National Development Plan 2007 - 2013

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

STRIVE
Report Series No.11

EXAMINING THE USE OF FOOD WASTE DISPOSERS

STRIVE
Environmental Protection Agency Programme
2007-2013

SSTI
Strategy for Science, Technology and Innovation

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government

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EPA STRIVE Programme 2007–2013

Examining the Use of Food Waste Disposers

(2005-WRM-DS-23-M1)

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by

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DISCLAIMER

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Acronyms

AD:	Anaerobic Digestion
ABPR:	Animal By-Product Regulation
BNR:	Biological Nutrient Removal
BOD:	Biochemical Oxygen Demand
COD:	Chemical Oxygen Demand
CSO:	Combined Sewer Overflow
CSO:	Central Statistics Office
DEHLG:	Department of the Environment, Heritage and Local Government
EPA:	Environmental Protection Agency
ERTDI:	Environmental Research, Technological Development and Innovation
FOGs:	Fats, Oils and Greases
FCEs:	Food and Catering Establishments
FWDs:	Food Waste Disposers
ISE:	In-Sink-Erator
PE:	Population Equivalent
TEL:	Trade Effluent Licence
TSS:	Total Suspended Solids
SS:	Suspended Solids
WWTP:	Wastewater Treatment Plan

Executive Summary

Food Waste Disposers (FWDs) are units used by householders or commercial food operators to dispose of organic kitchen waste down the sinkhole to the sewer system. FWDS are easy to install to a premise's water outlet and can be retrofitted in buildings. Powered electronically, the units contain spinning metal plates to grind the food into particles varying in size from 2 mm to 50 mm on average.

Currently, over one-third of waste generated from households and almost half of waste generated from the commercial sector (in particular, food service establishments) in Ireland is organic. The policy for organic waste management in Ireland is to implement source-separate collection of this waste. FWDs transfer the management and treatment of organic waste from the solid waste stream to the wastewater system. Food wastes disposed of to sewer by FWDs have to be treated at a wastewater treatment plant (WWTP) rather than composted at home or collected separately and treated biologically. The increase in their use commercially and more recently in households is linked to the introduction of use-related waste charges and the high-profile marketing of the products.

The purpose of this report is to examine the potential impacts of domestic and commercial FWD use on the wastewater collection and treatment systems, the environment and stakeholders in Ireland.

Methodology

The study involved the review of available literature on the national and international use of commercial and domestic FWDs and their impacts on the environment, waste and wastewater systems. While many international studies on FWDs were reviewed, it should be noted that several of these had been commissioned by FWD manufacturers, so there remains a scarcity of independent data in this area.

Direct consultation was made by email or telephone with personnel from environmental authorities (environmental protection agencies or government departments with responsibility for waste management policy) in a number of countries in Europe and further afield in relation to the legislative status of FWDs in other countries and reasons behind restrictions, or lack thereof, for this technology. Consultation was also carried out with stakeholders from public authorities, the waste industry, the wastewater sector and the FWD industry in Ireland. Telephone contact was made with the Sanitary, Water and/or Environment Departments of 12 Irish local authorities in relation to their use of the Trade Effluent Licence system and councils' efforts to control discharge of food waste from commercial premises.

To determine the potential impacts on Irish wastewater systems, the number of FWD units in use in Ireland was determined. There are no FWD manufacturers based in Ireland, so these units are imported into the country. To estimate the number of domestic and commercial FWDs that may currently be in use in Ireland, importation data was sourced and examined. A classification code for domestic FWDs was identified through Customs and Excise data and, using this code, the Trade Section of the Central Statistics Office (CSO) was able to determine the number of these units imported to Ireland since 1992. It was not possible to determine this information for commercial FWDs.

Typical urban wastewater characteristics were used to determine the potential estimated loading of suspended solids at Irish WWTPs.

Key Findings

Domestic and Commercial FWD Use in Ireland

FWD distributors in Ireland have marketed domestic and commercial units on a local and nationwide basis since the mid-1990s. Sales of FWDs have increased significantly – particularly from the early 2000s when waste charges were applied nationwide in accordance with the 'Polluter Pays Principle'. According to Irish FWD distributors, this has been the main driver for the installation of FWDs. Vigorous media marketing campaigns have been carried out at local and national levels to stimulate greater public demand. In addition, an attempt has been made to market these to housing developers but their uncertain legislative status has limited their uptake in new developments.

An estimate of the number of domestic and commercial FWDs currently in use in Ireland is outlined in Table 1. An estimate of domestic and commercial food waste disposed of from FWDs is also calculated, including the potential loading of suspended solids at Irish WWTPs because of FWD use.

Consultations and Literature Review

The highest penetration of FWD use globally is found in the United States (almost 50% at household level). The situation is different in Europe where the units are either banned outright (e.g. in Austria, Belgium, Luxembourg and the Netherlands) or their use is discouraged (e.g. in Denmark, France, Germany, and Sweden, where the decision is made at local level). The main reasons behind the approach in Europe are:

- A policy of source-separate collections and biological treatment is being implemented.
- WWTP capacities are under pressure.
- Sewer network systems are inadequate and/or are at risk of blockages.
- Concerns over pollution from WWTP discharges to receiving surface waters or to coastal areas.

The cases where local authorities have allowed for the use of FWDs are specific and include, where:

- Access for food collection is restricted or a pay-per-use system is not in use for organic waste collection.
- WWTP and sewer capacity is adequate and anaerobic digestion is in place for resource recovery.
- Carbon is required for a system of enhanced nutrient removal at WWTPs.

Review of Policy in Ireland and of Potential FWD Impacts

FWD use in Ireland is not consistent with government policy on waste management or water services for the following reasons:

- The National Strategy of Biodegradable Waste (2006) promotes the source separation of organic waste for collection and treatment. It encourages local authorities to introduce by-laws encouraging separate collection systems for recyclables and organic waste.

Table 1: Key Statistics on Food Waste Discharged from Domestic and Commercial FWDs*

	Quantity
Approximate number of domestic FWDs in Ireland	26,000 units
Estimate of food waste discharged from domestic FWDs to sewers*	6.8 tonnes/day
Estimate of food waste discharged from commercial FWDs to sewers**	35.9 tonnes/day
Estimated combined total solid food waste from domestic and commercial FWDs***	10.7 tonnes/day
% of total SS influent loading at WWTPs discharged through a FWD	**2.3–8.2%**

*Based on estimated number of FWD units and average estimated food waste generated per household
**Based on estimated % hotels and restaurants with FWDs and estimated food generated from hotels and restaurants
***Solid food waste based on 25% of 42.7 tonnes domestic and commercial food waste

- FWD use goes against the EU Waste Hierarchy[1] by not encouraging waste prevention and minimisation.
- FWD use does not support Irish policy on the 'Polluter Pays Principle'.
- Use of FWDs inequitably transfers the additional collection and treatment cost burden to other water services consumers who do not have such units installed.
- FWDs have a direct impact on the receiving wastewater treatment networks.

