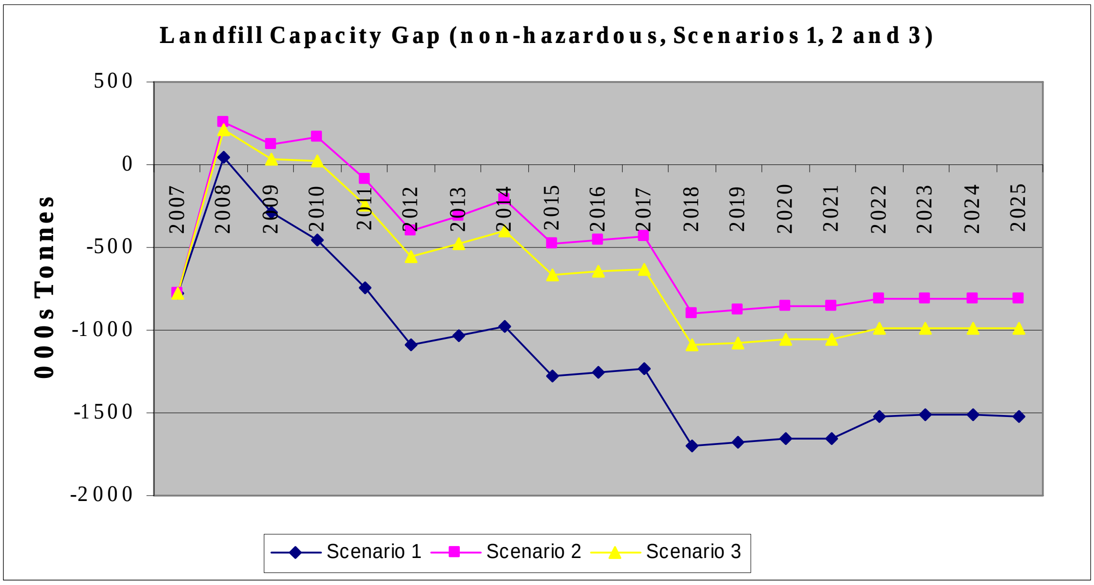
Projected Gap in Capacity Requirement 2025			**000s Tonnes**
Waste Management	**Scenario 1**	**Scenario 3**	**Scenario 2**
Landfill (non-hazardous)	-1,518	-987	-816
Incineration with Energy Recovery	-82	-221	-114
Treatment Plant	995	995	995
Recycling	670	284	12
Composting	-121	-127	-133
Landfill (hazardous)	-124	-124	-124
Landfill (C+D)	-2,028	-1,014	-1,014
Recycling (aggregates, C+D)	381	-633	-633

The cumulative non-hazardous landfill requirement under Scenario 3 is 11.3m tonnes between years 2010 and 2025 as indicated in **Figure 18.**



The annual capacity gap for non-hazardous landfill under the three baseline scenarios is illustrated in **Figure 19.**

Figure 19 Scenarios 1, 2 & 3 Capacity Gap Landfill (non-hazardous)



Scenario 13 (Median Recycling and Recovery): Annual Capacity Gap
000s Tonnes

Waste Management	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Landfill (non-hazardous)	-783	207	32	25	-242	-561	-479	-398	-669	-649	-630	-1092	-1073	-1054	-1054	-988	-984	-985	-987
Incineration	-92	-174	-257	-339	-322	-305	-288	-271	-254	-254	-254	-255	-255	-255	-255	-221	-219	-220	-221
Treatment plant	285	271	256	1011	1005	997	989	980	971	971	970	970	969	967	970	988	995	996	995
Recycling	720	597	474	521	452	382	313	243	174	164	152	140	128	115	115	283	291	290	284
Composting	-40	-29	-39	-48	-57	-66	-75	-84	-113	-116	-119	-123	-126	-129	-129	-127	-127	-127	-127
Landfill (hazardous)	23	21	19	17	15	13	10	8	6	3	1	-104	-107	-110	-112	-115	-118	-121	-124
Landfill (C+D)	-1012	-578	-464	-378	-269	-269	-287	-306	-645	-665	-685	-705	-726	-748	-770	-793	-816	-990	-1014
Recycling (aggregates, C+D)	1144	1064	882	698	513	325	269	210	51	-10	-73	-137	-203	-270	-339	-410	-482	-557	-633

Table 13 Annual Capacity Gap (GM provision minus Arisings) Scenario 3 (Median Levels of increased Recycling and Recovery) (000's tonnes)

This table shows the annual capacity (1000's tonnes) from the Capacity database that is, or is predicted to be, available in Greater Manchester at each year from present (2007) to 2025 minus the waste arisings in Greater Manchester over the same period based upon the model, here showing Scenario 3. It shows the relationship whether the provision of management capacity within Greater Manchester is greater (surplus shown in black) or less than the arisings (negative shown in red)

5.4 Translation of Projected need into Facility Options

Table 14 provides some indication of the number of new facilities that could developed in order to meet the gap at nominal year 2025 from the 3 baseline scenarios (1-3). This is produced for illustration purposes, as running other scenarios could produce alternative results.

