



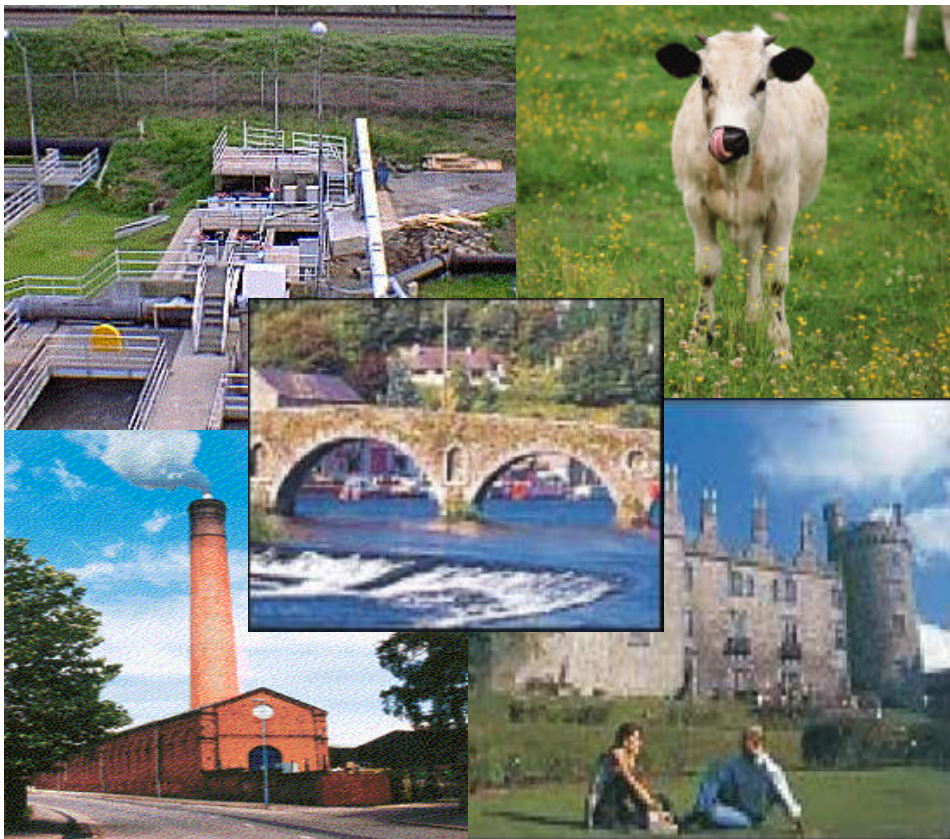
# Kilkenny County Council

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## Sludge Management Plan

for

## County Kilkenny



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February 2003

**Entec and O'Dwyer**

# Draft Sludge Management Plan for County Kilkenny

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February 2003

# Acknowledgements

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Entec and O'Dwyer sincerely appreciate the assistance offered by all parties during the preparation of the County Kilkenny Sludge Management Plan.

In particular we wish to thank the following:

Kilkenny County Council

Waterford City Council

Teagasc

The Department of Agriculture Food & Rural Development (DAFRD)

The Department of the Environment and Local Government (DoELG)

Central Statistics Office (CSO)

Ordnance Survey of Ireland

Environmental Protection Agency (EPA)

Irish Farmers Association (IFA)

Geological Survey of Ireland

Coillte

Industrial Development Authority (IDA)

Enterprise Ireland

Kompass Ireland

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# Executive Summary

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## Introduction

The Sludge Management Plan for County Kilkenny has been prepared in accordance with the guidance document Sludge Management Plans: A Guide To Their Preparation And Implementation (DoELG 1998) and with reference to the recommendations in the Strategy Study On Options For The Treatment And Disposal Of Sewage Sludge In Ireland (DoELG 1993). The Sludge Management Plan considers all forms of non-hazardous sludge arising and predicted to arise in the county over the next 20 years and proposes sustainable management strategies for them.

