

APPENDIX 5 - DEVELOPMENT OF LONG TERM GENERIC WASTE MANAGEMENT OPTIONS

5.1 BASELINE INFORMATION

Table A5.1 provides details of municipal waste arisings for the years 1998/99 to 2002/3. The figures show considerable growth in waste arisings over this period, however it is unclear whether this is true growth in arisings or a result of evolving and changing methodology for recording municipal waste tonnages.

	2002/3	2001/2	2000/1	1999/00	1998/99
Municipal Waste (tonnes)	76,123	70,973	68,112	63,757	61,400
Increase on previous year (tonnes)	5,150	2,861	4,355	2,357	-
Increase on previous year (% increase)	7.3%	4.2%	6.8%	3.8%	-

Table A5.1: Municipal Waste Arisings

5.2 WASTE PROJECTIONS

It is recognised that municipal waste arisings throughout the UK are increasing year by year, with current annual growth for the UK as a whole put at 2.7% per annum. Figure A5.1 and A5.2 depict waste arisings for Municipal Waste and Household Waste respectively up to the year 2020 for a number of growth rate scenarios:

- Current growth rate calculated at approximately 2.2% (over the past two years for the first 6 months of the year);
- The growth rate for the last 5 years calculated at approximately 6% growth;
- A 3.8% declining growth rate (as proposed by the North Wales Region in the TAN 21 Regional Waste Plan); and
- 1% growth rate.

Figure A5.2 also depicts a 'Meet WAG Targets growth rate' which aims to comply with the waste reduction and stabilisation targets, for household waste only, set out in 'Wise about Waste'. These targets are:

- by 2009/10 waste arisings per household should be no greater than those in 1997/98;
- by 2020 waste arisings per person should be less than 300 kg/annum.

At this point in time, the most appropriate waste growth scenario is deemed to be the regional declining growth scenario. This figure will be used in subsequent development and modelling of the various waste management scenarios.

² Green waste is thought to make up only 20% of material delivered to CA sites compared to typical national figure of 35% - 45%.