Table 14 Indicative number of additional facilities required by 2025 under the 3 scenarios (000s tonne)

Each block represents 1 facility, while the width of the block indicates the capacity of the facility (based upon average capacity of each facility type).

The modelled scenarios indicate surplus capacity at 2025 for recycling and treatment and no new facilities are shown as required. However, materials specific capacity can be expected to be required for both recycling and treatment. This is because we are not able to break down the sub-categories of recycling capacity to relate it to the arisings information (as this is not expressed by recycling process). There is no detail on capacity information for individual waste streams of paper, card, glass, plastics, ELV etc, so that the only information is for total recycling capacity. If there is a surplus gap this could also be taken up by imports – unfortunately at this point in time there is no way of knowing for certain. The table therefore shows an indicative surplus capacity for these two waste management facilities with this note of warning attached.

6 Conclusions

Conclusions – Baseline Data

The most up to date available data has been used within the model drawing on the basic sources available. There is obviously not available a perfect data set, however the model is robustly constructed so that it can easily be updated when the latest information becomes available.

Areas that need further work for improved baseline data include construction, demolition and excavation wastes, new data reflecting the new legislative regime classifying hazardous waste and updating sites specific information on current and planned capacity as more information becomes available together with updated information on exempt sites will all help improve the confidence levels of the baseline data used within the needs assessment model.

Conclusions – Low Level Radio Active and Agricultural Waste Data

Low level radio active waste is at very low levels in Greater Manchester, requires specialist management and as such is self contained and is not represented consequently in the modelling process.

Agricultural wastes are at fairly low quantities; 300,000 tonnes having a 96% land recovery usage with <10% going to treatment and <3,000 tonnes to incineration. Agricultural waste figures are contained within the modelling process.

Conclusions – Modifiers used in the model

Legislation and policy forecasts have been factored into the Modifiers based upon the recent national waste strategy, the NW RSS, the Regional Spatial Strategy and the Municipal Waste Management Strategies for Greater Manchester and Wigan. These factors have been important in defining the assumptions underpinning the scenarios developed for modelling. Any changes to legislation/strategy in the future will need to be incorporated into the future modelling assumptions. Again the model can easily be

adjusted to accommodate this. An important product of the model is that it also allows waste arisings to be analysed by material types and projected destinations.

* Conclusions – GMFM Model

The GMFM model has been the key to informing the modifiers for the economic and social factors. Baseline models have been used in this report following recent update in November 2007. The accelerated growth GMFM models has only been used for results contained in Appendix 1 for an earlier version of analysis in the model using the original GMFM AG data. It is understood that this has been significantly revised and will be available in early 2008 to allow new AG modelling to take place. The GMFM model has been outlined and discussed with the Sub Group and it was agreed that this was the best available tool presently available for use within the needs assessment process. The model can accommodate any future updates in the GMFM model as time progresses.

* Conclusions – The Needs Assessment Model

The model has been constructed to create a level of detail and consistency that has not been previously available. The model provides an understanding of waste management, in terms of who is producing the waste, the material streams and the waste management destinations. The model also includes data on which materials have the potential for recycling or energy recovery by waste stream and producing sector. Together with the modifiers used provide a forecasting of future arisings and disposal scenarios if the aim of managing waste more sustainably and towards the top of the waste hierarchy is to be achieved. This is important in practical terms as these elements of the modelling output show where specific changes in waste management practice will have to occur. Further reports for the model can be run which will show which commercial and industrial sectors are generating those wastes which could be more productively managed.

* Conclusions – Developing the Scenarios

It was considered that the most practical approach for the needs assessment was to run a small number of scenarios that reflect a realistic range of possibilities that could be implemented. In developing the scenarios it was necessary to make certain assumptions in particular about how the various categories of waste arisings will be managed. The initial scenarios modelled therefore include the assumption that requirements for municipal waste take up all existing or planned capacity that it requires. This means that the model therefore essentially provides an assessment capacity and capacity gaps that relate primarily to commercial and industrial waste sector arisings with respect to treatment and disposal management methods.

* Conclusions - Scenario 1

A key output from running scenario 1 is the net capacity surplus or gap for waste management. The main apparent capacity gaps at 2025 are for landfill for non-hazardous waste and for landfill for CD&E waste. Composting is also in deficit and will require an additional annual capacity of 121,000 tonnes. Although recycling and treatment are shown as surplus capacity it is not possible to calculate how much of this capacity would be taken by imported wastes and how much remain unused. Recycling and reprocessing facilities are material specific and surplus capacity is not transferable between material types. The projection indicates cumulative landfill capacity for 23 m tonnes of non hazardous waste will be required from 2007 to 2025. The capacity deficit for CD&E waste indicates that 25m tonnes of waste would require landfill disposal from 2007 to 2025.

* Conclusions – Scenario 2

Maximising recycling and recovery will produce some important differences in the capacity requirements for different waste management methods. Under this scenario the non hazardous landfill requirement is reduced to 8.9m tonnes from 2011 to 2025. CD&E landfill requirement also reduces from 2007 to 2025 to 12m tonnes. Under this scenario although there appears to be a net surplus for treatment and recycling capacity the requirement for materials specific capacity is likely to mean there may be significant deficits in capacity for certain materials.