This Executive Summary presents a brief appraisal of each of the subjects addressed within the document, as follows:

- ◆ Quantities of Non Hazardous Sludge Arising in County Kilkenny
- ◆ Existing Strategies for Management of Non Hazardous Sludges
- ◆ Continuation of Existing Management Strategies
- ◆ Sludges Requiring New Management Strategies
- ◆ The Potential for Agriculture use of Biosolids
- ◆ Sludge Hub- Centres and Satellite-sites
- ◆ Evaluation of New Management Strategies
- ◆ Procurement Strategy
- ◆ Synergies with other Counties
- ◆ Implementation Procedure
- ◆ Public Information Strategy
- ◆ Quality Control
- ◆ Specific Recommendations of the Sludge Management Plan

## Quantities of Non Hazardous Sludge Arisings in County Kilkenny

Non hazardous sludges are produced in four main categories: Agriculture, Industry, Water Treatment and Wastewater Treatment. The population of the County is projected to grow over the next 20 years. Water, wastewater and industrial sludges will grow accordingly. In addition to this, the increased levels of treatment required as a result of the implementation of the European Urban Wastewater Treatment Directive, will cause a dramatic rise in the quantities of sludge produced from the treatment of domestic and industrial effluents. The quantities of agricultural sludges are not predicted to vary significantly over the 20 year period.

For water, wastewater and industry, the quantities of sludge quoted are those generated as a residue from treatment and purification processes. In agriculture the quantities

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reflect only those slurries and sludges which are collected as a result of intensive farming processes and housing of livestock during winter, overnight or during breeding, as opposed to manure from livestock applied to the land while open grazing. These intensively produced sludges require collection and redistribution, or treatment and disposal.

Table 1 shows the current and anticipated ultimate quantities of sludge produced in each category.

**Table 1 Total Sludge Arisings for County Kilkenny**

	<b>Sludge Production in tds/a</b>		
	<b>2002</b>	<b>2010</b>	<b>2020</b>
<b>Agricultural Slurries</b>			
Cattle	124,000	124,000	124,000
Pigs	4,800	4,800	4,800
Sheep	2,450	2,450	2,450
Poultry	300	300	300
Horses	4,500	4,500	4,500
Marts	0	0	0
Mushroom compost	500	500	500
<b>Industrial Sludges</b>			
Animal Slaughtering	480	480	480
Dairy Processing	2,250	2,250	2,250
Paper Processing	408	408	408
Other	11,201	11,201	11,201
<b>Wastewater Sludges</b>			
Digested Arisings	0	0	0
Raw Arisings	2,581	2,805	3,114
Unsewered Rural Arisings	0	670	684
<b>Water Treatment Sludges</b>			
	159	297	434
<b>Total</b>	<b>153,629</b>	<b>154,661</b>	<b>155,121</b>

## **Existing Strategies for Management of Non Hazardous Sludges**

Dewatered Sludge Cake is produced at Kilkenny City wastewater treatment works. This dewatered sludge cake has lime added to it and is currently spread on agricultural land in the vicinity of Kilkenny urban area.

Municipal wastewater sludges, from the 36 existing small treatment works in the county, are currently spread on agricultural land around the works. There are currently no digesters operating within the County.

Industrial sludges from direct processes and on-site treatment plants are all currently spread on agricultural land.

Agricultural sludges are also currently applied to agricultural land.

Water Treatment plant sludges are currently disposed of to landfill.

## **Continuation of Existing Management Strategies**

The nutrient balance calculations undertaken for the Sludge Management Plan show that nutrients applied to agricultural land from agricultural and industrial sludges do not exceed those required by the crops grown on the land. A large amount of inorganic fertiliser is also applied to farmland throughout the county that, on the basis of current Soil Test Phosphorus data and advice given to farmers by Teagasc, results in a significant excess of nutrients. The balance between use of organic and inorganic fertilisers needs to be examined, particularly with regard to the impact on water quality in the rivers, streams and aquifers within the county. It is therefore recommended that the current practice of land application of agricultural and industrial sludges can be considered sustainable only if it is carried out under strict nutrient management guidelines. This will only be achievable if a dramatic reduction in application of inorganic fertilisers is implemented.