Following a review of the Irish wastewater collection networks and treatment facilities, it was found that, in spite of the significant investment in recent years, the wastewater collection system still faces challenges. These include:

- Current problems experienced by local authorities with sewer blockages due to food waste.
- Extensive use of combined sewer overflows (CSOs) and potential risks to receiving water bodies.
- WWTPs may not have sufficient capacity to treat additional organic loadings from FWDs and the additional production of sludge and biogas the units generate.

Recommendations

This report recommends that recognised regulatory controls are put in place for the use of FWDs at the household and commercial level. In the absence of national regulation on the use of FWDs, it is recommended that local authorities are permitted to regulate FWD use as required in their functional areas. Ireland could adopt the approach taken by many European countries which regulate FWD use at local or regional levels. The extent of the regulation should reflect the specific local waste and wastewater conditions – for example, waste-collection arrangements and the status of wastewater collection and treatment infrastructure. The production of a national guidance circular on the appropriate actions/steps would be appropriate and useful. A nationwide awareness campaign to discourage both the existing and future use of commercial and domestic FWD units is recommended.

Household

- Householders should be encouraged to adopt a more environmentally friendly approach to the management of biodegradable waste arising in the home (particularly kitchen waste). The roll-out of brown bin segregated collection services for kitchen and garden waste will afford householders the opportunity to deal with this waste in a manner consistent with the aims and objectives of the National Strategy on Biodegradable Waste.
- Regulating the use of FWDs is recommended at household level, and local authorities need to consider the most appropriate approach and statutory mechanism. The strategy needs to consider both existing FWDs and the future use of the units.
- The introduction of household waste by-laws or wastewater by-laws to restrict or regulate the use of FWDs is recommended.

Commercial

At commercial level, an effective regulatory system is available to local authorities:

- Some local authorities currently use Trade Effluent Licences to restrict the use of FWDs commercially. Consideration needs to be given to more widespread application of these controls, with support from the Department of Health and Local Government (DEHLG) and the Environmental Protection Agency (EPA).
- An annual charge related to WWTP usage may be applied under the Water Pollution Act. It may be appropriate to implement a trial project to determine the appropriate costs to FWD users.

[1] EU waste management policy which prioritises waste prevention, minimisation, reuse and recovery over waste disposal.

Where the decision to allow and regulate the use of FWDs commercially is made by local authorities, the local wastewater infrastructure conditions and the sensitivity of receiving water bodies need to be taken into consideration.

Alternative Regulatory Mechanisms for Control of FWDs

- **The Planning System** – For Irish local authorities who roll-out, or arrange for the roll-out, of a separate organic waste collection, the use of FWDs in new residential developments may be prohibited by setting out a condition in the planning permission. The implementation and enforcement of such a condition will encourage developers and architects to design new developments with sustainable waste management systems in place. This measure will provide residents with the opportunity to maximise recycling on-site through source separation of waste materials, including organic waste.

- **Wastewater Discharge Authorisation Regulations** – The Wastewater Discharge Authorisation Regulations 2007, Statutory Instrument Number 684 of 2007, requires discharges from local authority wastewater works (sewers or treatment plants) to be licensed by the EPA (the Agency). In accordance with the duties set out in the regulations, the Agency will be responsible for setting necessary emission limits to ensure that discharges are controlled and environmental objectives are achieved. Local authorities will be required to take all necessary steps to ensure compliance with the limits set down. The implementation of these regulations may have implications for the use of FWDs in a local authority area. Discharges from FWDs units could have a negative effect on the level of organic matter within the water body and cause local authority discharges to exceed the limits set by the Agency.

Awareness Campaigns and Initiatives

It is recommended that national and regional awareness campaigns are implemented to promote better management of organic waste at home and at work and guidance on the use of FWDs provided.

- Awareness campaigns could be carried out on a local scale (or nationwide) prior to and during the roll-out of brown bin collection services to emphasise to householders and businesses the potential environmental impact of these units.

- Households with adequate garden space should be encouraged to engage in home composting to the greatest degree possible.

- Revenues from the Environment Fund could be used to support the financing of future awareness campaigns by local authorities on household organic waste management, including the impacts of FWD use.

- Finally, it is recommended that a national awareness brochure on FWD is prepared by the DEHLG and/or the EPA and circulated to all relevant stakeholders, including local authorities, state agencies and to the public in print and online.

1 Introduction

1.1 Study Details

This desktop study was funded by the ERTDI Programme 2000–2006 and carried out primarily during 2006 by RPS. It addresses the thematic area of 'Developing Sustainable Organic Waste Management and Composting'. The Steering Group was made up of the Environmental Protection Agency (EPA) and the Environment and Water Sections of the Department of the Environment, Heritage and Local Government (DOEHLG).

Figure 1.1: Food Waste Disposed of to Sink

1.2 Study Objectives

This study comprised two parts; the first examined the management of organic waste in apartments. The purpose of this second part of the study is to examine the use of in-sink macerators or food waste disposers (FWDs) in Ireland.[2] This study will examine the potential impacts that FWDs have on the wastewater collection and treatment systems, the environment and stakeholders.

FWDs dispose of organic kitchen waste through a water outlet (Figure 1.1) to the foul sewer and from here to the local wastewater treatment plant (WWTP) for treatment. In recent times this technology has been promoted by manufacturer as environmentally responsible and a way in which to reduce organic-waste disposal charges. Their popularity in both the commercial, and more recently in the domestic, sector is mainly driven by the introduction of use-related waste disposal charges as Ireland's policy makers attempt to divert organics from landfill to meet the EU Landfill Directive.[3]

The National Strategy of Biodegradable Waste (2006) promotes the source separation of organic waste for collection and treatment. It encourages local authorities to introduce by-laws encouraging separate collection systems for recyclables and organic waste. Source separation has been demonstrated to improve recycling rates and deliver a cleaner waste stream. Pay-by-use charging for waste disposal was established nationwide in 2005. This incentivises recycling, which is provided to the householder or business at a lower cost than disposal to the residual waste bin. Irish waste-management policy reflects the 'Polluter Pays Principle', which proposes that those who generate waste should be responsible for paying for its disposal and treatment.

FWDs in effect transfer the management and treatment of organic waste from the solid waste stream to the wastewater system (Figure 1.2).