* Conclusions – Scenario 3

Scenario 3 assumes a major increase in recycling and recovery but at a level which is median when the impacts of pricing and policy initiatives have been taken into account. Both scenarios 2 and 3 decrease the requirement for landfill for non-hazardous waste. Scenario 3 has lower levels of recycling and thus more materials are available for energy recovery. Under this scenario, energy recovery requirements are 75% higher than in scenario 2.

* Conclusions – Comparison of Scenarios 1, 2 & 3

The three scenarios show a range of different capacity requirements depending upon how waste is managed within the waste management hierarchy. Whilst scenario 2 illustrates the possibilities for maximising recycling and recovery, scenario 3 has lower recycling rates but increase energy recovery. The table below shows the specific capacity deficits under the 3 scenarios as an annual capacity requirement.

Table 12
A comparison of the capacity gap at year 2025 across the 3 scenarios

Projected Gap in Capacity Requirement 2025 **Waste Management**	**Scenario 1**	**Scenario 3**	**000s Tonnes** **Scenario 2**
Landfill (non-hazardous)	-1,518	-987	-816
Incineration with Energy Recovery	-82	-221	-114
Treatment Plant	995	995	995
Recycling	670	284	12
Composting	-121	-127	-133
Landfill (hazardous)	-124	-124	-124
Landfill (C+D)	-2,028	-1,014	-1,014
Recycling (aggregates, C+D)	381	-633	-633

The negative numbers indicate a deficit in capacity that could be provided by new facilities in Greater Manchester or by export of material outside the region.

*

Conclusions – Upkeep of the Model

It is recommended that the model is maintained so that new information covering planning and additional capacity once granted is updated and that modifiers are adjusted as appropriate to reflect any policy responses or other factors. It is also recommended that additional updated scenarios be run to cover the updated GMFM Accelerated Growth data when it becomes available. The model also presents the opportunity to run new scenarios to reflect specific knowledge on sectors response to waste minimisation and changes in businesses competitiveness.

Appendix 1 Definitions

AG	Accelerated Growth
AGMA	Association of Greater Manchester Authorities
BREW	Business Resource Efficiency and Waste Programme
BVPI	Best Value Performance Indicator
C&D(E)	Construction & Demolition (Excavation)
C&I	Commercial & Industrial
DCLG	Department of Communities and Local Government
E Permits	Environmental Permits
EA	Environment Agency
GM	Greater Manchester
GMFM	Greater Manchester Forecasting Model
GMGU	Greater Manchester Geological Unit
GMWDA	Greater Manchester Waste Disposal Authority
HWRC	Household Waste Recycling Centres
JWDPD	Joint Waste Development Plan Document
JWPC	Joint Waste Planning Committee
MRF	Materials Recycling Facility
MSW	Municipal Solid Waste
MWMS	Municipal Waste Management Strategy
Non-Haz	Non-Hazardous
NW RSS	North West Regional Spatial Strategy
NW RTAB	North West Regional Technical Advisory Body
NW RWS	North West Regional Waste Strategy
NWS	National Waste Strategy
PFI	Private Finance Initiative
PVC	Polyvinyl Chloride
RATS	Regis Attached Tonnage System
SIC	Standard Industrial classification
SOC	Substance Orientated Classification
SRF	Solid Recover Fuel
WDA	Waste Disposal Authority
WRAP	Waste and Resources Action Programme

Appendix 2 The GMFM Model

The GMFM is an econometric model developed by Oxford Economic Forecasting.

It has been used to forecast hundreds of variables pertaining to the regional economy and its sub-regions. The OEF regional model is part of an integrated suite of models that feed 'top-down' on a geographical basis. The core of the structure is a model of the world economy covering 24 countries with further attention being paid to another 20 emerging market economies.

Country models are interlinked via trade, prices, exchange rates and interest rates and the UK, along with the US, Japan Germany, France, Italy, Canada and China, all defined among the primary county group. Countries have a natural growth rate that is the result of interaction between population and both productivity growth/output cycle around the growth trend.

On the demand side, a series of traditional behavioural functions are employed for consumption and investment with exports dependent on world demand and the real exchange rate and imports determined by (real) domestic demand and competitiveness (Technical evaluation of economic models, PION Economics April 2006).

Outputs from the OEF UK macro model are used as inputs for the UK industry model which covers some 59 sectors. The OEF regional model sits directly beneath the UK macro and industry sector models. Conventional time-series econometrics are employed to estimate behavioural relationships and forecasts are scaled back to match OEF UK sector totals.

The baseline scenario has the Greater Manchester performing in relation to the global and national economy.

An Accelerated Growth Scenario detaches the Greater Manchester economy by allowing it to grow faster than anticipated from global and national trends.

