D Facility Design

D.1 Infrastructure

D.1.(a) Facility Security The site comprises a triangular shaped area, measuring 250m x 230m x 210m, and covering a total area of 2.7 hectares. The site is situated on the western side of a north-south trending third class country road. The front of the property extends for 195m along this road, is located in part behind a former farmhouse and sheds and in part behind a berm and hedgerow. The farmhouse is now the domestic dwelling of the owner of Shannon Vermicomposting Limited. The facility is accessed through the former farmyard, by an entrance gate that is located to the south of the domestic dwelling. There is a 2.5m high, metal fence and gate at the entrance beside the road and a second fence and gate at the western end of the former farmyard, at the entrance to the site. A 2m-high timber fence runs along the roadside at the front of the former farmyard and the rear of the farmyard is separated from the site by a second timber fence. The southern boundary of the site consists of a hedgerow and trees with a shed at the eastern end. The northwestern side of the site is bounded hedgerow with a 3m high berm adjacent to it on the facility side. A system of CCTV is in place and monitors the entrance area and the operational area.

D.1.(b) Access Road There is a public road adjacent to the site and the entrance gate is set back 9.3m from the western margin of the road. This gives ease of access to the facility and provides a field of vision for exiting vehicles of 200m to the south towards Rathcabbin.

D.1.(c) Hardstanding areas The surface of the facility is a combination of either concrete or hard-cored surfaces. The concreted surfaces consists of the floors of the polytunnels, the waste reception area, a road joining the access gate to the waste reception building and passing the weighbridge and wheel wash, and the surface of the former farmyard. The hard cored surfaces are composed of limestone aggregate and gravel.

D.1.(d) Weighbridge There is currently a weighbridge in operation at the facility and its location is marked on Drawing 1208/A/PL/101. The weighbridge is manufactured by Leon, model 5218 and is capable of weighing vehicles with a gross weight of up to 60 tonnes. A copy of the Certificate of Conformity dated 15/04/2004 is attached. The details recorded at each weighing will include:

- Date and time
- The haulier

Legal Metrology Service

Limerick Regional Centre

Plessey Technological Park,
Castletroy,
Limerick.

Tel: 061 330 708
Fax: 061 330 698

Metrology Acts, 1980-1998

Certificate of Conformity

Certificate No: L04/1029.

File No: N/A **Job No: N/A** **Order No: N/A**

CLIENT NAME : Shannon Vermi Composting Ltd.,

ADDRESS: Coolross, Rathcabbin, Co. Tipperary.

This is to certify that the metrological instrument described hereunder was examined and tested by me on 15/04/2004 and was found to be in conformity with the requirements of the Metrology Acts, 1980-1998 and that the Standards used to perform the tests are traceable to National Standards.

DESCRIPTION

Instrument Type: Non-Automatic Weighing Instrument.

Manufacturer	Model	Serial No.	Capacity	Scale Interval	Type Approval No.	Accuracy Class (where Applicable)
Leon	5218	100283653	60,000Kg	20Kg.	DK0199.27	III

CERTIFIED CORRECT.

Date: 15/04/2004

(DENIS CORKERY)
Legal Metrology Inspector

- Vehicle registration
- Waste type
- Laden weight
- Empty weight
- Drivers signature

D.1.(e) Wheelwash A wheel-wash will be provided at the site at the position shown on Drawing 1208/A/PL/101. It will be positioned to ensure that the waste vehicles leaving the site do not carry any material onto the public road. The wheel-wash will recycle the water it uses and the water will be disposed off by sprinkling it on the aeration composting beds.

D.1.(f) Laboratory There will be no laboratory facility on the site.

D.1.(g) Fuel Storage Area Diesel is the main fuel used on site and it will be stored in a 2000 litre tank. This tank will be located within a waterproof, concrete bund that has a capacity in excess of 110% of the volume of the largest diesel tank. Refueling will only take place at a designated area adjacent to the bund.