## **Sludges Requiring New Management Strategies**

Of all the wastewater treatment sludges currently spread on agricultural land only that imported from the Purcellsinch plant uses additional treatment, in this case lime stabilisation, the other sludges (approximately 10%) are spread untreated. As the use of untreated sludge on agricultural land is being phased out a new strategy is required. In addition 90% of Kilkenny has a moderate to low lime requirement. Alternative strategies must be considered in case the lime content of the treated product from Kilkenny City exceeds the 'spreadlands' lime requirement.

Water treatment sludges are largely inert in nature and have little value in reuse applications. These sludges should be landfilled with efforts being concentrated on efficient dewatering to minimise the quantity and cost for landfilling. At this stage it is uneconomic to consider advanced processing for additional volume reduction. At the point in time when the cost of landfill reaches €108/t to €133/t for transport and disposal it will start to be economic to consider thermal drying, as a volume reduction technique, prior to landfill. At this price it could also be economic to consider the use of the sludge as an inert filler in manufacture of building materials along with other waste products, although plants of this type are currently in their infancy and their viability depends heavily on local market conditions.

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Industrial sludges currently disposed of to agricultural land may be restricted by future EU Directives. Those sludges will then require suitable treatment to render them acceptable for reuse or alternative disposal routes found. This responsibility will fall to the industrial producer.

Co-treatment of municipal and industrial sludge is possible, and would be attractive to industry if it were financially competitive. Due to the widely varying nature of industrial sludges this can only be assessed on a case by case basis against an established process. Therefore it is recommended that Kilkenny County Council develop their own strategy for municipal sludge treatment first. Spare capacity may be then be made available at a market rate, contingent upon assessment of sludge suitability and satisfactory analysis.

Hence a new management strategy is required at this time for wastewater treatment plant sludges, and water treatment plant sludges as outlined above.

## **The Potential for Agricultural Use of Biosolids**

Biosolids is the term used to describe wastewater sludge which has been treated to an approved level for reuse.

The phosphorus load from wastewater sludge is only 1% of that from agricultural sludges. Under the appropriate system of nutrient management, there is scope for application of biosolids to agriculture within the county. Biosolids may only be applied to agricultural land if the residual levels of particular heavy metals is sufficiently low. Soil sampling by Teagasc indicated that 10% of samples analysed exceeded maximum permissible levels of Cadmium and Lead for land application. It would be necessary to undertake a programme of sampling to determine levels of heavy metals before confirming the availability of this route. If residual levels were found to be too high, as is the case in other counties to the north and east, suitable land would have to be sought outside the county. Application to agricultural land in other counties may be possible, but only within the context of the Sludge Management Plans produced for those counties.

## **Sludge Hub-centres and Satellite-sites**

### *Sludge Hub- Centres*

The wastewater treatment works at Kilkenny City generates 80 % of the total wastewater sludge arisings to be managed in the county. The technical and financial analysis indicates that initially a single Hub-centre should be preferred over a split site solution. This Hub-centre is proposed to be at Kilkenny City Wastewater Treatment Works. Should the opportunity arise in the future to transfer sludge to the new plant in Waterford it would be economically advantageous to send some of the small sites in the South of the county to Waterford instead of Kilkenny.

### *Sludge Satellite-sites*

The radial nature of the sites around Kilkenny City does not favour the use of Satellite-sites. Growth of treated arisings in the South of the County, combined with future

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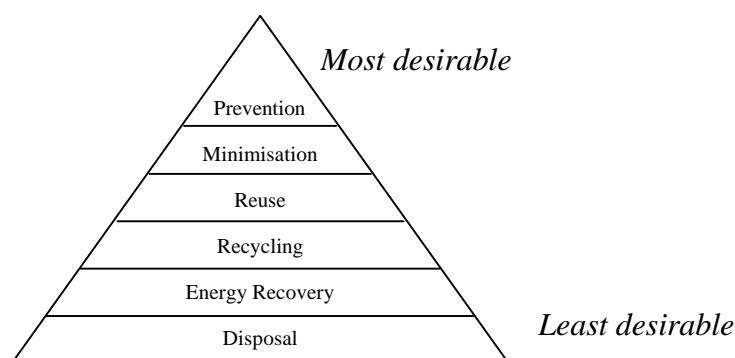
treatment of rural unsewered arisings may result in it being economical to operate a dewatering plant at Mooncoin and use it as a Satellite-site. This is not expected to be an economical option until 2010. Another option is to consider a mobile thickening plant to reduce the volumes of sludge transported from sites producing especially thin sludge. This may involve additional plant or tanks at certain sites and the logistics are not always favourable but it warrants further consideration.