Appendix 3
Data list – Arisings Information

1. Data Sources and Information

1.1 Needs Assessment - Background Documents –Web-links and Reference Documents

Information on radioactive waste
http://www.nda.gov.uk/strategy/waste/index.cfm

A Waste Strategy for the North West – The Challenge Ahead: The Banks Foundation, April 2004
http://rpg.nwra.gov.uk/documents/index.php?group_id=72&expand=6

Regional Planning Guidance 13
http://rpg.nwra.gov.uk/planning/rpg_for_the_nw.php

Submission Draft RSS for the North West
http://rpg.nwra.gov.uk/planning/spatial.php

Regional Waste Strategy for the North West: NWRA, Sept 2004
http://rpg.nwra.gov.uk/waste/regional_waste_strategy.php

Regional Economic Strategy for the North West 2006 and the RES baseline Report November 2006
http://www.nwda.co.uk/publications/strategy/regional-economic-strategy-200.aspx

The Environment Agency Data for year 2004/05
http://www.environment-agency.gov.uk/subjects/waste/1031954/315439/1434288/

DCLG report by Symonds on CDEW ‘ Survey of Arisings and Use of Construction and Demolition and Excavation Waste as Aggregate in England in 2003’ and updated 2006 report which this becomes available
http://www.communities.gov.uk/pub/123/p1508123.htm

Environment Agency Strategic Waste Management Assessment Data for NW Region

Greater Manchester Economic Development Plan Future Scenarios for Employment Change in the Greater Manchester Economy 2002 to 2015

Greater Manchester Economic Development Plan 2002 - 2015

Manchester Enterprises - Demand for Employment Land in Greater Manchester Final Report 30th May 2006

2003 Population Projections (source GMGU)

JWDPD – Interim Needs Assessment (ERM, 2007)

JWDPD – Stage 1 Issues and Options Report, May 2007

Manchester City Region Spatial Strategy, September 2006

2006 ‘City Region’ Forecasts April/May 2006 Oxford Economic Forecasting Regional Forecasts Limited

Greater Manchester Joint Waste Development Plan Document: Project Plan June 2006

NW Regional Economic Strategy, 2006

Regional Waste Strategy for the North West, September 2004

REWARD NORTH WEST Building evidence to inform regional commercial & industrial waste policy - A report to the Environment Agency 12th October 2004

Municipal Solid Waste Management Strategy Wigan Metropolitan Borough Council October 2006

Greater Manchester Waste disposal authority Municipal Waste Management Strategy Review 2006-07

1.2 Data Sets

1.2.1 Hazardous Waste Data

Special Waste Produced in Greater Category by European Waste Code for Greater Manchester (EA supplied & published on their website)	Total 2004/5
Mining and Minerals	19
Agricultural and Food Production	52
Wood and Paper Production	441
Leather and Textile Production	54
Petrol, Gas and Coal Refining/Treatment	34
Inorganic Chemical Processes	1927
Organic Chemical Processes	42,497
MFSU Paints, Varnish, Adhesive and Inks	6,915
Photographic Industry	5,834
Thermal Process Waste (inorganic)	3,743
Metal Treatment and Coating Processes	3,017
Shaping/Treatment of Metals and Plastics	924
Oil and Oil/Water Mixtures	11,156
Solvents	465
Packaging, Cloths, Filter Materials	3006
Not Otherwise Specified	6985
C&D Waste and Asbestos	78,042
Healthcare	606
Waste/Water Treatment and Water Industry	24,442
Municipal and Similar Commercial Wastes	982
Unclassified	1,701
Total all Classes	192,841

1.2.2 Municipal Waste Key Data and Targets

2006/7 000s Tonnes	**Composted**	**Recycled**	**Residual**		**Commercial + Other**	**Household**	**Municipal**	**KG/Hd**
			TRF	Landfilled				
GMWDA	103	206	121	903	184	1148	1332	513
Wigan	14	21	0	149	51	133	184	523

Targets

Waste Growth	2010	2015	2020	2030
GMWDA	1%	0.5%	0	0
Wigan	1%	0.5%	0	0
Regional	1%	2014 0%		
National				

Recycling/Composting	2010	2015	2020	2030
GMWDA	33%	47%	50%	50%
Wigan	30%	33%	50%	?
Regional	35%	45%	55%	
National	40%	45%	50%	

Recover of value	2010	2015	2020
GMWDA	44% (120,000 Tpa TRF)	75% (120,000 Tpa TRF)	76% (120,000 Tpa TRF)
Wigan	45%	67%	
Regional	45%	67%	
National	53%	67%	75%

Landfill	2010	2015	2020
GMWDA LATS + inert (MWMS)	819,000	499,000 (340,000)	381,000 (333,000)
Wigan LATS+ inert (MWMS)	116,188 (209,225)	70,750 (228,745)	250,000 (56,798)

Residual Kg/Hd popn	2020 NWS target	2020
GMWDA	225	(180)
Wigan	225	?

1.2.3 Regional and National Targets

Objectives and targets
The Government's key objectives are to:
- decouple waste growth (in all sectors) from economic growth and put more emphasis on waste prevention and re-use;
- meet and exceed the Landfill Directive diversion targets for biodegradable municipal waste in 2010, 2013 and 2020;
- increase diversion from landfill of non-municipal waste and secure better integration of treatment for municipal and non-municipal waste;
- secure the investment in infrastructure needed to divert waste from landfill and for the management of hazardous waste; and
- get the most environmental benefit from that investment, through increased recycling of resources and recovery of energy from residual waste using a mix of technologies.