D.1.(h) Waste Quarantine Area The waste reception area currently comprises of 8 bays that are located on a reinforced concrete surface. The bays vary in width from 5.3m to 6.4m, are 19.5m in length and are separated by reinforced concrete wall 0.35m thick and 2.55m high. The bays occupy approximately 50% of the concrete surface and it is planned to enclose this entire surface within a building. This will ensure that all the waste tipping, inspection and mixing will be conducted indoors. All wastes are delivered to the site in covered, watertight containers and are only tipped within the waste reception area. One of the bays is used specifically as a waste material quarantine / rejection area.

D.1.(i) Waste Inspection Areas The waste reception area is located on the southern side of the site and is 50m from the entrance gate. The building, when complete, will have a maximum height of 8.9m and will cover an area of 2,078m^2. The sides and roof of the building will consist of dark green, zinc coated, mild steel corrugated cladding. It contains 8 material bays, a large working area to the front of the bays and 2 vehicle access gates. An underground leachate collection tank is located at the front of the building.

Each delivery of biodegradable organic waste material will, on arrival at the reception building and after been weighed at the weighbridge, be inspected by a trained Shannon Vermicomposting

member of staff at the entrance to the waste reception area. If the material is suitable, it is unloaded in one of the mixing bays and inspected in more detail as it is being unloaded. If the material is not suitable, it will be rejected and reloaded onto the truck to be returned to its source. When the load is fully inspected, it will be mixed with mature compost and amendment material.

D.1.(j) Traffic Control When fully operational, there will be up to 8 trucks delivering licensed biodegradable organic wastes to the facility each day plus one delivery of wood chips each week. The facility will employ up to 15 trained operators and they will travel to the site by mini bus or in their own cars. Eleven parking spaces will be provided in the former farmyard at the entrance to the facility to ensure that all vehicles are parked off the public road.

Arrangements will be made with North Tipperary County Council to have roadside warning signs erected 100m either side of the entrance to the facility.

A traffic survey was conducted by Minerex Environmental Ltd on the traffic travelling through the village of Rathcabbin. The results of the survey indicate that the Shannon Vermicomposting facility would increase the volume of traffic travelling through the village on weekdays between 9.00 – 18.00 by approximately 5%.

D.1.(k) Details of Services. The facility is currently operational and is serviced by electricity and two telephone lines. Water is supplied by an on-site private well. This water quality is currently not fit for drinking. It is planned to upgrade and disinfect this well. If the water quality is still poor after this, a new well will be drilled elsewhere on the site. An application has been made with the ESB to have three-phase electricity connected to the site. Currently, three diesel generators provide electric power to the facility and it is planned that these will be kept on site to provide back-up power in the event of a power breakdown.

D.1.(l) Sewage and Surface Drainage The existing house on the site is serviced by a septic tank and percolation area. It is planned to install a Puroflo proprietary on-site effluent system as part of the development of the facility. This system will be used to treat the sewerage and wastewater from the facility offices, toilets and canteen.

The vermicomposting process occurs indoors and thus there is no runoff from it to surface water drains. Run-off from concrete covered, hard standing area will be gathered in two underground storage tanks to be used in the composting process. Runoff from the roof of the waste reception building will be collected in water storage tanks and used in the composting process. When these

tanks are full, the surplus roof runoff water will discharge directly to the drain that runs along the road to the front of the facility and this water will flow eastwards to the drain that flows north to the Little Brosna River.

D.1.(m) Plant Sheds and Garage Apart from the 20 composting / mushroom tunnels and the waste reception building, the only other plant shed to be built on the site will comprise the covered area for parking and maintaining plant and machinery that is operational on-site.

D.1.(n) Site Accommodation A building to include administration and staff facilities will be built beside the main gate, close to the waste reception area and the weighbridge. This will accommodate the site manager's office and general office where all the records and documentation relevant to the operation of the facility will be maintained. The building will also contain a canteen, toilets and showers plus first-aid facilities.

D.1.(o) Fire Control System A water tank specifically for fire control will be put in place and kept full at all times. This will have a 100mm hard suction connection at its base for connection to fire hoses. Fire extinguishers will also be available throughout the site and buildings plus a mobile slurry tanker full of water will be present at all times on site. The management of Shannon Vermicomposting will ensure that smoke detectors and alarm system are installed in each building and an emergency response plan will be put in place to ensure the safety of the staff.

D.1.(p) Civic Amenity There will be no civic amenity facility associated with this site.