The study involves the review of literature on commercial and domestic FWDs, their use by businesses and householders and their impacts on the environment, waste and wastewater systems. Many of the studies

2 In-sink residential or commercial food waste grinder and disposal unit.

3 Transposed into Irish law on 2 July 2002 the EU directive aims to improve standards of landfilling across Europe, through setting specific requirements for the design, operation and aftercare of landfills, and for the types of waste that can be accepted in landfills. It also sets targets for the reduction of the amount of biodegradable municipal waste sent to landfill (Irish Regions Office, 2008).

identified during research have been commissioned by manufacturers or suppliers of FWDs. To ensure a balanced report, consultation was carried out with stakeholders in the public and private solid waste management and wastewater sectors as well as stakeholders that promote the FWD technology.

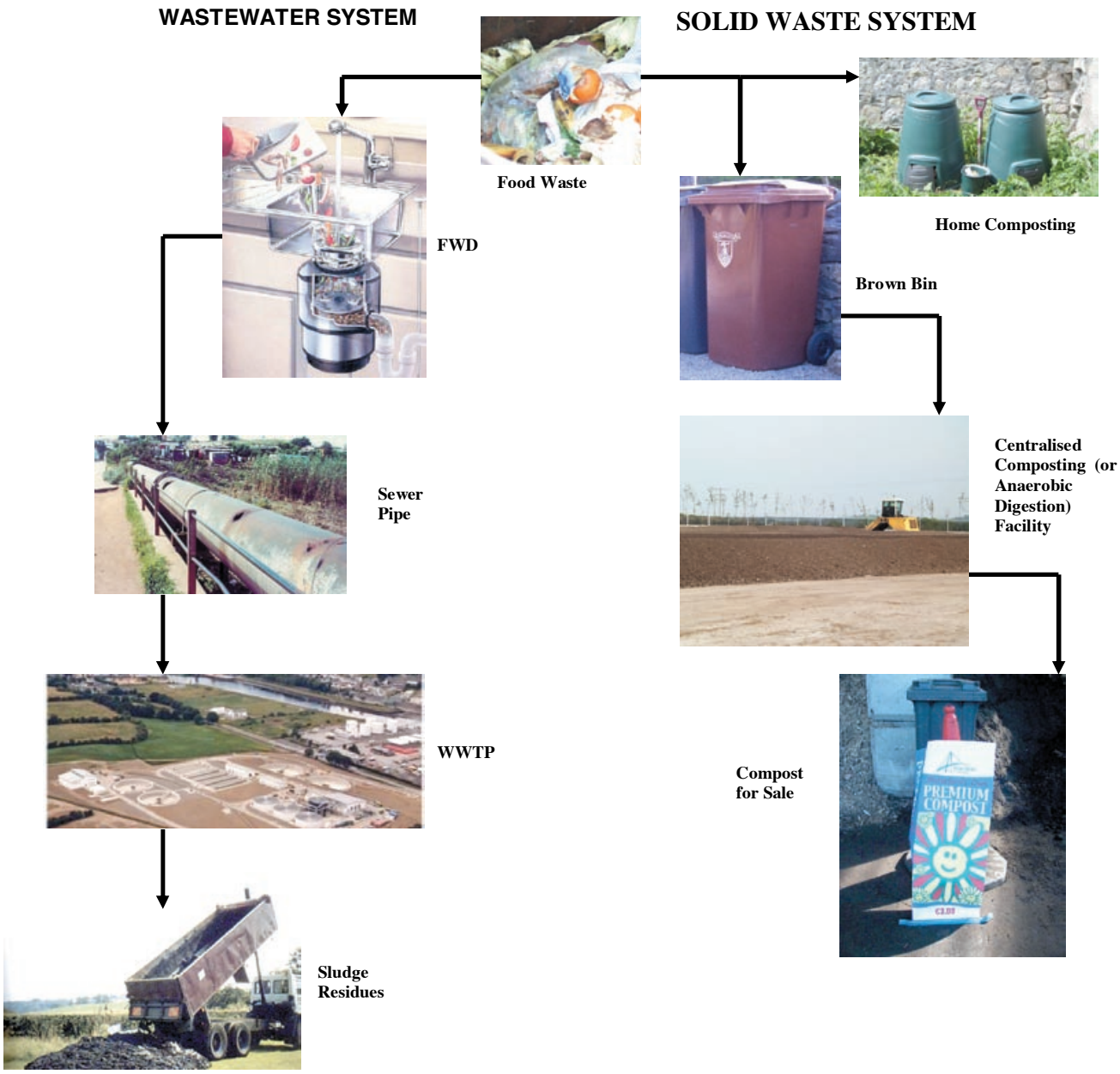

Figure 1.2: Food Waste Disposal Options via Solid Waste and Wastewater Systems

2 Food Waster Disposers: Functionality and Use

2.1 Operational Aspects of FWDs

In-sink macerator units or food waste disposal units (FWDs) may be used to dispose of household and commercial waste. Made by numerous manufacturers worldwide, they range in size and shape to deal with different volumes of food waste, but all work on the same principle – to grind food to smaller size particles before disposing to the wastewater system.

In households, FWDs are fitted to the waste outlet of the kitchen sink in place of the U-bend; they are located under the kitchen counter and powered electronically (as shown in Figures 2.1 and 2.2). A wall switch is typically used to turn the unit on. Food waste is disposed of down the sink, which then goes into the food chamber together with cold water. This facilitates the operation of flushing the ground food into the sewer and cold water, which is manufacturer-recommended, so that fats, oils and greases (FOGs) don't solidify down the drain later. Cooked or uncooked food waste, including meat and small bones, may be disposed of to the FWD.