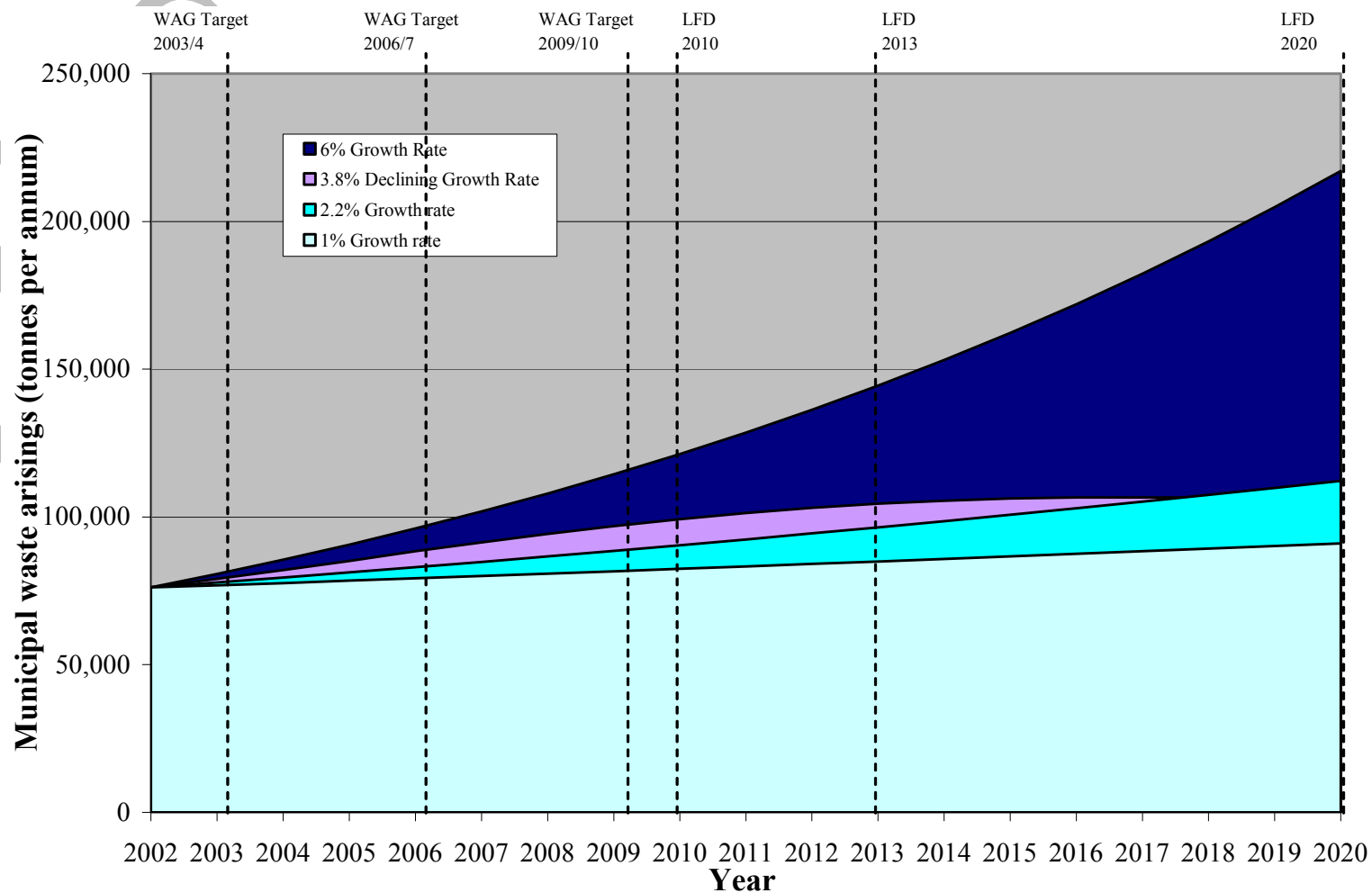


Figure A5.1. Municipal growth projections for Gwynedd

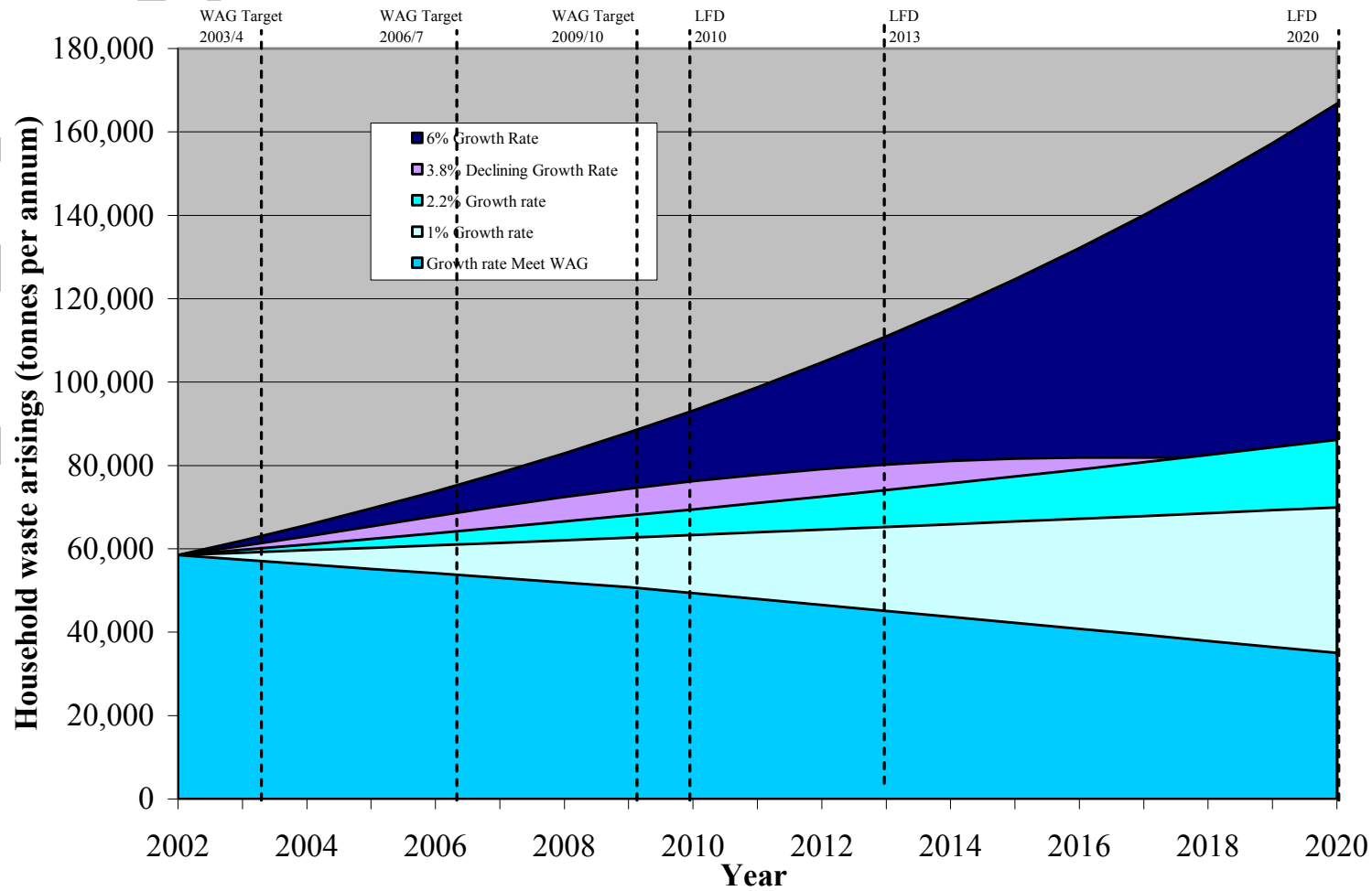


Figure A5.2. Household waste projections for Gwynedd

3.0 OPTIONS DEVELOPMENT

3.1 Introduction

The waste hierarchy is broadly accepted as the guiding principle for securing a more sustainable waste management system. The hierarchy suggests that the most effective environmental solution is to minimise the generation of waste. Where further reduction is not practicable, products and materials can sometimes be used again, either for the same or for a different purpose (reuse). Failing that, value should be recovered from waste through recycling or composting, or through energy recovery. Only if none of these offers an appropriate solution should waste be incinerated without energy recovery, or disposed to landfill.

In practice, strategic waste planning options will comprise a combination of these methods, because the 'best' option will vary according to the type of waste, its source and composition, and the viability of alternative methods, both generically and in the local context. A variety of different methods can also be used for the collection and transport of waste. Overall, an integrated approach will be required to manage all waste arising, and this will include landfill for residual wastes for which no alternative is available, despite landfill being at the bottom of the waste hierarchy.

The Welsh Assembly Government's statutory and non-statutory landfill diversion, recycling and recovery targets, together with the Landfill Directive, provide a framework for identifying future waste management strategy for Gwynedd. However, these targets can be met (or exceeded) by various means and a range of options is discussed below.

A number of waste management options have been developed that attempt to meet the Waste Strategy and Landfill Directive targets. The relevant targets are:

- *By 2003/04 achieve at least 15% recycling/composting, with a minimum of 5% composting (with only compost derived from source segregated materials counting) and 5% recycling (Waste Strategy Target)*
- *By 2006/07 achieve at least 25% recycling/composting, with a minimum of 10% composting (with only compost derived from source segregated materials counting) and 10% recycling (Waste Strategy Target)*
- *By 2009/10 achieve at least 40% recycling/composting, with a minimum of 15% composting (with only compost derived from source segregated materials counting) and 15% recycling (Waste Strategy Target)*
- *By 2010 to reduce BMW landfilled to 75% (by weight) of that produced in 1995 (Landfill Directive Target)*
- *By 2013 to reduce BMW landfilled to 50% (by weight) of that produced in 1995 (Landfill Directive Target)*
- *By 2020 to reduce BMW landfilled to 35% (by weight) of that produced in 1995 (Landfill Directive Target).*

3.2 Outline of Options

The following generic waste management options have been considered

- Option 0: Baseline recycling and composting levels (2002/03) with residual waste to landfill
- Option 1: Meet WAG targets, all biodegradable residuals to in-vessel composting, residuals to landfill
- Option 2: Meet WAG targets, sufficient residuals to in-vessel composting to meet LFD targets, residuals to landfill
- Option 3: Meet WAG targets, all biodegradable residuals to Anaerobic Digestion, residuals to landfill
- Option 4: Meet WAG targets, sufficient residuals to Anaerobic Digestion to meet Landfill Directive targets, residuals to landfill
- Option 5: Meet WAG targets, all residuals to MBT
- Option 6: Exceed WAG targets, all residuals to MBT

These options are discussed in more detail in the preceding pages.