D.1.(q) Other Waste Recovery There is no other waste recovery infrastructure proposed.

D.1.(r) Other Infrastructure There is no other infrastructure proposed.

D.2 Facility Operation

Shannon Vermicomposting Ltd commenced composting small volumes of organic biodegradable material at this site in Rathcabbin in 1998. Much of this early activity was directed towards practical research and field trials to examine variations in the composting process and the quality of the final compost product produced, based on varying biowaste materials and duration of composting. At that stage, Shannon Vermicomposting worked with and continues to work with companies like Bord

na Mona and Treatment Systems in Kilkenny to address practical composting methods and product quality. This period was also used to commence building up the large stock of worms that are required for the vermicomposting process.

The issue of the liquid / water component of the waste was identified as a issue relevant to the efficiency of the process, both at the initial mixing stage where it requires to be mixed with large amounts of amendment product and during the composting phase where maintaining moisture levels at the appropriate levels is crucial to the efficiency of the composting process. Shannon Vermicomposting has examined these problems and plans to extract the liquid at the mixing stage by passing the waste materials through a fan separator. This will reduce the amount of amendment material required and will speed up the composting at the early stages. The liquid, after pasteurization, will be fed to the worms in the vermicomposting process and help to maintain the required moisture levels. Any excess amounts of liquid can be used in the in-vessel aeration composting phase to help to generate the maximum amount of bacteria to reduce the biodegradable material.

The facility is currently operating under the terms of Planning Permission, No. (PLC/24499), issued on the 4th April 2002 and a Waste Permit, No. WP TN 08, granted 2nd August 2002 both of which were granted by North Tipperary Co. Council. The Waste Permit granted the facility permission to treat up to 1000 tonnes per annum of sewage sludge, household waste and green waste. The planning permission granted permission for the erection of 20 tunnels and ancillary facilities. Site preparation works and tunnel construction commenced during 2003. A second planning application was submitted to North Tipperary Co. Council, on the 18th June 2004. This application is seeking permission to:

- Change the location of 11 of the tunnels.
- Retain and complete the waste reception facility.
- Retain the existing weighbridge
- Retain and complete existing security fencing.
- Construct new office, canteen and covered area for plant and machinery.
- Install a Puroflo effluent treatment system.
- Install a wheel wash facility, bunded fuel storage area, oil interceptor, and water storage tanks for fire fighting.
- Install two pasteurization tanks for the processing and storage of the liquid fraction of the biodegradable organic wastes.
- Construct perimeter security fence at the western, western and roadside boundary of the site.

- Construct car parking, hard areas, landscaping and other associated site works.

D.2.(a) The vermicomposting operation is a 5-stage process that converts organic waste materials into a quality compost product. The five stages of the process comprise:

1 Waste reception
2 Pre-vermicomposting aeration
3 Screening
4 Vermicomposting
5 Product utilisation

A flow diagram summarizing the overall process is included on Page 26.

In summary the process comprises;

1 Waste reception: At the waste reception, the incoming biodegradable organic waste will be tipped in the tipping bay. The material is then passed by a screw auger through a fan separator that will separate the solid and liquid fractions. The fan separator will be accommodated at the back of the tipping bay. The liquid fraction will be collected in one of the two pasteurization tanks that are located to the western side of the waste reception building. The liquid waste will be pasteurized by heating it to a temperature of 70^{0}C for 1-hour. The pasteurised liquid fraction will be consumed and processed by the worms. The solid fraction will be moved to one of the mixing bays where it will be mixed with wood chippings and seeded with a quality mature compost. When the materials are thoroughly mixed, the immature compost is moved to the aeration tunnels.

2 Pre-vermicomposting aeration: In the tunnels, a forced aeration system located beneath each bed will ensure an evenly distributed aeration of the compost. The aim of this stage of the process is to achieve the total elimination of all pathogens by the heat generated by the composting and the stabilization of the compost prior to the vermicomposting stage. The aeration phase of the process lasts for approximately 14 days and during this stage it is important that a constant moisture level is maintained. If the compost is allowed to dryout, micro-organism development will be restricted and the composting process will be inhibited. To ensure that this does not occur, the compost will be turned every four days during the period and an overhead sprinkler system will keep the compost sufficiently moist. Each tunnel is fitted with an underground leachate collection tank. All the collected leachate is sprinkled back onto

the compost to keep it moist and to ensure that the system is sealed. A separate supply of leachate or water will be available for each tank if extra liquid is required.