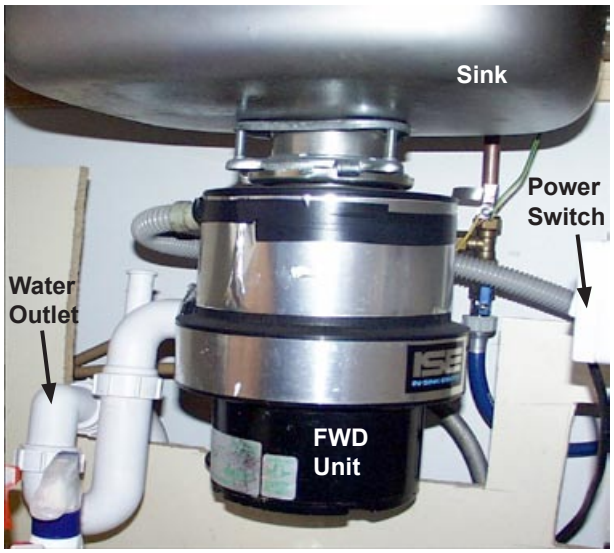

Figure 2.1: Household ISE FWD Unit with Power Switch and Sink Connectors

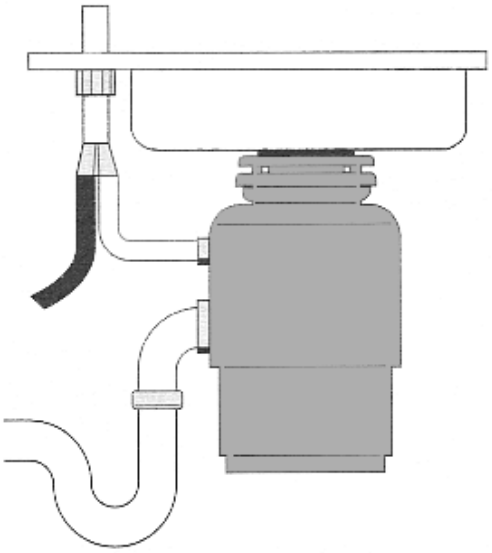

Figure 2.2: Household FWD Unit Attached to Sink and Water Outlet

Source: http://en.wikipedia.org/wiki/Image

Commercial FWDs may be in the sink or freestanding (Figures 2.3 and 2.4). When the waste enters the food chamber from the sink, it is ground into fine particles using a spinning metal plate that pushes the food against a tough grind ring fixed to the chamber wall. The centrifugal force of the rotating disk (approx. 1,400 rpm) throws the waste onto the shredder, passes it through the holes and into the outlet pipe (In-Sink-Erator, 2006). The particles pass through small holes in the plate and the effluent is then sent to the foul sewer or to an individual domestic septic tank.

Karlberg and Norm (1999) state that the limited hole diameter of the disposer causes harder, non-shreddable materials to stay in the upper part of the disposer. Such material must be removed manually when the disposer is turned off. Furthermore, the power to the motor is cut in case of an overload.

Figure 2.3: Free-Standing Commercial FWD
Source: http://www.sissons.co.uk/

Figure 2.4: Functional Parts of a Commercial FWD
Source: CESA and AMDEA, 2005

According to In-Sink-Erator (ISE) and KAL (1998), 98% of the particle output is less than 2 mm. However, a thesis study conducted on an ISE disposer at Mälardalens Högskola College in Sweden found that particles of up to 20 mm were common and also that pieces up to 40–50 mm could be found after onion and potato peelings were disposed of (Karlberg and Norm, 1999). Shredded particles discharged from FWDs and ranging in size from 2 mm–20 mm have a negative impact on both receiving collection and treatment systems. In addition, receiving waters are at risk where combined sewer overflow networks are in use (further details are provided on these systems in Section 6.3.3).

It should be noted that operation and performance of this product vary and the descriptions above are generic.

2.2 Availability and Use of FWDs

2.2.1 Products Currently on the Irish Market

Food waste disposers are manufactured by a number of different companies around the world, the largest of which is In-Sink-Erator (ISE), with 80% of the US and 75% of the worldwide market share (In-Sink-Erator, 2006). There are no FWD manufacturers based in Ireland so the units must be imported into the country. Three Irish distributors of FWDs were identified during the consultation process:

- Kitchen Accessories Ltd (KAL) is the largest Irish distributor of FWDs for ISE.
- Highway Wholesalers Ltd in Waterford supply WasteMaid FWDs for Anaheim Manufacturing, the second largest worldwide manufacturer of FWDs.
- Ekologically Ltd in Cork typically supplies BoneCrusher FWDs, again for Anaheim Manufacturing.

The average prices of these are €180 for a 45-horsepower version (recommended by KAL for apartment use) and €484 for a 65-horsepower version for domestic use (KAL, 2005).

2.2.2 FWD Marketing Campaigns

Waste charges to Irish householders and businesses have increased since the mid-1990s: in 1996 landfill charges were €20–25 per tonne; by 2005 this had increased to €120–240 per tonne depending on the local authority. Pay-by-use waste charges introduced nationally in 2005 relate directly to the amount of waste left out for collection: as a result, businesses and householders have been seeking alternative and cheaper methods of waste disposal. To address this demand, FWD distributors have carried out ongoing and regular local and nationwide marketing to promote this technology as an environmentally friendly and convenient solution to cut costs. Indeed, the potential reduction in a householder's waste charges is the main sales pitch in FWDs promotional material (as illustrated in the advert in Figure 2.5). It also promotes the FWD unit as 'the clean, hygienic and cost effective answer to the problem of food waste disposal … it's responsible management of your food waste'. Figure 2.6 shows a

Figure 2.5: Advertisement for ISE Domestic FWD (Sunday Independent, 14/5/2006)

Source: http://www.zestcreative.ie/press_KAL_1.htm

Figure 2.6: Generic Advertisement for Domestic FWDs

Source: Evening Echo, 1/9/2006

generic advert for all FWDs, which describes them as cost saving and 'ecological'.

2.2.3 FWD Suppliers in Ireland: Sales Drivers and Marketing Campaigns

RPS contacted three FWD suppliers in Cork (Ekologically Ltd), Waterford (Highway Wholesalers Ltd) and Dublin (Kitchen Accessories Ltd, distributors for ISE) to discuss their product and particularly their market growth in the last few years.

Ekologically Ltd

This consultee (based in Cork) suggests that waste charges are the primary sales driver of FWDs and that they are promoted strongly as a money saver. This company's marketing campaign includes:

- Leafleting of 15,000–20,000 houses and running advertisements in local Cork and Limerick papers and 'show house' magazines (e.g. *Modern Homes*).
- The company's customer base is primarily middle-class households trying to save money over the lifetime (7–10 years) of the unit, and, according to this consultee, there has been an increase in interest in the past 6–7 years.

The developer of a student accommodation complex in Cork city was approached to install a FWD in each unit. Owing to potential regulatory constraints and health and safety considerations, however, the developer did not give serious consideration to the proposal.

Highway Wholesalers Ltd

Based in Waterford, the company is the distributor of WasteMaid FWDs and an agent for Anaheim Manufacturing in Ireland. The company began selling small quantities of the units in 1995 and almost 100% are sold to the domestic market. Sales and marketing aspects of the business include:

- Sales of FWDs have increased 200% since 2005, encouraging them to increase the time and marketing budgets to promote these.
- During this time the company has been canvassing architects and developers actively, marketing these units as a selling point for development schemes. Campaigns are aimed especially at inner-city housing developments.
- Promotions and advertisements are carried out in local papers in Cork, Limerick and Waterford and – on the strength of the growing market – the company is soon planning a nationwide marketing campaign.
- The market is seen to be driven mainly by waste charges. The company has found that demand for FWDs increases when there is a change in the waste-management system of a local authority. For instance, sales in Waterford have increased substantially from 2005 to 2006, and this is considered to stem from the closure of the local Kilbarry landfill (waste is now sent to Co. Carlow) and the subsequent rise in waste charges throughout the city and county. Sales also grew in Cork city and county when Pay-by-Weight for waste disposal was introduced in 2004.
- Buyers are also interested in modernising their kitchens and the company believes that FWDs units are seen as a 'modern appliance' that will become 'as popular and commonplace as the microwave'.