## Evaluation of New Management Strategies

With the objective of gaining maximum benefit by reuse of biosolids and increasing the sustainability of disposal options a number of new management strategies for wastewater sludge have been evaluated.

With due regard to the Hierarchy of Waste Management shown in Figure 1, options have been considered in order of desirability. Sludges of this nature cannot be prevented therefore minimisation becomes the primary aim.

**Figure 1 Hierarchy of Waste Management ‘Changing our Ways’ (DoELG Sept 1998).**



### ***Minimisation of Sludge***

Within County Kilkenny, 80% of the sludge will be produced at one major treatment plant at Kilkenny City. There are no current plans for future development with regard to sludge at this plant, such as digestion, which would reduce the quantities of sludge produced. A significant proportion of the remainder of the sludge in the county is from private domestic septic tanks, which by their design are sludge minimisers already. Certain sites could be developed to reduce the total output of sludge but these are all small. The marginal cost of including these sites in a centralised strategy would be very much less than the cost of individual development, as the capital cost of development would be disproportionately large.

***Reuse of Sludge***

Reuse of the sludge product is therefore the highest achievable aim. Reuse of the organic matter and nutrient content can be achieved in agriculture, short rotation coppicing, forestry and land remediation. Discussions with Coillte have confirmed that there is limited potential for application of biosolids to forestry in and around County Kilkenny. Bord na Mona are not currently interested in using biosolids for cut away bog remediation. Submissions have been received by the council with regard to re-use in horticulture, however the security of this market is not clear. An assessment of other areas showed that there are very few sites such as landfills, quarries and derelict industrial sites, in need of remediation. While there are some sites where biosolids application could be used to great advantage, they are insufficient to base a long-term reuse strategy on. This leaves only agriculture and short rotation coppicing as a reuse outlet. As stated earlier, there is some potential for agricultural use of biosolids within the county to replace some inorganic fertiliser, depending on the type of biosolids product being produced. Short rotation coppicing may also be feasible, but the main issue with this option will be whether a secure market can be found for the product, and this is not currently clear.

In terms of treatment options for reuse, the availability of outlets determines which techniques can be employed. Lime stabilisation carries high operating costs due to the quantities of lime needed, and some insecurity imposed by the lime requirement for most of Kilkenny County being moderate to low. Composting and lime stabilisation both require large quantities of raw material and end product to be transported. Should land close to the treatment facility be unavailable for spreading then transport costs would significantly increase. A thermal drying process produces a significantly smaller quantity of material in a granulated or pelletised form, which is the preferred form of biosolids for agricultural application. It is possible that agricultural outlets may be identified within the County subject to acceptable results from soil sampling and the production of sustainable nutrient management plans. Alternatively land may be sought outside of the County, but this would have associated increased transport costs.

***Recycling of Sludge***

There is little scope for recycling of sewage sludge into other useful materials.

***Energy Recovery from Sludge***

Energy recovery holds a similar position in the waste hierarchy to Recycling in that the primary purpose is reduction in the use of raw materials. Energy is recovered from biosolids by using its organic matter content. Dried raw sludge has a calorific value of approximately 18MJ/kg, equivalent to that of a brown coal fuel. It can also be used as a substitute for fossil fuels in certain industrial processes, such as cement and brick kilns or it can be processed on site to produce energy in the form of gas heat or electricity, again reducing the direct or indirect use of fossil fuels. Three generic processes have been considered, all of which start with a thermal drying plant:

- Use of dried product as a substitute fuel in industrial processes
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- Dried product incineration to provide heat for the dryer
- Gasification/Pyrolysis using product gas to substitute natural gas in the dryer

Technical details of these processes are contained within the body of the report but in terms of evaluation of secure long term strategies, the important feature is that the first option relies on off-site use requiring no significant additional capital investment (other than the cost of the drying plant), while the other options are on-site processes requiring additional plant. Also of importance is that the first option requires the operator to bear the risk of the development of a secure long term contract with an outside party, whilst the other options place greater control of the risk in the hands of the process operator.