3 Screening: After the aeration process, the compost is then screened through an electric screener to produce an even sized material for the vermicomposting process. The screener consists of a trommel with three conveyors to segregate the different size components. The oversized components, which generally comprises wood chippings and fragments plus minor amounts of inorganic material. The wood is returned to the reception building to be re-mixed with new wastes and any inorganic material is moved to the rejection bay. The minor amounts of inorganic and inert reject material will be removed by a licensed contractor to a licensed landfill facility.

4 Vermicomposting: The compost is then moved to the vermicomposting tunnels where it is placed on the worm beds. In each tunnel there are two sealed concrete tanks that measure 100 ft long x 7 ft wide x 3 ft high that contain the worms beds. The compost is spread in layers up to 150mm at a time. In the right conditions, 1 tonne of worms can consume their equivalent weight of composted material and liquid in a 24-hour period. The parameters that influence the rate at which the vermicomposting is progresses are:

- Worm bed temperature
- Population / density of the worm stock per square foot
- Moisture levels
- The pH of the bed.

The temperature of the worm bed can be regulated by the flow rate of air through the bed. Warm air from the aeration tunnels will be circulated through the worm beds to keep these at the required temperature. The extracted air from the vermicomposting tunnels will be fed back through the aeration tunnels to maintain a balanced air system. The cooler the conditions the slower the worms breed and feed. The other factor that is related to the temperature is the moisture content of the bed. The optimum moisture level is maintained by the in-tunnel sprinkler system which uses liquid from the pasteurization tank plus liquid from the tunnel's leachate collection tank. The size of the worm population is another factor that controls the rate of the compost assimilation. The worm capacity can be as high as 2kg of worms per ft^3 to a low density of 1kg per yd^3. The higher the worm density, the faster the rate that the compost will be consumed and the worm cast compost produced.

5 Product Utilisation: Shannon Vermicomposting currently produces windrow compost and a limited amount of worm cast compost. This compost is used as a source of food for the large quantity of worms that have been nurtured over the past three years and as an amendment material added to the organic wastes at the start of the composting process. When the vermicomposting tunnels are operational, the facility will produce a top quality worm cast compost. This will be used as an amendment material to be mixed with organic wastes at the start of the composting process and as a compost for growing mushrooms.