Kitchen Accessories Ltd (KAL)

The company, which acts as a distributor for ISE, notes that its target market for FWD is mainly domestic. It markets its product through the following channels:

- Kitchen retailers are a core channel as they are the first port of call for customers looking for a new kitchen, and appliance sales are sold as part of the kitchen package.
- Hardware and DIY stores.
- Electrical retailers.
- Contract market – KAL targets developers and architects, offering an appliance package directly or in conjunction with the kitchen company in new developments.

KAL promote ISE in Ireland using the following:

- Press advertising – a high-frequency campaign using the national press, such as *The Independent, The Irish Times, Ireland on Sunday*, etc., and interiors press such as *Image Interiors*, *House and Home*, and the *All Ireland* kitchen guide, which is sold in both Northern Ireland and the Republic of Ireland. The company also advertises to the electrical and kitchen trade using trade magazines like *IER (Irish Electrical Retailing)* and *ERT Ireland*, and to other channels such as *National Hardware, Plan* and *Selfbuild Ireland* magazines. To support its press advertising campaign, the company uses a consumer PR agency, who engages in continuous activity throughout the year – issuing general press releases, topical press releases, and placing promotions such as local competitions in regional newspapers (including information about ISE and competitions to win an FWD unit).

Other activities include mailshots to specific areas, architects, dealer leaflets, in-store 'Point of Sale' units and brochures.

2.3 Growth in FWD Units Imported into Ireland

According to the Irish suppliers consulted above, since the introduction of nationwide waste charging, sales of FWDs have grown. KAL, the largest distributor of FWDs in Ireland for example, has recorded a 75% increase in sales volume between 2004 and 2005. Figure 2.7 shows the annual increase in sales for one type of FWD sold in Ireland. The percentage increase is calculated on a base of 0% in 2002. It was not possible to quantify these figures for competitive reasons.

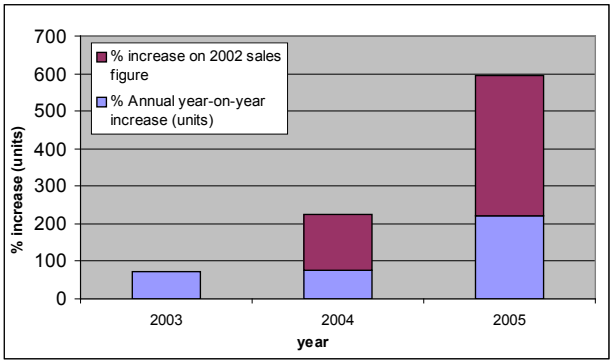

Figure 2.7: The Annual Increase, and Increase on 2002 Sales Figures of WasteMaid FWD Units Since 2003
Source: Highway Wholesalers Ltd

Importation data was sourced and examined to determine an accurate estimate on the increase in current sales and use of FWD units in Ireland. A tariff classification code was obtained from the Customs and Excise division in the Department of Revenue for the items imported and registered under the name 'Domestic kitchen waste disposers, with self-contained electric motor'. This code was then used to obtain the tonnage, monetary value and number of units imported since 1992 (years previous to this were not available electronically) from the Trade Section of the Central Statistics Office (CSO). As there was only one FWD unit imported in 1992, it is likely that a negligible number of units were imported into the country before this. It should be noted that importers might sometimes enter data erroneously so these data should be considered to be approximate.

All units under 20 kg in weight are registered under the code '85093000'. However, some commercial FWDs are also less than 20 kg: therefore, any registered under this code cannot be strictly classified as domestic units alone as there will be an overlap in domestic and commercial units. Data for the number of FWDs more than 20 kg in weight (commercial units) imported into Ireland were more difficult to obtain than those for those under 20 kg, simply because importers are not required to register the units under a classification specific to commercial FWDs. Consultation with three of the biggest commercial FWD suppliers in Ireland (Broderick Brothers, Masser Hammond, Servequip Kitchens) highlighted this problem. They pointed out that importers often classify units under various commodity codes, including classifications that include all types of catering and cooking equipment. Because of this, it would be inaccurate to use general codes to estimate commercial FWD numbers, as they would incorporate many other types of commercial kitchen equipment in addition to FWDs.

Between 1992 and 1994, data for the numbers of the commodity classified under the code 84798200 as 'Mixing, kneading, crushing, grinding, screening, sifting, homogenising, emulsifying or stirring machines, n.e.s. (excl. industrial robots)' was recorded for units over 20 kg in weight. According to the Trade Section in the CSO, commercial FWDs would most likely have been classified under this code. These can therefore also be included in the total estimated number of domestic and commercial FWD units available to be used in Ireland. There were a total of 10,388 units classified under this code.

The upward trend in imports (Figure 2.8) equals the demand in the market for this technology. This graph, which is based on actual importation figures, is a good indicator of demand because, as noted above, there is no supplier for these units within the country, so all have to be imported. It shows an overall increase (using a moving average trend line) in the number of FWD units <20 kg imported into the country since 1992. A deviation in this trend is found in 2000: this may be because of the increase in the waste-disposal charges at landfills in the late 1990s and early 2000s or data entered erroneously under other codes. Some local authorities (e.g. Dublin City Council) waste charges only introduced at this time.

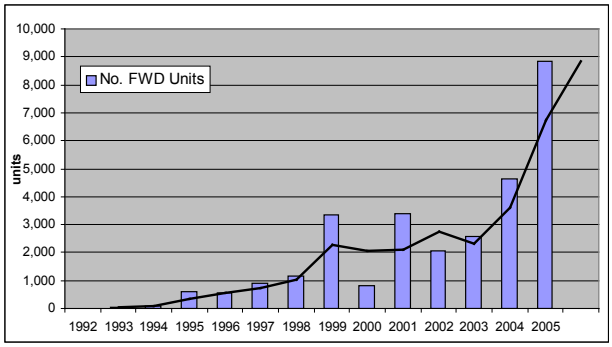

Figure 2.8: Total Number of FWD Units <20 kg Imported into Ireland Since 1992

Pay-by-use was introduced nationwide in 2005, and is now in operation in almost 100% of local authorities. As householders and businesses sought ways of reducing these charges, distributors would have imported more units in an attempt to meet demand. There is a steady increase in units imported since 2002, the number quadrupling in three years. There were 3,437 units imported in 2006 up to the end of May – further evidence of steady growth in demand.