#### *Disposal of Sludge*

At the bottom of the waste hierarchy is disposal. Incineration of sludge cake with landfill of ash is a technically feasible option for the Sludge Hub Centre. Although there can be an element of heat recovery in the process, for a plant of this size it should essentially be considered a disposal option. Financial analysis of the incineration option has indicated that it would be uneconomic at the scale envisaged for County Kilkenny.

#### *Viable Options and Costs*

The financial appraisal contained in the report presents detailed cost analysis for a range of options.

In terms of technical and financial suitability there are seven viable options which show potential as long term sustainable strategies for wastewater sludge management over the next 20 years. These are:

- Lime Stabilisation
- Composting and use of the product in agriculture or non-agriculture
- Composting and use of the product in Short Rotation Coppicing
- Drying with agricultural use of dried product
- Drying with use of dried product as fuel in industry
- Drying and gasification using product gas in the dryer
- Drying and combustion using waste heat in the dryer

Financial analysis of these options has been undertaken on a whole-life basis (referred to as Net Present Value (NPV)), looking at the capital, operating and transport costs over 20 years and using a prevailing discount rate of 5%.

Two additional landfill options have also been presented to provide supporting information. These are not seen as sustainable options. The cost for landfill of

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dewatered cake is presented to provide a worst case cost comparison. The cost for landfill of dried product is also presented as an option which would possibly be used on a temporary basis under emergency circumstances.

### *Whole Life Costs*

Including dewatering and transport costs the 'Composting with Short Rotation Coppicing' and 'Drying and Combustion' options have NPVs of €21.5M and €22.5M respectively, and are the least favoured. The whole life cost of the remaining options are broadly similar in the range of €18.4M to €20.5M NPV.

Landfill of dried product would have a cost of €23.0M. If landfilling of cake were possible it would cost €29.4M NPV. This would be almost entirely operating expenditure for the Council, equating to approximately €2.5M annually. In addition to the rapidly escalating cost of landfill, environmental and legislative pressures make both of these unsustainable options.

### *Annual Operating Costs*

While the viable reuse and energy recovery options are all fairly similar on whole-life cost basis. Analysis of operating costs shows a more complex picture. Excluding dewatering and transport cost: Drying and agricultural use has an operating cost of approximately €5.4M compared with the cost of using the dried product as a replacement fuel in industry of €5.3M. The combustion and gasification of dried product options have operating costs of €5.0M and €4.6M respectively. The reasons for this range are:

- the relatively low revenue available from agricultural use of dried product compared with use as a fuel substitute
- the additional capital expenditure on energy recovery options brings benefits in terms of reduced on-site consumption of gas, as well as reducing transport costs.

Composting and coppicing has an operating cost of €5.1M and Lime stabilisation would cost €7.5M.

## **Procurement Strategy**

To arrive at a preferred option, cost must be considered against sustainability, risk, reliability and environmental impact. There are many factors associated with each option, and these are discussed in detail in the body of the report. There are limited land outlets for products of the simpler treatment processes within the county. Therefore more advanced and relatively new technologies must be considered in addition.

### *Design and Construction of the Facility*

Given the choice of viable options the benefits of letting a Design and Build contract are clear. Flexibility can be exercised to ensure acquisition of the best value facility, while the risk associated with advanced technologies or with securing re-use outlets can be

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carried by those best able to manage it. It is recommended that tenders should be invited for a **‘Sludge Processing Facility with Beneficial Reuse Of The Product, Utilising Its Nutritional Or Energy Value.’**. This gives adequate scope to cover all the above viable options.

### ***Operation of the Facility and Reuse Outlets***

It is also recommended that operation of the facility should be let as part of the same contract. The whole life cost of many of the viable options is highly sensitive to operating cost, which is a function of efficiency and, where appropriate, outlet availability. There is little benefit in accepting a facility with the lowest capital cost if the operating efficiencies, or indeed outlets cannot be guaranteed.

If the contract is let as a Design, Build and Operate (DBO), careful attention should be paid to the potential operational risks and who is best placed to manage them. Often a policy of maximum risk transfer to the contractor is adopted, when the purchaser is better placed to manage some of these risks. A full quantification of the risk profile associated with the DBO contract should be undertaken early in the project to determine the most cost effective allocation of risk between the Council and the Contractor.