Photograph 7. 2 of the tunnels being constructed

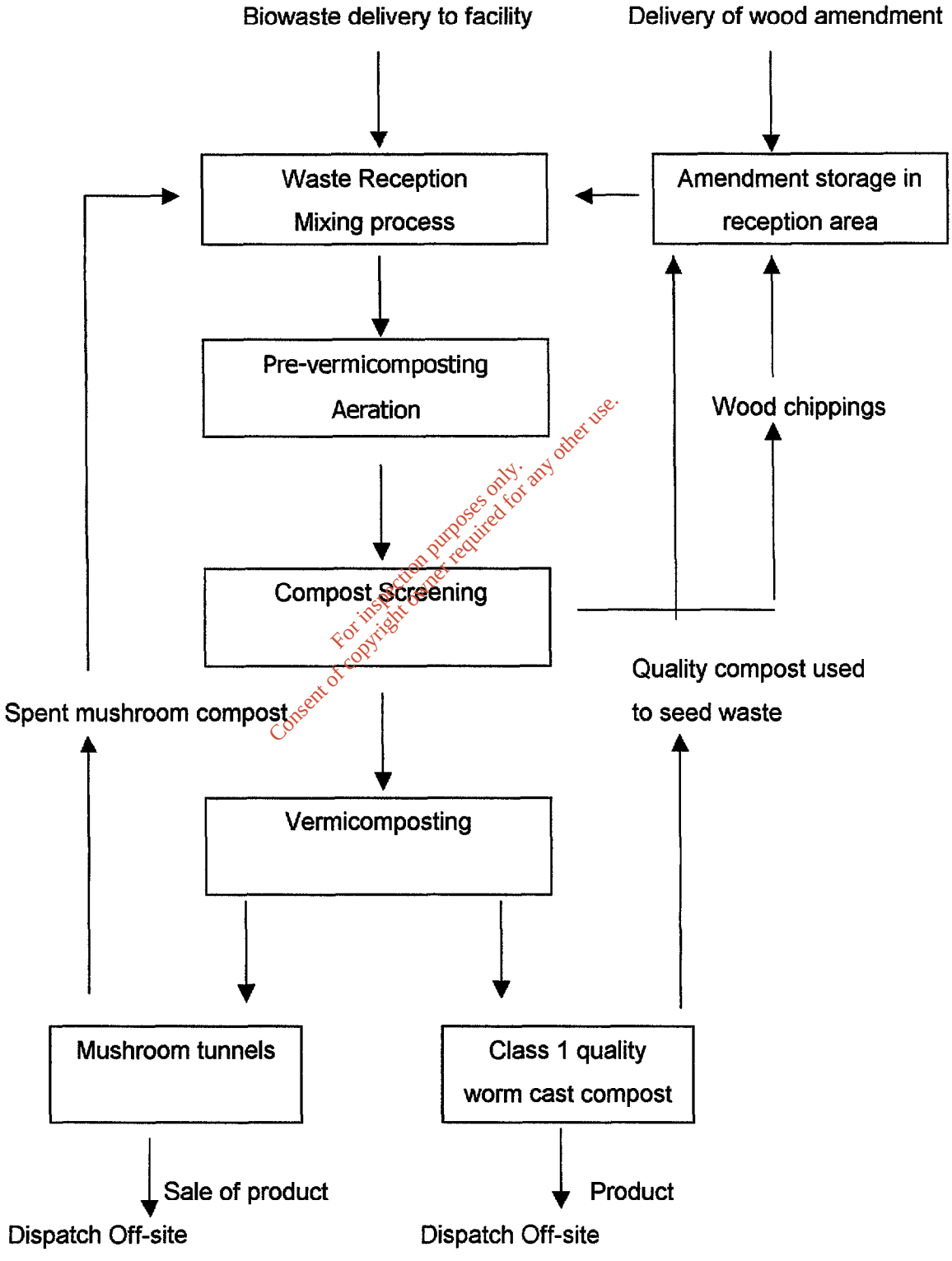
Photograph 8. Construction of the concrete base of more of the tunnels.

Photograph 9. Compost stored in one of the bays in the reception area

Photograph 10. View of the waste reception bays and the concrete base in front of them

Photograph 11. View of the screening unit

Flow diagram summarizing the overall process at Shannon Vermicomposting Ltd.



D.3 Materials Management

The Shannon Vermicomposting facility only contains one major process stream and this comprises the composting of organic waste materials to produce a quality Class 1 compost. A report on the quality of this compost, produced by Bord na Mona and titled "Analysis of Vermi-Composting from Shannon Vermicomposting and Interpretation of Results" is attached. The facility only accepts and processes non-hazardous biowastes. The facility is currently operating under the terms of a waste permit, No. WP TN 08, issued by North Tipperary Co. Council and it composted 2264.05 tonnes in 2003 comprising;

Material	EWC Code	quantity
Green organic waste	20 01 08	1000 tonnes
Sewage Sludges	19 05 01	600.45 tonnes
Restaurant wastes	20 01 08	663.60 tonnes

Shannon Vermicomposting is applying to the EPA for a Waste Licence to compost up to 20,000 tonnes per annum of non-hazardous, organic biowastes by the vermicomposting process. Shannon Vermicomposting will maintain just one process stream and the biodegradable biowastes to be composted will comprise;

Material	EWC Code	quantity
Household green wastes collected by or on behalf of local authorities.	20 01 08	10,800 tonnes
Sewage Sludges	19 05 01	2,700 tonnes
Commercial green wastes	20 01 08	4,500 tonnes
Wood chippings	03 01 01	2,000 tonnes

1609-126

BORD NA MÓNA

BORD NA MÓNA ENVIRONMENTAL LIMITED

Technical Services

ANALYSIS OF VERMI-COMPOST FROM SHANNON VERMICOMPOSTING AND INTERPRETATION OF RESULTS

1 Introduction

Shannon Vermicomposting composts house hold waste by Vermicomposting process. The sample received by Bord na Móna was 8 weeks old.