A greater focus on waste prevention will be recognised through a new target to reduce the amount of household waste not re-used, recycled or composted from over 22.2 million tonnes in 2000 by 29% to 15.8 million tonnes in 2010 with an aspiration to reduce it to 12.2 million tonnes in 2020 – a reduction of 45%. This is equivalent to a fall of 50% per person (from 450 kg per person in 2000 to 225 kg in 2020).

Higher national targets than in 2000 have been set for:
- recycling and composting of household waste –
at least 40% by 2010, 45% by 2015 and 50% by 2020; and
- recovery of municipal waste – 53% by 2010, 67% by 2015 and 75% by 2020.

Commercial and Industrial

The Government will shortly be setting a new national target for the reduction of commercial and industrial waste going to landfill. On the basis of the policies set out in Waste Strategy for England 2007, levels of commercial and industrial waste landfilled are expected to fall by 20% by 2010 compared to 2004.

The Government is considering, in conjunction with the construction industry, a target to halve the amount of construction, demolition and excavation wastes going to landfill by 2012 as a result of waste reduction, re-use and recycling.

1.2.2 Base Data and Information Sources

Waste Arisings data				
Sector/Sub Sector	**Waste Type/ Management Method** (Current)	**Latest data**	**Source**	**Data Trend**
Municipal		2006/7 GMWDA 2005/6 Wigan	**GMWDA Wigan WDA**	**2001-2006/7**
Household	Recyclates			
Percentage of household waste arisings sent for recycling (-26.85% 308453 GMWDA) tonnes	Green/Kitchen (compostable)			
	Residual			
HWRCs	Recyclates			
	Green(compostable)			
	Residual			
Non Household	Residual – (landfill)			
Commercial	Residual – (Landfill)			
Kg of household waste collected per head of population				
Percentage of change from previous year in Kg of household waste collected per head of population				
Commercial		**2006**	**NW C&I Survey**	**1999 – 2006 3 datasets**
Public Sector	Detailed in C&I Survey 2006 9 waste categories 9 Management Methods			
Retail & Wholesale				
Other Services				
Industrial				
Food, drink and tobacco				
Textiles/wood/paper/publishing				
Power & Utilities				
Chemical/non-metallic minerals manufacturing				
Metal manufacturing				
Machinery & equipment (other manufacturing)				
Hazardous waste	Old Special Waste data Includes some import/export data	**2004**	**Environment Agency**	**No trend for new Regulations**
Sector/Sub Sector	**Waste Type/ Management Method** (Current)	**Latest data**	**Source**	**Data Trend**
House builders	Estimate 65,000	**2006**	**Smiths Gore**	**No**

Highways works	27,500 **NW Region only**		**NW CD&E Survey 2006/7 (Symonds Capita No data at GM scale)**	
Pre-cast concrete manufacture	Estimate 3,957,360			
Quarries	Estimate 1,499,436			
Rail ballast recyclers	Estimate 436,000			
Crushers and screens	Estimate 5,168,157			
MRFs and WTSs	Estimate 3,357,349			
Registered Exempt Sites3	Estimate 3,438,940			
Landfill sites	Estimate 4,113,878			
Registered Exempt Sites[3]	Estimate 3,438,940			
Construction and Demolition	**No data**	**No data**		**No data**
Skip hire operators	**No data**	**No data**		**No data**
Land regeneration firms	**No data**	**No data**		**No data**
Agricultural Waste		2003		
Low Level Radio Active			EA	
Waste Management Capacity Data	**Source**	**Latest data**	**Trends**	
Landfill	GMGU	2006	No	
	EA	end 2005	No	
	EA	2005	2001/5	
treatment	EA	2005		
MRS	EA	2005		
Transfer sites	EA	2005		

Appendix 4 Legislation Review

2. Key developments for Municipal Waste

2.1. Waste Minimisation

The objective of the NWS mirrors the EU Waste Framework policy aim to decouple waste growth (in all sectors) from economic growth. This has no direct mathematical relationship with the model but is clearly a policy influence on a wide range of waste legislation proposals and other practical initiatives.

2.2. Recycling

Higher national targets than in 2000 have been set for:

- recycling and composting of household waste – at least 40% by 2010, 45% by 2015 and 50% by 2020; and

The North West Regional Strategy sets the following recycling/composting targets for household waste across the North West:

recycle and/or compost 35% of household waste by 2010
recycle and/or compost 45% of household waste by 2015 (SU)
recycle and/or compost 55% of household waste by 2020

- recovery of municipal waste – 53% by 2010, 67% by 2015 and 75% by 2020.

The North West region's targets in respect of recovering value from municipal waste are the same as those promoted nationally:

(including recycling targets)
recover value from 45% of MSW by 2010
recover value from 67% of MSW by 2015.

- Household residual waste

A greater focus on waste prevention will be recognised through a new target to reduce the amount of household waste not re-used, recycled or composted from over 22.2 million tonnes in 2000 by 29% to 15.8 million tonnes in 2010 with an aspiration to reduce it to 12.2 million tonnes in 2020 – a reduction of 45%. This is equivalent to a fall of 50% per person (from 450 kg per person in 2000 to 225 kg in 2020).