3.3 Outline of Options

Option 0- Baseline recycling and composting levels (2002/03) with residual waste to landfill

This option represents the Authority’s current performance and is summarized in Table A5.3 and Figure A5.4

Option 0				
Year	Indicator	Target	Actual	Target met
2003	Recycle 10% of Municipal Waste	7,902 t	6,131 t	N
	Compost 5% of Municipal Waste	3,951 t	3,677 t	N
2006	Recycle 15% of Municipal Waste	13,256 t	6,857 t	N
	Compost 10% of Municipal Waste	8,837 t	4,113 t	N
2009	Recycle 25% of Municipal Waste	24,218 t	7,517 t	N
	Compost 15% of Municipal Waste	14,531 t	4,508 t	N
2010	reduce BMW to landfill to 75% of 1995 level	34,630 t	8,094 t	N
2013	reduce BMW to landfill to 50% of 1995 level	47,599 t	8,521 t	N
2020	reduce BMW to landfill to 35% of 1995 level	54,766 t	8,698 t	N

Table A5.3 Option 0 performance

Table A5.3 indicates that Option 0 fails to meet all recycling and Landfill Directive targets including the composting element of the 2003/04, 2006/07 and 2009/10 targets.

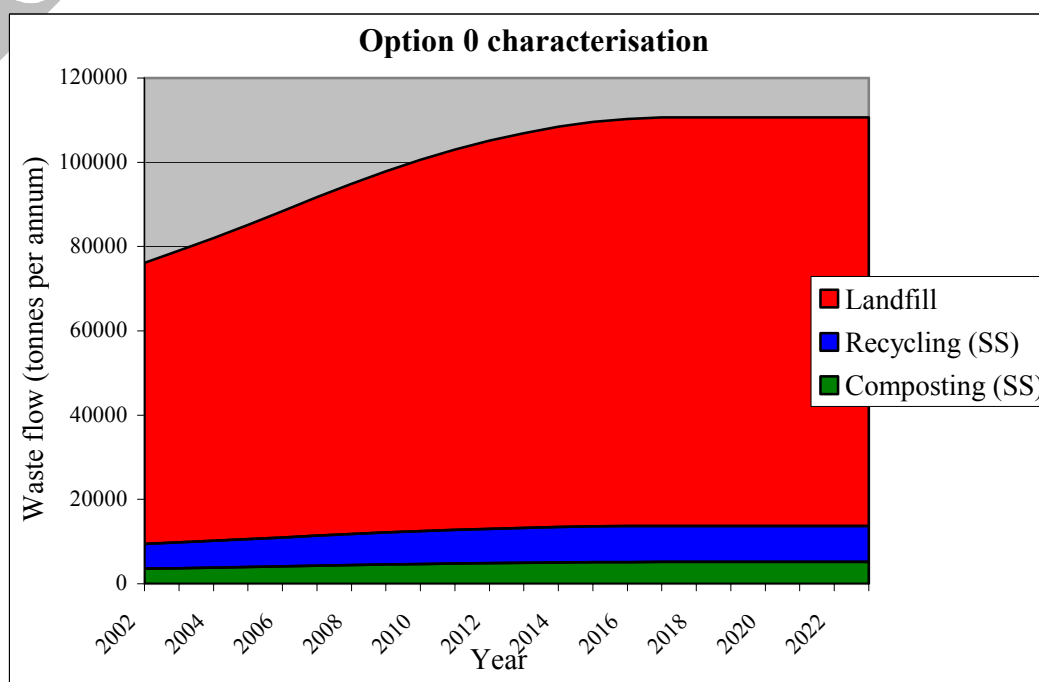


Figure A5.4: Projected Waste Quantities by Waste Management type for Option 0

Figure A5.4 indicates that there is no residual treatment of waste associated with Option 0, with all residual waste being consigned to landfill. Clearly, Option 0 cannot be considered as a viable strategy for future waste management as it fails to meet even the 2003/4 recycling

targets. However, Option 0 will be retained for the Options Appraisal process as a base case for comparison.

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Option 1: Meet WAG targets, all biodegradable residuals to in-vessel composting, residuals to landfill

This option represents the minimum required performance to achieve the source segregated recycling and composting targets for 2003/04, 2006/07 and 2009/10. Thereafter all biodegradable residuals are sent for composting. Table A5.4 and Fig A5.5 provide an overview of the performance of Option 1.

Option 1				
Year	Indicator	Target	Actual	Target met
2003	Recycle 10% of Municipal Waste	7,902 t	7,902 t	Y
	Compost 5% of Municipal Waste	3,951 t	3,951 t	Y
2006	Recycle 15% of Municipal Waste	13,256 t	13,256 t	Y
	Compost 10% of Municipal Waste	8,837 t	8,837 t	Y
2009	Recycle 25% of Municipal Waste	24,218 t	24,218 t	Y
	Compost 15% of Municipal Waste	14,531 t	14,531 t	Y
2010	reduce BMW to landfill to 75% of 1995 level	34,630 t	57,374 t	Y
2013	reduce BMW to landfill to 50% of 1995 level	47,599 t	60,398 t	Y
2020	reduce BMW to landfill to 35% of 1995 level	54,766 t	61,657 t	Y