Figure 2.9 indicates the countries from which FWDs are imported, the UK being the most popular, followed by the United States, China and France. As mentioned previously, none are manufactured in the Republic of Ireland.

2.4 Organic Waste Discharged from Domestic and Commercial FWD Units

The total number of FWD units <20 kg imported into Ireland since 1992 is 32,503 (almost a third of which were imported in 2005). If the number of units >20 kg (10,388) is added to this, at least 42,891 domestic and commercial units are available to be used in Ireland. With an average lifetime of a standard unit of between 7 and 10 years, some of these may not still be in use. Because it is not possible to determine the number of commercial FWDs imported after 1994 this number (42,891) cannot be used to solely estimate the organic waste discharged to sewer from both domestic and commercial FWDs.

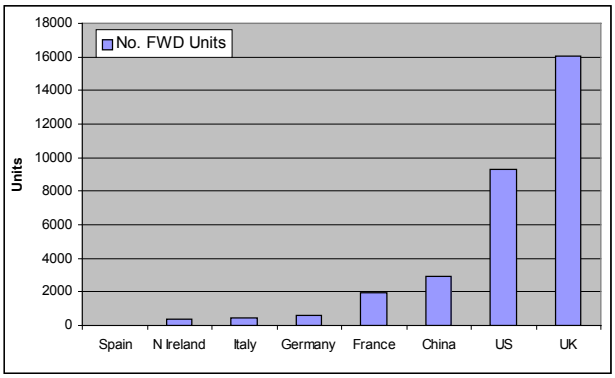

Figure 2.9: Countries from which FWD Units <20 kg are Imported into Ireland (1992–2006)

2.4.1 Domestic FWDs

In 2004 487,933 tonnes of household compostable organic waste was generated according to the National Waste Report, 36.2% of which was food waste (EPA, 2005), equalling 176,632 tonnes. If an assumption is made that 80% of the FWDs under 20 kg are domestic FWDs and the latest data from a selection of key reports (as seen in Table 2.1) is used, it is possible to determine an indicative tonnage of food waste discharged from households to WWTPs in Ireland per day based on FWDs units currently present in Ireland.

This implies that approx 1.8% of Irish households have and use a FWD. According to CECED (2003) the average penetration of household FWD usage in Europe is 1% (the equivalent of 4.8 tonnes food waste per day in Ireland, Table 2.2).

Therefore, the most likely estimate of food waste discharged from FWDs to sewers ranges from 4.8–6.8 tonnes per day.

2.4.2 Commercial FWDs

The 2005 EPA Programme for Municipal Waste Characterisation Surveys report estimates the total national waste generated from restaurants in Ireland in 2005 as 103,076 tonnes, 48.7% of which was organic waste. This equates to approximately 50,198 tonnes of organic waste. For hotels, the EPA estimates that 101,677 tonnes of waste was generated, 49.8% of which is organics or 50,635 tonnes of organic waste. Based on

Table 2.1: Estimate of Food Waste Discharge from Domestic FWDs in Ireland (based on penetration of FWDs in Ireland)

	Quantity
Household food waste generated (2004)	176,632 tonnes*
Number of households in Ireland	1,478,200**
Average weight food waste generated per household per year	119.49 kg
% Organic that is used in a FWD unit	80%
Approximate number of domestic FWDs in Ireland (80% of 32,503)	26,000 units
Indicative estimate of food waste discharged from domestic FWDs to sewers	**6.8 tonnes/day**

* EPA (2005)
** Quarterly National Household Survey: September to November, 2005 (CSO, 2005)

Table 2.2: Estimate of Food Waste Discharge from Domestic FWDs in Ireland (based on average penetration of FWDs in EU)

	Quantity
Household food waste generated (2004)	176,632 tonnes*
Estimated % of households that use FWDs (based on EU average)	1%
Estimate food waste discharged from households per year via FWD	1,766 tonnes
Indicative estimate of food waste discharged from domestic FWDs to sewers	**4.8 tonnes/day**

*National Waste Report (2004)

Table 2.3: Estimate of Food Waste Discharge From Commercial FWDs in Ireland

	Quantity
Hotel and restaurant food waste generated (2005)	100,831 tonnes
Estimated potential % of hotel and restaurants using FWDs ($^1/_3$ x 40%)	13%
Food waste discharged from hotel and restaurants per year	13,108–40,332 tonnes
Indicative estimate of food waste discharged from commercial FWDs to sewers	**35.9 tonnes/day**

consultation with suppliers and anecdotal evidence these two commercial sectors would be the largest users of commercial FWDs, as much of their business is related to catering. This is reflected in the fact that almost half of the waste they generate is organic. The catering industry is also the most likely to use FWDs to macerate food waste. Canteens in other industries (e.g. finance, communications, health, etc.) generate less organic waste according to the EPA report. This would indicate that they are less likely to invest in commercial FWDs to dispose of their waste. Therefore, the available figure of 100,831 tonnes will be taken as the total commercial (hotel and catering) food waste most likely to be macerated.

Figure 2.10: Hotel Food Waste Disposed of in Compactor and Dewaterer

Source: Westport Woods Hotel and Spa, Co. Mayo

It is not possible to estimate food waste discharged to sewer from commercial premises based on the number of FWDs available in Ireland. The Catering Equipment Suppliers Association (CESA) and the Association of Manufacturers of Domestic Appliances (AMDEA) (2005) state that commercial usage of FWDs in the UK is about 40%. However, the household FWD usage in Ireland (at least 1.8%, according to calculations in Table 2.1) is approximately one-third of that in the UK (5%, according to ISE). If it is assumed that market penetration of commercial FWDs in Ireland is also approximately one-third of that in the UK, then the likely discharge of food waste from commercial FWDs in Ireland is 35.9 tonnes per day (see Table 2.3).

The Irish Hospitality Institute (IHI) has produced a benchmarking report stating the amount of types of waste produced by the hotel and catering sector in Ireland. This data is due to be available at the end of 2006 and should give a clearer picture of the prevalence of FWD usage in the commercial sector. Consultation with those in the catering industry indicates that the penetration of commercial FWD use (where effluent is going to sewer) is probably currently less than 13%, as stated above. It should be noted however that with consistent and vigorous marketing the commercial usage of FWDs could rise to match that in the UK (40%), resulting in up to 110.5 tonnes of organic waste generated from FWDs per day.

Figure 2.11: Commercial Food Waste is Macerated, Compacted and Dewatered in Onsite Unit

Some hotels or large restaurants that do not have their food waste collected for disposal usually invest in on-site units (usually costing €30,000–80,000) that compact and de-water the food (Figure 2.11), converting the waste to a dry pellet/power (Figure 2.12) form, which can then be composted. The waterless macerator is an alternative to FWDs and can reduce waste disposal charges as well as having less potential to cause negative environmental impact. However, the use of these types of units is the exception rather than the norm.