### **Synergies with other counties**

The *Strategy Study On Options For The Treatment And Disposal Of Sewage In Ireland* suggests that Sludge Hub-centres should be developed in central locations within economic areas in which sewage sludge can be managed. This is a sensible approach and the recommendations have been examined in this report.

Processing synergies with Waterford City and sludge processing at the proposed new works at Gorteens have been assessed. Both these options currently prove less favourable than treatment within Kilkenny City.

### **Implementation Procedure**

Implementation of the recommendations of the Sludge Management Plan revolve largely around rapid development of facilities for long-term treatment and beneficial reuse of wastewater sludge.

Given the time-scale for such a development, a short term interim solution of lime stabilisation at Kilkenny WWTW has been implemented. This solution should be reviewed periodically as changes in legislation and agricultural practice occur.

### **Public Information Strategy**

It is well recognised that to successfully implement a long term sustainable Sludge Management Plan it is important not only to comply with a wide range of legislation but also to have the support of local communities, environmental bodies, users of the final product and other bodies affected by the use of that product.

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During the development of the Sludge Management Plan a public notice was issued requesting interested parties to contribute. No replies have been received by the council at this stage.

All interested parties will be consulted at key stages during the implementation phase. Their input will influence the decision making process which will lead to adoption of the final treatment and utilisation option. Public and private consultations will be arranged prior to preparation of tender documents and during preparation of any Environmental Impact Assessment/Detailed Planning Application.

## **Quality Control**

As a continuation of the aims of the public information strategy, Quality Control systems will be implemented and effectively operated. Relevant legislation and codes of practice provide the framework for protection of the public interest, and effective quality control is the best way to demonstrate compliance.

Procedures will be drawn up and administered in the areas of sludge generation, sludge transportation, operation & maintenance of Hub-centre facilities, reuse of sludge derived products and landfill disposal.

## **Specific Recommendations of the Sludge Management Plan**

1. A DBO contract will be let for the provision of Hub-centre sludge processing facilities at the Kilkenny City Wastewater Treatment Plant. This should include the establishment and 20 year operation of a beneficial reuse programme for the biosolids product.
  2. Waterworks sludge should be disposed of as cake in engineered landfill sites until the cost of such disposal makes expenditure on volume reduction processes viable.
  3. Landfill capacity should be reserved for both waterworks sludge and wastewater sludge. In the case of waterworks sludge an ultimate annual capacity of 1767t/year of cake at 25% dry solids should be planned for. For wastewater sludge a capacity of 360t/week of cake at 20% solids, and 80t/week at 90% solids of dried product, should be reserved.
  4. The current interim sludge management operation at Kilkenny WWTW should be reviewed regularly.
  5. For the agricultural and industrial non-hazardous sludges for which the current management strategy is agricultural use, a continued policy of agricultural use is proposed.
  6. It is recommended that the implementation of nutrient management planning should be encouraged throughout the County to protect the vulnerable aquifers and minimise the risk of watercourse pollution through run-off and leaching. A bye-law
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under the Local Government (Water Pollution) (Amendment) Act of 1990 to regulate organic and inorganic fertiliser spreading should be enacted.

7. The high dependence on inorganic fertilisers across Kilkenny is creating a large surplus of phosphorus. In addition to enactment of a bye-law it is recommended that liaison is established with Teagasc or the IFA to determine the most appropriate method to reduce levels of fertilisers used.
  8. Detailed soil sampling should be undertaken to determine the availability of agricultural land for the application of biosolids within the County. This sampling can be carried out at implementation stage.
  9. The development of intensive agricultural industries will be controlled in line with guaranteed nutrient management planning for the spreading of sludges.
  10. A public information strategy will be developed and implemented. The focus of the strategy will be to raise general awareness of the unsustainability of current wastewater sludge disposal and of the beneficial reuse options available. It will also aim to encourage public support at an early stage in the decision making process and to engender confidence in the preferred process / reuse option.
  11. Quality control systems will be developed and implemented to cover all necessary aspects of the management of wastewater sludges.
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