Table A5.4: Option 1 performance

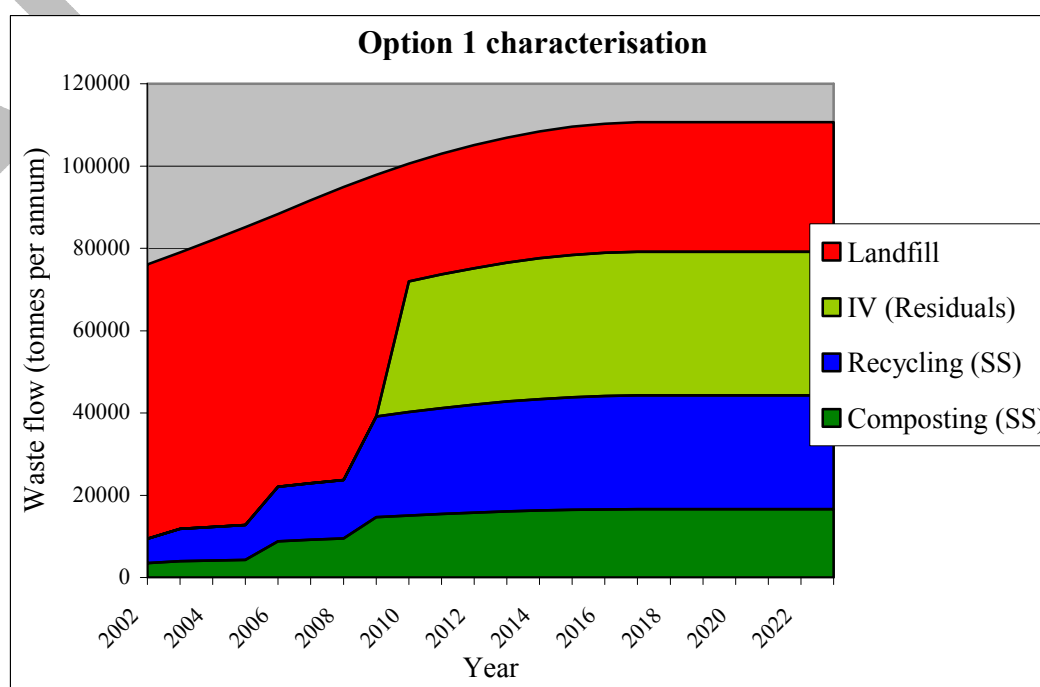


Figure A5.5: Projected Waste Quantities by Waste Management type for Option 1

1.5.1.1.1 As Table A5.4 shows, Option 1 meets the Waste Strategy targets for 2003/04, 2006/07 and 2009/10 and the Landfill Directive targets in subsequent years. Figure A5.5 indicates that there is residual treatment of waste, comprising in-vessel composting of the fines fraction (underflow) from the pulverisator plants. To achieve Option 1 performance it would be necessary to bring the redundant pulverisator plant back into operation. It is assumed that the resulting compost could be put to beneficial use as a low grade compost. The DANO

drums will generate a low quality biostabilised product, that through further treatment and processing will be suitable for agricultural / forestry use within Gwynedd. There is currently uncertainty about the quality of compost derived for mixed waste treatment processes and thus the level of beneficial uses that can be achieved. However, successful composting and beneficial utilisation of mixed waste derived material is achieved elsewhere in Europe, and there is no reason to think that this cannot also occur in the UK in the future.

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Option 2: Meet WAG targets, sufficient residuals to in-vessel composting to meet LFD targets, residuals to landfill

This option represents the minimum required performance to achieve the source segregated recycling and composting targets for 2003/04, 2006/07 and 2009/10. Thereafter sufficient biodegradable residuals to achieve the landfill directive targets are sent for composting. Table A5.5 and Fig A5.6 provide an overview of the performance of Option 2.

Option 2				
Year	Indicator	Target	Actual	Target met
2003	Recycle 10% of Municipal Waste	7,902 t	7,902 t	Y
	Compost 5% of Municipal Waste	3,951 t	3,951 t	Y
2006	Recycle 15% of Municipal Waste	13,256 t	13,256 t	Y
	Compost 10% of Municipal Waste	8,837 t	8,837 t	Y
2009	Recycle 25% of Municipal Waste	24,218 t	24,218 t	Y
	Compost 15% of Municipal Waste	14,531 t	14,531 t	Y
2010	reduce BMW to landfill to 75% of 1995 level	34,630 t	34,631 t	Y
2013	reduce BMW to landfill to 50% of 1995 level	47,599 t	47,601 t	Y
2020	reduce BMW to landfill to 35% of 1995 level	54,766 t	54,767 t	Y

Table A5.5 Option 2 Performance

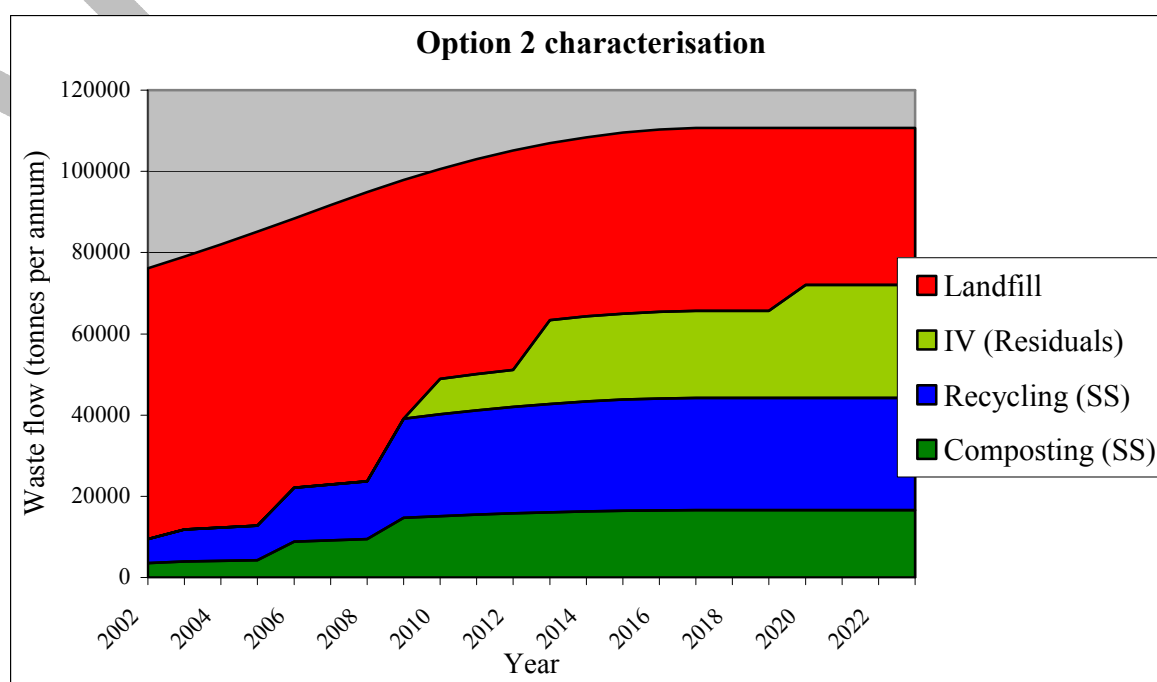


Figure A5.6: Projected Waste Quantities by Waste Management type for Option 2

1.5.1.1.2 As Table A5.5 shows, Option 2 meets the Waste Strategy targets for 2003/04, 2006/07 and 2009/10 and the Landfill Directive targets in subsequent years. Figure A5.6 indicates that there is residual treatment of waste, comprising in-vessel composting of the fines fraction (underflow) from the pulverisator plants. To achieve Option 2 performance it would be necessary to bring the redundant pulverisator plant back into operation. It is assumed that the resulting compost could be put to beneficial use as a low grade compost. The DANO

drums will generate a low quality biostabilised product, that through further treatment and processing will be suitable for agricultural / forestry use within Gwynedd. There is currently uncertainty about the quality of compost derived for mixed waste treatment processes and thus the level of beneficial uses that can be achieved. However, successful composting and beneficial utilisation of mixed waste derived material is achieved elsewhere in Europe, and there is no reason to think that this cannot also occur in the UK in the future.