2010: 29% reduction
2015: 35% reduction
2020: 45% reduction from 2000 levels

The Government will review the targets for 2015 and 2020 in the light of progress to 2010 and future forecasts, to see if they can be even more ambitious.

2 NWS Key developments and proposals for Commercial, Industrial and Other Waste Producing Sectors

2.1 Statutory Requirements

- Pre-treatment requirements - The Landfill Regulations 2002 require waste to be treated prior to disposal to landfill. Initially, it was only applied to new sites and hazardous waste, but from 30 October 2007, it will apply to all waste and all landfill sites. For non-hazardous waste, it will be satisfied through a reduction in the weight of waste going to landfill through a process. In general, this will be satisfied by recycling a proportion of the original waste.

- Simplifying the regulatory system and making it more proportionate and risk based through:
  waste protocols that clarify when waste ceases to be waste (and so not subject to regulation)
  reforms of the permitting and exemption systems and the controls on handling, transfer and transport of waste, (with cost savings to business and regulator of, e.g. on permitting reforms, at least £90 million) – better communication with stakeholders
  Implementing actions which will reduce fly-tipping

- Site Waste Management Plans a mandatory requirement for construction projects over a certain value (subject to consultation), and extend to other parts of the supply chain the recent agreement with the manufacturers on recycling of plasterboard, as part of reducing waste and increasing re-use and recycling by the construction sector.

2.2 Incentives

- Greater financial incentives to businesses (landfill tax escalator) to reduce, re-use and recycle waste (from £24 now to £48 in 2010)

- New national target for the reduction of commercial and industrial waste going to landfill - levels of commercial and industrial waste landfilled are expected to fall by 20% by 2010 compared to 2004.

- Annual greenhouse gas emissions target: 2020: reduction of 10 million tonnes of CO_2 equivalents

- A target to halve the amount of construction, demolition and excavation wastes going to landfill by 2012 as a result of waste reduction, re-use and recycling.

- Government Departments to reduce their total waste arisings by 5% by 2010 relative to 2004/05 levels
- Departments to reduce their total waste arisings by 25% by 2020 relative to 2004/05 levels
- Departments to increase their recycling figures to 40% of their total waste arisings by 2010
- Departments to increase their recycling figures to 75% of their total waste arisings by 2020

2.3 NWS Initiatives

- Key waste materials where diversion from landfill could realise significant further environmental benefits. The Government is taking action on paper, food, glass, aluminium, wood, plastic and textiles

- Incentives for excellence in sustainable waste management through a zero waste places initiative to develop innovative and exemplary practice;

- Making greater use of third sector expertise, particularly to prevent waste, raise awareness, segregate waste at source, and increase re-use and recycling of waste through capacity-building support;

- Taking forward voluntary agreements with the relevant producers in order to increase separate collection, recycling and recovery of potentially hazardous household wastes

- Developing a joint industry, regulator and skills council training plan to improve levels of competency within the waste sector and a strategy to address any skill shortages or gaps

- Defra is working to further improve the outcomes from the BREW programme

- Emphasis on minimisation, especially in manufacture, and existing Producer Responsibility may be toughened and new Regulations coming in, such as in packaging.

- Encouragement for local authorities to take a 'wider' role in 'partnerships' to help local businesses reduce and recycle their waste with 'more integrated' management. However, local authorities do not generally have the resources to support the commercial sector.

2.4 NWS Policy Proposals

- Proposed consultation on further restrictions on the landfilling of biodegradable wastes and recyclable material. This could have implications on both businesses and waste management operators if there are statutory limit to the types of non-hazardous wastes that can go to landfill, especially food waste.

- Producer responsibility proposals for statutory higher packaging recycling targets, the Government is seeking further voluntary action, but is prepared to regulate if this does not deliver - introducing measures to:
    - reduce excess packaging, for example by setting optimal packaging standards for a product class;
    - support development of a joint protocol to ensure that local government and industry both identify the best systems for cost effective collection of packaging waste
    - extend WRAP's Courtauld Commitment to non-food retailers to increase the total commitments by retailers to reductions in packaging, food and other post-consumer waste;

Appendix 5 Model Assumptions

4.1 Assumptions for MSW

Household waste (tonnes per household) - single point forecast falling 0.5% per annum from 2006 level.

Variability: At the last project meeting it was suggested that variability in the tonnes per household would follow the 0.5% annual fall but that this could vary +/- 10% each year. Initially I took this to mean the tonnes per household could vary by +/- 10% i.e. if the 2007 figure of tonnes per household was 1.2, the model would examine variability between 1.32 and 1.08 tonnes per household. The annual reduction of

0.5% means that by 2025 means that the central estimate of tonnes per household is around 1.1 with a range of 1.21 to 0.99.

An alternative approach is to simply place the variability on the rate of reduction. For example, we can assume that the 0.5% is the most likely outcome but the possible range around this is, say, for a maximum fall of 0.75% but also a potential for growth in waste per household of 0.5%.