A thorough knowledge of the feedstock materials is essential to assess the final application of the product.

This report outlines the parameters under which the analysis was carried out, and provides detailed results of the laboratory tests. The results are also interpreted in terms of the product being used as a growing media and soil amendment

2 Applied Standards

The Environmental Protection Agency (EPA) has produced a document outlining the quality standards for the use of compost as a soil improver. German standards are also taken into consideration when interpreting the results recorded from these tests.

It is important the have a thorough knowledge of the raw material being composted before developing a programme of analysis.

The analysis carried out on the samples of compost from Shannon Vermicomposting was largely based on the EPA Standards for Compost Quality, with some additional analysis to increase the relevance for the specific situation.

3 Results of Analysis

One sample was received from Shannon Vermicomposting on the 9th March 2004 (GW 106). It was received in good condition. Analysis was carried out on the samples as requested by the client.

Comprehensive analysis was carried out to realise a full maturity, chemical and physical profile of the sample.

Compost Testing and Analysis Service

Report ref: GW 106

Sample reference: GW 106
Sample matrix: Source separated vermin compost biowaste.

Maturity Tests

Sample	Self Heating Test (maximum temperature reached, °C)	Cress Test 100% sample %	Cress Test 50% sample %
GW 106	65.9	20	90

Plant Nutrient and Organic Matter Content

Water Soluble Nutrients

Sample lab number	PH	EC $\mu S.cm^{-1}$	NH4-N $mg.L^{-1}$	NO3-N $mg.L^{-1}$	PO4-P $mg.L^{-1}$	K $mg.L^{-1}$
GW 106	7.72	3350	165	<1	11	620

Total Plant Nutrients and Carbon Content (Dry Wt. Basis)

Sample	N %	P %	K %	C %	ASH %	C:N %
GW 106	1.56	0.42	0.68	23.39	57.9	15

Heavy Metals (Dry Wt. Basis)

Sample	As $mg.kg^{-1}$	Cd $mg.kg^{-1}$	Cr $mg.kg^{-1}$	Cu $mg.kg^{-1}$	Hg $mg.kg^{-1}$	Mo $mg.kg^{-1}$	Ni $mg.kg^{-1}$	Pb $mg.kg^{-1}$	Se $mg.kg^{-1}$	Zn $mg.kg^{-1}$
GW 106	39.5	0.627	60.3	189	0.097	1.95	34.4	126	0.705	277

Physical Analysis

Sample	H_20 %	MBD‡ $g.L^{-1}$	DBD† $g.L^{-1}$
GW 106	38.9	524	320.2

Particle Size Analysis (Dry Wt. Basis)

Sample	<1mm %	1-2mm %	2-4mm %	4-8mm %	8-16mm %	16-35mm %	>35mm %
GW 106	30.15	27.59	19.16	13.86	5.51	3.73	0

Contaminants (Dry Wt. Basis)

Sample	Fraction	Glass %	Metal %	Plastic %	Stones/ Gravel %	Other %
GW 106	<1	<0.01	<0.01	<0.01	<0.01	<0.01
	1-2	<0.01	<0.01	<0.01	<0.01	<0.01
	2-4	<0.01	<0.01	<0.01	<0.01	<0.01
	4-8	0.05	<0.01	<0.01	0.24	<0.01
	8-16	1.02	<0.01	<0.01	2.57	<0.01
	16-31.5	<0.01	<0.01	<0.01	<0.01	<0.01

Note:

N/A NOT AVAILABLE

Results given on a fresh weight basis except where indicated

Samples will be kept for three months

[/]Yield is expressed as % of control plants grown in 100% peat in relation to plants grown in 10%, 25%, 50% and 100% GW.

[†]DBD=Dry bulk density (after drying at 105°C for 12 hours)

[‡]MBD=Moist bulk density (sample as received)

CBW=Composted Biowaste

MP=Multipurpose Peat (fertilised peat)

4 Interpretation

The results of the analysis are interpreted on the basis of the EPA standards and German Standards. In some cases, where a particular standard is not applicable, a desirable range of values has been indicated, based on Bord Na Móna Ltd. research.