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Option 3: Meet WAG targets, all biodegradable residuals to Anaerobic Digestion, residuals to landfill

This option represents the minimum required performance to achieve the recycling and composting targets for 2003/04, 2006/07 and 2009. Thereafter all biodegradable residuals are sent for anaerobic digestion. Table A5.6 and Fig A5.7 provide an overview of the performance of Option 3.

Option 3				
Year	Indicator	Target	Actual	Target met
2003	Recycle 10% of Municipal Waste	7,902 t	7,902 t	Y
	Compost 5% of Municipal Waste	3,951 t	3,951 t	Y
2006	Recycle 15% of Municipal Waste	13,256 t	13,256 t	Y
	Compost 10% of Municipal Waste	8,837 t	8,837 t	Y
2009	Recycle 25% of Municipal Waste	24,218 t	24,218 t	Y
	Compost 15% of Municipal Waste	14,531 t	14,531 t	Y
2010	reduce BMW to landfill to 75% of 1995 level	34,630 t	54,245 t	Y
2013	reduce BMW to landfill to 50% of 1995 level	47,599 t	57,104 t	Y
2020	reduce BMW to landfill to 35% of 1995 level	54,766 t	58,295 t	Y

Table A5.6 Option 3 Performance

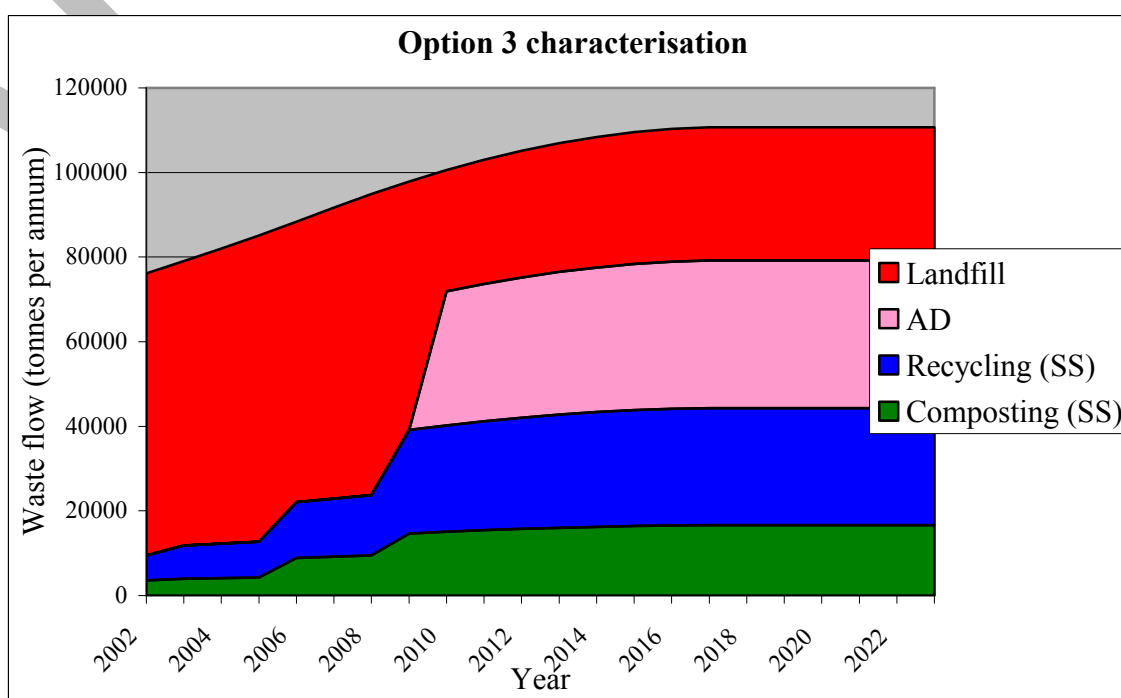


Figure A5.7: Projected Waste Quantities by Waste Management type for Option 3a

As Table A5.6 shows, Option 3 meets the Waste Strategy targets for 2003/04, 2006/07 and 2009/10 and the Landfill Directive targets in subsequent years. Figure A5.7 indicates that there is residual treatment of waste, comprising anaerobic digestion of the fines fraction (underflow) from the pulverisor plants. To achieve Option 3 performance it would be necessary to bring the redundant pulverisor plant back into operation. A 90% reduction in

weight of the biodegradable materials is assumed, the 10% remaining sludge is assumed to be consigned to landfill.

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Option 4: Meet WAG targets, sufficient residuals to Anaerobic Digestion to meet Landfill Directive targets, residuals to landfill

This option represents the minimum required performance to achieve the recycling and composting targets for 2003/04, 2006/07 and 2009/10. Thereafter sufficient biodegradable residuals to achieve the landfill directive targets are sent for anaerobic digestion. Table A5.7 and Fig A5.8 provide an overview of the performance of Option 4.

Option 4				
Year	Indicator	Target	Actual	Target met
2003	Recycle 10% of Municipal Waste	7,902 t	7,902 t	Y
	Compost 5% of Municipal Waste	3,951 t	3,951 t	Y
2006	Recycle 15% of Municipal Waste	13,256 t	13,256 t	Y
	Compost 10% of Municipal Waste	8,837 t	8,837 t	Y
2009	Recycle 25% of Municipal Waste	24,218 t	24,218 t	Y
	Compost 15% of Municipal Waste	14,531 t	14,531 t	Y
2010	reduce BMW to landfill to 75% of 1995 level	34,630 t	34,631 t	Y
2013	reduce BMW to landfill to 50% of 1995 level	47,599 t	47,600 t	Y
2020	reduce BMW to landfill to 35% of 1995 level	54,766 t	54,766 t	Y