Non-household waste – The historic actuals will be used for the forecasts. It was agreed that non-household growth would be modelled as growing by 1% per annum through to 2010 with zero growth thereafter. No variability was considered although this would be simple to add.

With respect to recycling and landfill targets, these are assumed to be achieved on time.

4.2 Assumptions for C&I Waste

Only three data points exist for C&I waste arisings: the two Environment Agency surveys in 1998 and 2003 and the Urban Mines survey for the North West in 2006. The surveys focussed predominantly on waste arisings per company. However, the output of the GMFM model is for number of employees by Standard Industrial Classification sector only, not the number of businesses. Therefore, the waste arisings per employee from the 2006 survey was used as the parameter to gross up by the number of employees in the relevant sector. Thereby the model reflects the economic underpinnings of the GMFM methodology.

The variability in waste per employee is factored in by analysis of the 2006 survey data that shows the range of waste per employee for al the companies in each sector. This allows the forecast model to reflect the highly variable nature of waste arisings between different companies.

With respect to assumptions regarding future rates of diversion of C&I waste from landfill, some fixed assumptions are presented in the scenarios. However, the model allows these assumptions to be altered for two time periods (2010 and 2015) and allows different sectors to achieve different rates of progress toward diversion.

4.3 Assumptions for CD&E Waste

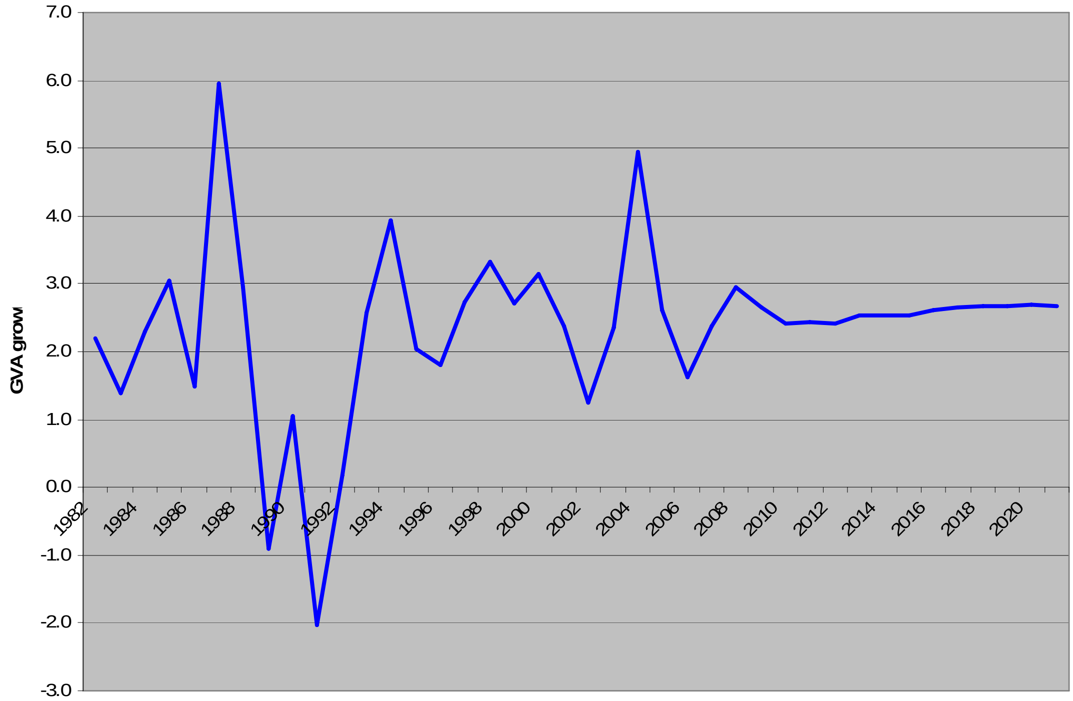
It was agreed that growth in CD&E waste would mirror that of the economy. Initially we have taken growth to reflect that in the GMFM which has an output for growth in gross value added. This is shown in the chart overleaf with GVA growth from 1982 to 2021. The forecast is for GVA to grow around 2.5% from 2007 onwards. We may wish to consider other possibilities for this as the chart shows that the actual level of growth is seldom close to the average rate.

Variability of whatever growth factor is chosen should be factored in. A single growth rate doesn't capture the possibility of recessions but the Accelerated Growth

Scenario that also will be used to generate forecasts does include “boom”. The growth factor can include the possibility (small) of negative growth rates.

With respect to future rates of diversion, the model initially assumes that 50% of the amount landfilled is diverted.

Figure GVA growth from 1982 to 2021 based upon GMGF model



Appendix 6

Accelerated Growth Scenarios 4, 5 and 6

1. Introduction

Scenarios 4, 5 and 6 were modelled using GMFM data supplied in October 2007, this data from the GMFM model is currently being updated and is expected to substantially change to also include historical changes as well as take into account changes in population, economic growth, immigration influences etc.

In this appendix are the results using the original AG GMFM data and comparisons that were made with the AG scenarios with the original GMFM data (October 2007). The latter has been updated and used in the main report.