Figure 2.12: Dewatered Food Waste

2.4.3 Suspended Solids (SS) Loading from FWDs

The EPA (2004) reports that all WWTPs in Ireland collectively represent a total population equivalent (PE) of 5,802,424. This represents a hydraulic loading of 1,305,545m^3 per day. The typical characteristics of urban wastewater issued by the EPA (1997) include a calculation for the influent loading of suspended solids (SS) at WWTPs of 100–350mg/l. This range as a percentage would be 0.01–0.035%. Using these values it is possible to determine an estimation of the presence of SS influent loading attributed to FWDs use in Ireland, as shown in Table 2.4.

Table 2.4: Estimate of SS Influent Loading at WWTPs due to FWDs

	Quantity
Total collective PE of all WWTPs in Ireland (EPA, 2004)	5,802,424
Average hydraulic loading of wastewater influent at WWTPs	1,305,545 m^3/day
% SS in hydraulic load of inflow wastewater (EPA, 1997)	0.01–0.035%
Range of SS loading in wastewater influent	130.5–456.9 tonnes
Total solid food waste from FWDs (25% of 42.8 tonnes*)	10.7 tonnes/day
% of SS influent loading discharged through a FWD	**2.3–8.2%**

* 6.8 tonnes from domestic FWDs and 35.9 tonnes from commercial FWDs (see Tables 2.1 and 2.3).
*There was little difference in 2005 data for the % of SS loading when compared with 2004 data.

The calculations given in Table 2.4 imply that between 130 and 456 tonnes of SS are treated at Irish WWTPs each day, assuming 225 l/c/d. The total estimated food waste discharge from commercial and domestic FWDs is 42.7 (Tables 2.1 and 2.3). Studies show that 25% of food matter is solid. This means that between 2.3% and 8.2% of the total SS influent to be treated at WWTPs is created by FWDs. If the penetration of FWD use was to increase, this could have a significant impact on sewer systems and the functioning of Irish WWTPs and sludge treatment and handling.

In addition, studies as outlined in Section 5.3 below show that in addition to total suspended solids (TSS) there is a corresponding increased loading of organic and nutrient loading because of discharge from FWDs. The percentage increase varies from study to study, and these are examined in greater detail in Section 5.3.

3 National and International Legislative Status of FWDs

3.1 Introduction

FWDs are used around the world, but by far the largest market for this technology is the United States. The first FWD came onto the market in 1935. At that time the editor of Wastes Engineering journal claimed that FWDs would 'eliminate household waste bins the way flush toilet eliminated outhouses' (Rathje, 2004). They became more widespread in the US in the 1960s but their growth slowed dramatically because of restrictive regulations in 1970s and 1980s, regulations prompted by the consensus that FWDs increased the load in WWTPs (CECED, 2003). As Table 3.1 shows, the use of this technology to dispose of organic waste has been approached more cautiously in other countries and has not had the same level of penetration as in the US.

Table 3.1: Legislative Status of FWD use in European Countries

Country	Banned at national level	Regulated locally (by municipalities)	Encouraged (by use of incentives)	Mandated (in certain areas)
Non-European				
US		●	●	●
Canada		●		
Australia		●		
Japan	● (stand-alone FWDs)	● (in-sink FWDs)		
New Zealand[4]		●		
European				
Ireland		●		
UK		●	● [5]	
Norway[6]		●	●	
Finland*		●		
Austria	●			
Sweden		●		
France[7]		●		
Germany		●		
Denmark[4]		●		
The Netherlands	●			
Belgium	●			
Luxembourg[8]	●			
Italy		●	●	

* Ritchey (2003)

4 30% market penetration of FWD use.

5 Incentivised in only two local authorities.

6 Permission is required in some local authorities (Ritchey, 2003). However the cities of Bardu, Froya and Hitra provide financial incentives to encourage householders to install FWD units into their homes (ISE and KAL, 2002).

7 Admin. Circular 9/08/1978, Article 83 of the health regulations give the implementing authority to the Department level, implying that potential users need to seek permission at their local municipality (CEDED, 2003). The use of FWDs is discouraged however.

8 The grand-ducal regulation from 7th Dec 1997 specifies that 'release solid waste, even after treatment into a grinder [FWD], into sewer water is banned' (Article 6, point 5) (CEDED, 2003).

Table 3.2: Comments on FWDs in Consultation with European Agencies

Country	Organisation	Comment
Germany	Federal Ministry for the Environment	Highly discouraged
UK	Department of Environment, Food and Rural Affairs	Prefers composting over FWD use
Sweden	Waste Department, Environmental Protection Agency	Discourages use
Denmark	Soil and Waste Department, Environmental Protection Agency	Discourages use

3.2 Current International Use of FWDs

Information for Table 3.1 and Sections 3.2.1 to 3.2.5 below was obtained through a combination of review of available literature and consultation with the EPA or Ministry of the Environment of the countries being examined. Direct consultation took place (either by email or phone) with personnel from most European environmental departments/organisations, in which case the consultee's name and organisation are stated. These consultees were asked about the legislative status of FWDs in their countries and reasons behind restrictions, or lack thereof, for this technology. While the results in Table 3.1 represent the official position of each outlined country, the points made by the consultees in the Consultation Section represent the official standing of the organisation they represent.

Table 3.1 illustrates the legislative status of FWDs in Europe and globally: where the use of FWDs is currently banned at national level; where permission from local authorities is required for FWD use; where units are encouraged by means of monetary incentives and where the units are mandated by law to be installed. The reasons for each decision are explained in detail for each country below in Sections 3.2.1 to 3.2.13.

Table 3.2 outlines the viewpoint of the European organisations that were consulted. This information is given because, in many cases where FWDs are regulated locally by the national waste management, environmental organisations feel strongly against their use. The table should be used to supplement Table 3.1.

3.2.1 The United States

In the United States, FWDs are installed in about 50% of the households connected to the municipal sewage system (CIWEM, 2002). This high penetration level is supported by many reports. Over 95% of American cities allow the use of FWDs, although a few cities have prohibited installation owing to a lack of capacity, or for other reasons (Wicke, 1987). In 1992, more than 90 municipalities required the installation of FWDs for new construction by law, including those in Mississippi, Colorado, Arizona, Detroit, Indianapolis and many towns in California. The total number of disposers in active use has been estimated at 45 million (Karlberg and Norm, 1999).