Table A5.7 Option 4 Performance

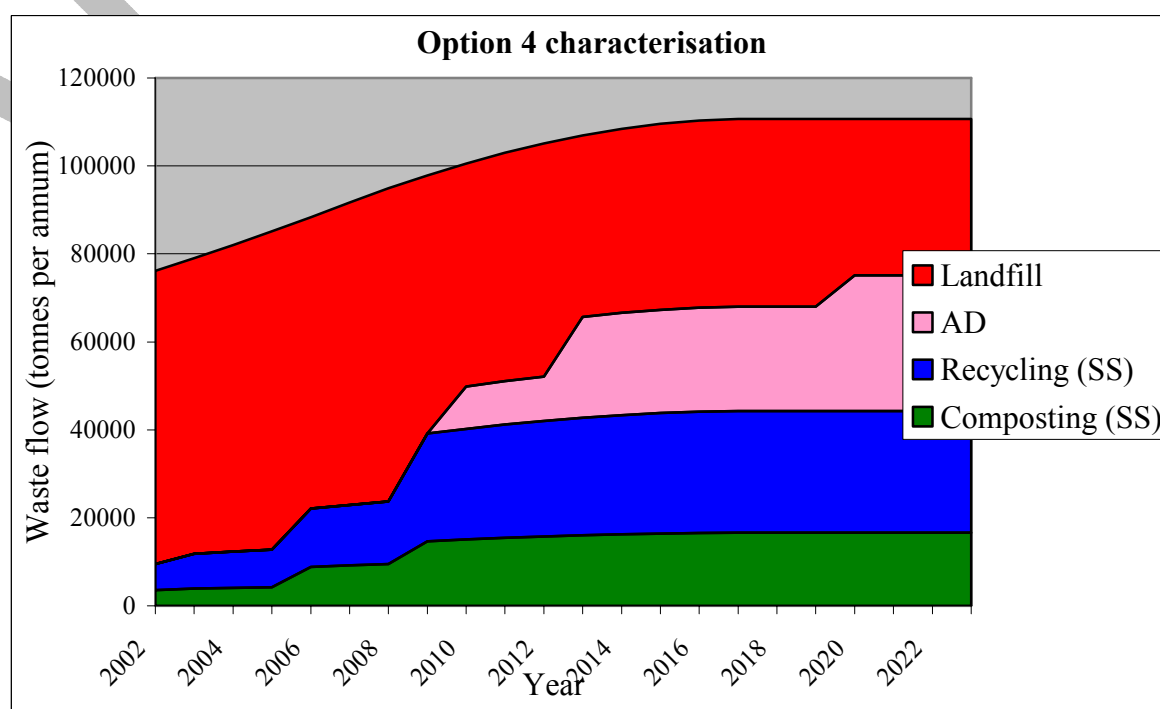


Figure A5.8: Projected Waste Quantities by Waste Management type for Option 4

As Table A5.7 shows, Option 4 meets the Waste Strategy targets for 2003/04, 2006/07 and 2009/10 and the Landfill Directive targets in subsequent years. Figure A5.8 indicates that there is residual treatment of waste, comprising anaerobic digestion of the fines fraction (underflow) from the pulverisator plants. To achieve Option 4 performance it would be necessary to bring the redundant pulverisator plant back into operation. A 90% reduction in

weight of the biodegradable materials is assumed, the 10% remaining sludge is assumed to be consigned to landfill.

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Option 5: Meet WAG targets, all residuals to MBT

This option represents the minimum required performance to achieve the recycling and composting targets for 2003/04, 2006/07 and 2009/10 with residual waste being sent to Mechanical Biological Treatment. It is assumed that the MBT plant will incorporate an element of RDF (Refuse-Derived Fuel) production and Energy from Waste (EfW) for treatment of the RDF. Table A5.8 and Fig A5.9 provide an overview of the performance of Option 5.

Option 5				
Year	Indicator	Target	Actual	Target met
2003	Recycle 10% of Municipal Waste	7,902 t	15,961 t	Y
	Compost 5% of Municipal Waste	3,951 t	3,951 t	Y
2006	Recycle 15% of Municipal Waste	13,256 t	21,209 t	Y
	Compost 10% of Municipal Waste	8,837 t	8,837 t	Y
2009	Recycle 25% of Municipal Waste	24,218 t	31,192 t	Y
	Compost 15% of Municipal Waste	14,531 t	14,531 t	Y
2010	reduce BMW to landfill to 75% of 1995 level	34,630 t	49,077 t	Y
2013	reduce BMW to landfill to 50% of 1995 level	47,599 t	51,663 t	Y
2020	reduce BMW to landfill to 35% of 1995 level	54,766 t	52,741 t	N

Table A5.8 Option 5 Performance

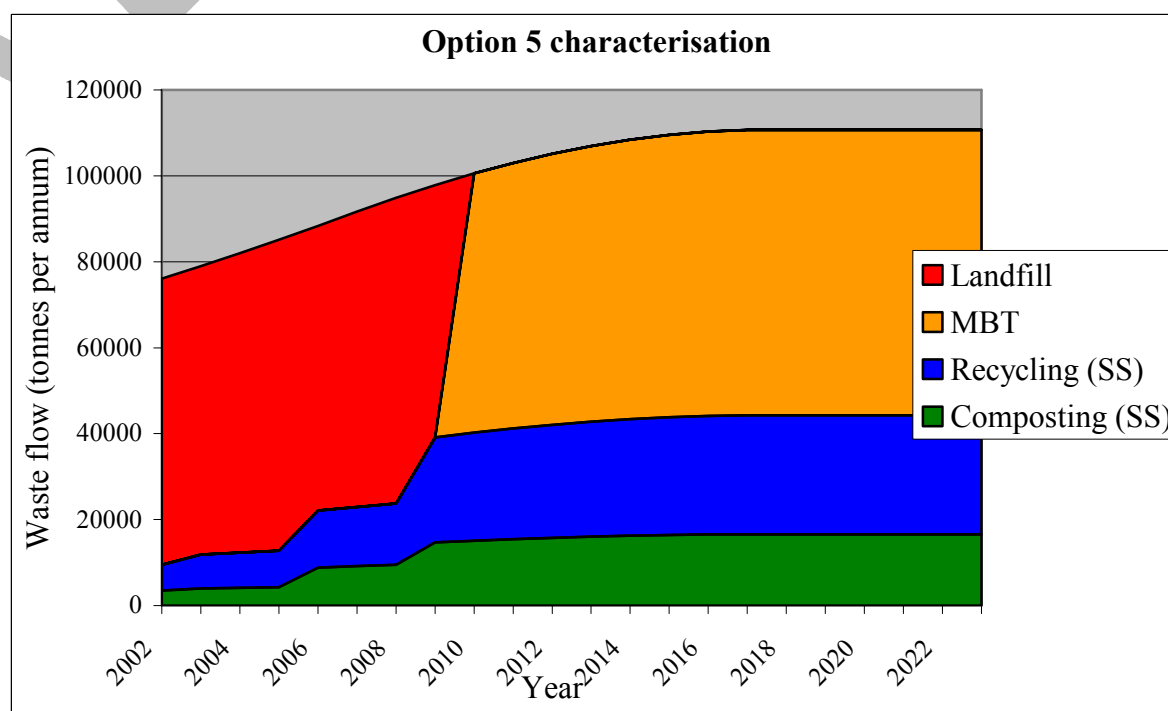


Figure A5.9: Projected Waste Quantities by Waste Management type for Option 5

As Table A5.8 shows, Option 5 meets the Waste Strategy targets for 2003/04, 2006/07 and 2009/10 and the Landfill Directive targets in subsequent years, except in 2020. Figure A5.9 indicates that there is residual treatment of waste, comprising Mechanical Biological Treatment of the entire residual waste stream. The main material outputs from the MBT plant are assumed to be a recyclable fraction (glass and metals), a low grade biostabilised

material and a Refuse Derived Fuel. It is assumed that the biostabilised product (compost) will only be suitable as landfill cover. For this reason, Option 5 is unlikely to meet the landfill directive targets in 2020