2. Modelling AG Scenarios

Modelling the Accelerated Growth Scenarios were undertaken with the same assumptions as for 1, 2 and 3 but with accelerated growth assumption taken from the GMFM model.

4). Accelerated Growth: Baseline

This assumes that:

- MWMS targets for recycling and diversion from landfill are achieved.
- C&I and CD&E waste arisings are managed by destination in the same ratio as in the data available from year 2006/7.

5). Accelerated Growth: Maximise Recycling and Recovery

This assumes that:

- MWMS targets for recycling and diversion from landfill are achieved
- C&I and CD&E waste arisings are managed
  by 2010 75% recyclable 25% possibly recyclable and 50% of remaining material used for energy recovery
  by 2015 100% recyclable 50% possibly recyclable and 50% of remaining material used for energy recovery
- CD&E waste arisings achieve a 50% landfill diversion 2012

6). Accelerated Growth: Median levels of increased recycling and recovery are achieved

This assumes that:

- MWMS targets for recycling and diversion from landfill are achieved.

- C&I and CD&E waste arisings are managed
  by 2010 50% recyclable 10% possibly recyclable and 50% of remaining material used for energy recovery
  by 2015 75% recyclable 25% possibly recyclable and 50% of remaining material used for energy recovery
- CDE 50% landfill diversion 2012

Key model run outputs covered are for dates of 2010, 2015, 2020 and 2025.

3. Initial Interpretation of Modelled Scenarios

NB Interpretation of this modelling output must take account of the following caveats (this applies to all data within the equivalent elements of each scenario report)

- "Don't know" refers to waste for which the producer did not know the destination from the C&I survey 2006/7. It is probable that most, if not all, of this waste will be disposed of by landfill. In the model therefore data under the "Don't Know category" (100%) has all gone into the category of Landfill.
- A significant proportion of waste managed through transfer stations (75% classified as mixed ordinary waste) estimated at 80% is disposed of by landfill. In the model therefore, the data under the Transfer Station category has been split such that 80% goes to Landfill with the remainder 20% to recycling.
- From our capacity information there is only details of incineration with energy recovery. In normal circumstances waste that is incinerated without energy recovery tends to be specialist generated wastes. Within the model it has been assumed that all incineration capacity includes energy recovery.

Accelerated Growth Scenarios 4, 5 and 6

Scenarios 4, 5 and 6 are modelled with the same assumptions as for 1, 2 and 3 but with accelerated growth assumption taken from the GMFM model.

The outputs from the model run on these Scenarios are illustrated by **Table 1** which shows the capacity gaps in terms of annual tonnage requirement for year 2020 for Scenario 1 (original GMFM October data) and its equivalent accelerated growth (AG) Scenario 4 and Scenario 2 and its equivalent accelerated growth Scenario 5. (AG GMFM October 2007 data).

Table 1 Comparison of the Accelerated Growth Scenarios (AG) against baseline scenarios 1 and 2 showing predicted gap in capacity at 2020 Accelerated Growth Scenarios (all modelling using October 2007 GMFM data)

Projected Gap in Capacity Requirement 2020 000s Tonnes						
Waste Management Method	Scenario 1	Scenario 4AG	Scenario 2	Scenario 5AG	Scenario 3	Scenario 6AG
Landfill (non-hazardous)	-1,270	- 1,309	- 432	- 428	- 613	- 619
Incineration with Energy Recovery	-72	- 74	- 109	- 113	- 226.9	- 237
Treatment plant	109	109	109	109	109	109
Recycling	800	731	26	- 84	326	231
Composting	-138	- 138	- 151	- 152	- 145	- 145
Landfill (hazardous)	-108	- 109	- 108	- 109	- 108	- 109
Landfill (C+D)	-1,619	- 1,645	- 735	- 748	- 736	- 748
Recycling (aggregates, C+D)	656	627	- 228	- 270	- 228	- 270
Transfer station	9,605	9,597	9,605	9,597	9,605	9,597
Waste water treatment	857	857	857	857	857	857

Whilst there are some differences when the accelerated model is run these are not on the whole highly significant.

The impact of accelerated economic and social growth under the GMFM models is barely significant in terms of future waste management requirements. Given the current assumptions on growth factored in through the GMGF model then no additional need is predicted above that shown under the baseline scenarios situation.

The output from the model runs on these accelerated growth scenarios indicates only a minimal additional capacity requirement. The differences in predicated capacity requirement and capacity gaps are so small that they are below a level of significance in terms of future needs provision.

4. Conclusions

* Conclusions – Accelerated Growth Scenarios 4, 5 & 6 (GMFM AG Data October 2007)

The Accelerated growth scenarios show only a small increase in capacity requirements under each of the comparative scenarios (scenario 1 compares with scenario 4, 2 compares with 5 and 3 compares with 6). The most significant change in capacity requirement would be under AG Scenario 4 which would require capacity for an additional 40,000 tonnes of non-hazardous landfill. However under scenarios AG5 & AG6 with recycling and recovery the additional landfill capacity would be only 4 000 and 5 ooo tonnes respectively. This demonstrates that the impact of accelerated economic and social growth under the GMFM models is barely significant in terms of future waste management requirements.