From the maturity tests it can be seen that the sample is mature. The maximum temperature recorded for the self heating test was recorded as 65.9 °C, less than 30°C is considered mature. There was high ammonia detected in this sample, and no nitrate, low ammonia to nitrate ratio is also another indication of mature compost, as ammonia gets converted to nitrate as the composting proceeds. The Specific Oxygen Uptake Rate is very high at 2.11mgO_2/g/h. There was 20% germination with the 20% sample + 80% peat mix, and 90% germination with the 50% sample and 50% peat mix. The electrical conductivity could have prevented germination in the 100% sample. Germinating seeds are susceptible to high electrical conductivity.

The pH of this sample is on the high side of acceptable levels. Soluble nutrient levels are good, except for potassium which is high. The ammonia and nitrate concentrations should alter as composting proceeds and through the curing stage.

The levels of foreign material, stones and contaminants are minimal at a total of 3.88%, this percentage includes stones. Particle size of compost refers to the size distribution of dominant particles. This sample has good size distribution. Organic matter content is also high indicating that it is a good product and not contaminated with soil.

Most of the heavy metal concentration fall within the EPA Standard limits for class I standard, except for copper, lead and zinc which falls into class II set out by the EPA.

A growing trial can be carried out if requested to assess the final applications of the product.

Compost Testing and Analysis Service
Interpretation of Results Sheet

Ref: IR-1

Below are detailed maximum values or desirable ranges of values for mature biowaste compost. Results are on a fresh wt. basis except where indicated.

Plant Nutrient and Organic Matter Content
Exchangeable Nutrients

pH*	SC* $\mu S.cm^{-1}$	NH4-N $mg.L^{-1}$	NO3-N $mg.L^{-1}$	P $mg.L^{-1}$	K $mg.L^{-1}$
6.9-8.3	**2000-6000**	**<1-500**	**<1-240**	**50-120**	**620-2280**

*Water soluble

Total Plant Nutrients and Carbon Content (Dry wt. Basis)

N %	P %	K %	ASH %	C:N	Mg %	Ca %
0.8-1.9	**0.4-1.1**	**0.6-1.7**	**24-51**	**≤25**	**0.18-0.78**	**1.57-5.07**

Heavy Metals (Dry Wt. Basis)

Class	Cd mg.kg-1	Cr mg.kg-1	Cu mg.kg-1	Pb mg.kg-1	Hg mg.kg-1	Ni mg.kg-1	Zn mg.kg-1
I	0.7	100	100	100	0.5	50	200
II	1.5	150	150	150	1	175	400

Physical Analysis

H_20 %	DBD** $g.L^{-1}$	MBD $g.L^{-1}$
55-76	**120-369**	**500-820**

Contaminants (Dry Wt. Basis)

vs.L-1	0.5.L-1 Free	0.5-2.L-1 Low	>2.L-1 Significant	
Foreign Material (Metal, Glass, Plastic etc)	**<0.1%** Free of foreign material	**0.1-0.5 %** Potentially free	**>0.5%** Marked quantity (Noticeable)	**>2%** Significant quantity (distinct)
Stones	**<5%** Low	**>5%** Significant		

Microbiological Analysis

Faecal Coliforms (MPN/g)	Salmonella (sp/25g)
<1000	**Absent in 25g**

**Denotes Bord na Móna suggested standard

Specific Oxygen Uptake Rate
Bord na Móna Maturity Indicator Values

$mgO_2/g/hr$**	Compost Process Stage
>1.00	Not finished
0.65-1.00	Fresh
0.35-0.65	Stable
<0.35	Very stable

leachate collection tanks

Leachate collection tanks to the rear

7625 NNNN26A PETER FOX PHARMACY

Glass Ground in 10 weeks
from Compost produced
at S.[illegible]

Warm Bed.

7655 NNNN22A PETER FOX PHARMACY

7655 NNNN20A PETER FOX PHARMACY

leachate collection tank.

leachate collection tank.

Aquatic System Above &
Below water beds -

Steel fabrication works for water Beds.

Vermi - Composting Beds
under Construction