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Option 6: Exceed WAG targets, all residuals to MBT

This option requires a high level of composting and recycling of source segregated materials, with residual waste being sent to a Regional MBT facility for treatment. It is assumed that the MBT plant will incorporate an element of RDF (Refuse-Derived Fuel) production and Energy from Waste (EfW) for treatment of the RDF. Table A5.9 and Fig A5.10 provide an overview of the performance of Option 6.

Option 6				
Year	Indicator	Target	Actual	Target met
2003	Recycle 10% of Municipal Waste	7,902 t	15,961 t	Y
	Compost 5% of Municipal Waste	3,951 t	3,951 t	Y
2006	Recycle 15% of Municipal Waste	13,256 t	21,209 t	Y
	Compost 10% of Municipal Waste	8,837 t	8,837 t	Y
2009	Recycle 25% of Municipal Waste	24,218 t	31,192 t	Y
	Compost 15% of Municipal Waste	14,531 t	14,531 t	Y
2010	Recycle 30% of Municipal Waste	29,764 t	35,716 t	Y
	Compost 20% of Municipal Waste	19,843 t	19,844 t	Y
2010	reduce BMW to landfill to 75% of 1995 level	34,630 t	52,446 t	Y
2013	reduce BMW to landfill to 50% of 1995 level	47,599 t	55,210 t	Y
2020	reduce BMW to landfill to 35% of 1995 level	54,766 t	56,362 t	Y

Table A5.9 Option 6 Performance

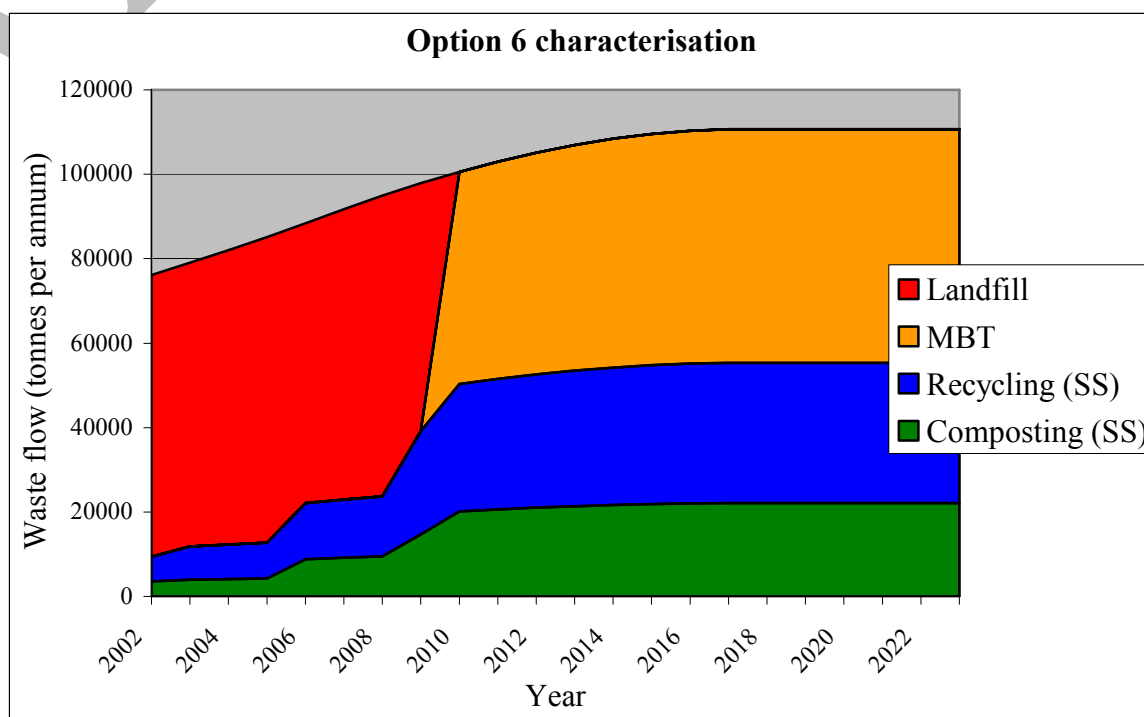


Figure A5.10: Projected Waste Quantities by Waste Management type for Option 6

As indicated in Table A5.9, Option 6 exceeds all Waste Strategy and Landfill Directive Targets.

4.0 OVERVIEW OF OPTIONS

Seven potential options (Option 0 to 6) for the future management of Municipal Waste in Gwynedd have been presented. These Options have been assessed against the relevant Waste Strategy and Landfill Directive Targets to determine compliance or non-compliance. Targets up to 2020 have been considered. Whilst Landfill Directive Targets have been set for 2020, for development of a Municipal Waste Strategy, this time horizon is deemed to be unrealistic. It is therefore suggested that 2010 is a more realistic time frame and that development of the waste management options and determination of the Best Practicable Environmental Option (BPEO) should be undertaken for this year.

All Options, except Option 0, achieve or exceed the Landfill Directive Targets for 2010. It is proposed to retain Option 0 as this represents the baseline position against which all other Options will be assessed. An outline of each of the Options for 2010 is presented in graphical format in Figure A5.11

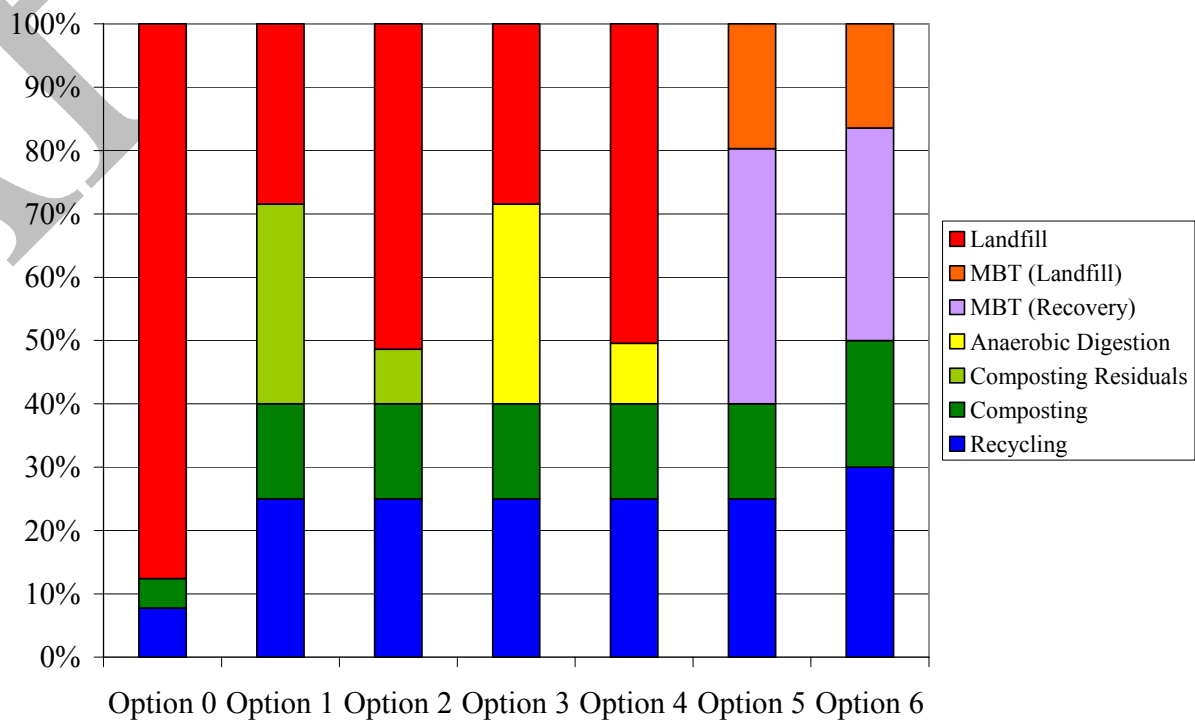


Figure A5.11 Outline of potential waste management options for 2010

Figure indicates that Option 0 has the highest percentage of waste going to landfill (above 80%). Option 6 is the highest landfill diversion option with less than 20% of waste consigned to landfill.

Tables A5.10 and A5.11 indicate the predicted facility capacity sizes and facility numbers for each of the options in 2010.

Table A5.10 Predicted facility capacity sizes for all Options

DESCRIPTION		PRIMARY WASTE HANDLING										SECONDARY WASTE HANDLING								
Option	Waste Stream	PRIMARY SOURCE SEGREGATION				MBT/Residual waste treatment capacity				Combined Residual Treatment (MBT) Mixed Waste Total	Energy from Waste plant capacity required	Direct to Landfill capacity	Capacity total for initial treatment (tpa)	Landfill capacity for ash from EfW	Landfill capacity for MBT ash	Landfill capacity for MBT stabilised material	Landfill capacity for AD Residual	Transfer facilities capacity		Capacity for total waste handled (tpa)
		MRF capacity	Compost plant capacity		AD	MRF	Bio-stabilisation	Landfill (rejects)	EfW									CA	OTS	
			OW	IV																
0	MSW	7,802	4,680		0	0	0	0	0	0	0	88,070	100,552	0	0	0	0	16,147	0	116,699
1	MSW	25,138	6,194	40,601	0	0	0	0	0	0	0	28,618	100,551	0	0	0	0	27,533	0	128,084
2	MSW	25,138	6,194	17,551	0	0	0	0	0	0	0	51,668	100,551	0	0	0	0	27,533	0	128,084
3	MSW	25,138	6,194	8,889	31,712	0	0	0	0	0	0	28,618	100,551	0	0	0	3,171	27,533	0	131,255
4	MSW	25,138	6,194	8,889	9,625	0	0	0	0	0	0	50,706	100,552	0	0	0	963	27,533	0	129,047
5	MSW	25,138	6,194	8,889	0	7,240	22,323	3,076	27,692	60,331	0	0	100,552	0	8,308	16,742	0	27,533	60,331	213,465
6	MSW	30,165	6,194	13,917	0	6,033	18,602	2,564	23,077	50,276	0	0	100,552	0	6,923	13,952	0	27,533	50,276	199,235

Table A5.11 Predicted facility numbers for all Options

DESCRIPTION		PRIMARY WASTE HANDLING								SECONDARY WASTE HANDLING										
Option	Waste Stream	PRIMARY SOURCE SEGREGATION				MBT/Residual waste treatment facilities				Combined Residual Treatment (MBT) plants	Energy from Waste plants required	Direct to Landfill facilities	Facility total for initial treatment (tpa)	Landfills for ash from EfW	Landfills for MBT ash	Landfills for MBT stabilised material & MBT rejects	Landfill for AD Residual	Transfer facilities		Facilities for total waste handled (tpa)
		MRF facilities	Compost plant facilities		AD	MRF	Bio-stabilisation	Landfill (rejects)	EfW									CA	OTS	
			OW	IV																
0	MSW	0.52	0.94	0.00	0.00			0.00		0.00	0.00	1.17	2.63	0.00	0.00	0.00	0.00	1.61	0.00	4.25
1	MSW	1.68	1.24	4.06	0.00			0.00		0.00	0.00	0.38	7.36	0.00	0.00	0.00	0.00	2.75	0.00	10.11
2	MSW	1.68	1.24	1.76	0.00			0.00		0.00	0.00	0.69	5.36	0.00	0.00	0.00	0.00	2.75	0.00	8.11
3	MSW	1.68	1.24	0.89	0.63			0.00		0.00	0.00	0.38	4.82	0.00	0.00	0.00	0.04	2.75	0.00	7.61
4	MSW	1.68	1.24	0.89	0.19			0.00		0.00	0.00	0.68	4.67	0.00	0.00	0.00	0.01	2.75	0.00	7.44
5	MSW	1.68	1.24	0.89	0.00			0.04		0.36	0.00	0.00	4.17	0.00	0.11	0.26	0.00	2.75	3.02	10.31
6	MSW	2.01	1.24	1.39	0.00			0.03		0.30	0.00	0.00	4.94	0.00	0.09	0.22	0.00	2.75	2.51	10.52

Facility type	Typical Capacity (t/a)
MRF	15,000
Open windrow	5,000
In-vessel	10,000
EfW Plant	50,000
Landfill	75,000
MBT	166,000
CA Site (MSW transfer)	10,000
Other transfer facility	20,000
Anaerobic Digestion	50,000

In Gwynedd, the number of facilities is dictated by the geography and this results in the predicted facility numbers elsewhere in the document.