However, the US EPA Office of Solid Waste (2006) recommends that householders and businesses compost as the preferred method of treating organic waste rather than putting food waste into the sewer, with landfilling the least preferred means of disposal. For example, the Georgia Department of Natural Resources (2000) promotes composting for businesses, stating that food waste discharged to a wastewater treatment plant will increase the cost of wastewater treatment dramatically, and – if released into storm drains – will affect a river's ability to sustain aquatic life forms significantly. Los Angeles County Sanitation noted that businesses using FWDs to dispose of food wastes are simply transferring disposal from a landfill to a wastewater treatment plant.

New York City expressly prohibited the use of FWDs for commercial and domestic use in the beginning of the 1970s. The reason was, among other things, an overflow of untreated wastewater into the city's rivers and harbours, and the protection of the city's surrounding waters from excessive amounts of nitrogen (Nilsson et al., 1999). After

a 21-month pilot programme showed that FWDs would have manageable impacts if installed in limited numbers of homes, the ban was rescinded in 1997 for domestic FWD units only. The Department of Environmental Protection is currently monitoring the situation, especially in an effort to reduce nitrogen discharges to Long Island Sound and Jamaica Bay.

3.2.2 Canada

FWDs use in Canada is not prohibited, but each municipality can restrict their use based on its own local conditions and ability to treat food waste in sewers. According to ISE (2006), the overall market penetration of FWD use in Canada is 10%. Studies carried out by Halton Council (2005), a regional municipality in Ontario, Canada, give an overview of the status of FWDs, and this is described below. (The study also includes findings from some other regions in Canada, as Halton Council contacted other municipalities in Ontario to determine the environmental impacts of FWDs.)

Halton, Ontario

The Halton Council carried out these studies based on The Halton Report PW 63/90 (1990, p. 3), which concluded that 'in light of the considerable disruption to upgrade wastewater treatment systems, it will be more viable, both economically and otherwise, for Halton to invest in a separate composting program'. On the basis of this recommendation, the Council looked at various impacts of FWD use at differing penetration levels. Examination of literature comparing the value of source-separated organics collection and central composting with FWDs and their impacts at WWTPs in Halton revealed that:

- They were able to achieve a 60% diversion rate of organics with source separation and collection (because of the ability to accept more materials such as fats, large bones, tissues, napkins paper towels and pizza boxes); FWDs, even at 100% participation rates, achieve diversion rate of only 11%.
- In terms of capacity, the increase in organic loading at WWTPs had a direct impact on operating costs (i.e. increased chemicals, power, maintenance, grit, biosolids, etc.) and it also utilised a portion of the capacity allotment for future development. At a 20% FWD market penetration (typical for municipalities that do promote FWDs), expansion of their WWTPs would cost Halton CAD$8.3m (€4.4m).
- The most cost-effective method of diverting organic material away from landfill over a 20-year timeframe is achieved through a kerbside collection and central composting initiative. On the other hand, the operating costs for kerbside collection (collection and processing) were considerably higher than for FWDs, although operating costs for FWDs include only the cost of processing the waste at WWTPs.
- Composting of organics reduces the amount of waste going to landfill while producing a valuable soil-amendment product that can be used in gardens, landscape rehabilitation projects, container plantings and agricultural applications.
- WWTP expansion is typically not required up to 10%–15% of FWD market penetration but the cost of accommodating future growth is not taken into consideration. An analysis of typical loadings of FWDs use of all seven of Halton's WWTPs revealed an average 21% increase in loadings for 100% market penetration. This compares to 10%–35% at City of Guelph, Ontario (Schiller, 1999) (see below).

Peel and City of Guelph, Ontario

In 1999, the Director of Region of Peel WWTP produced a memo (Schiller, 1999) discussing the effect of FWDs on the Peel wastewater system. It stated:

> Garbarator [FWD] use leads to a significant increase in the volume of solids produced, which in turn might require the expansion of existing facilities … Problems with grease accumulation and pump maintenance have also been associated with the use of garbarators.

Schiller's memo also summarised the findings from a City of Guelph report, stating: 'Garbarators are not consistent with a municipal composting program. Economies of scale are not realized if food waste must be dealt with in more than one way'.

Okotoks and Ottawa, Alberta

In June 2004, the town of Okotoks, Alberta, Canada, commissioned a study on the impact of FWDs on their WWTP. This found that banning future FWDs and removing existing units would bring 'a reduction in waste loading to the treatment plant by up to 20% in a few years' (p. 5) and allow the deferral of a planned expansion by three years.

The study also found that the city of Ottawa has a by-law banning FWDs because of their impact on WWTPs and that the city of Winnipeg allows residential FWDs, but is considering prohibiting new installations owing to problems with sewer lateral plugging (Halton Council, 2005).

3.2.3 Australia

The market penetration of FWD use in Australia is 12% (in comparison to 30% in neighbouring New Zealand). Each municipality has the authority to restrict their use depending on the local wastewater management infrastructure. There is varied opinion on the usefulness of FWDs at WWTPs between the following cities.

Sydney

In March 1999, Waverley Council (the municipality includes Sydney) resolved to ban the installation of in-sink waste disposal systems in multi-unit housing and to amend the Development Control Plan 1 for Multi-Unit Housing to reflect this policy position. This ban was implemented because of council concerns, including:

- Increased hydraulic flow within the sewerage reticulation system and the subsequent reduction in the Bondi Sewage Treatment Plant treatment efficiency.
- Potential increase in sewer overflow incidence within the Waverly area.
- Increased pollutant loading discharged from the Bondi STP into the marine environment.

ISE (FWD manufacturer) then commissioned the Cooperative Research Centre (CRC, 2000) to undertake a life-cycle analysis study by comparing the environmental, technical, economic and social impacts of FWDs, landfill, central composting and home composting. Currently, there is a flat rate charge and all waste is sent to landfills. Based upon a 50% market penetration of FWDs within the Waverley Municipality, the Council came to the following conclusions from the CRC report findings:

- Water use would increase by 6.2 l/household/day due to FWD use – 12.4 l required to shred 1 kg of waste. Energy consumption would also increase.
- The additional hydraulic flow within the sewerage system would exert additional pressure on council resources and reduce the lifespan of the existing infrastructure.
- Market penetration of 50% throughout the complete catchment would exceed the treatment capacity of the sewage treatment plant (STP) and result in treatment bypass and sewer overflows. Sewer overflows would create risks in regard to virus/bacterium/parasitic protozoan/helminth vector infection.
- A 50% market penetration would increase oil and grease within the wastewater by 16–47 kg/day. During sewer overflow, oil and grease could be discharged into the local marine environment.

The report concluded that in terms of environmental impacts that home composting is the preferred method of disposal. The report recommended that council uphold the ban on FWDs in all Development Approvals for Multi-Unit Dwellings.

The council noted that when a 'user-pays' waste system is introduced, residents will be encouraged to install FWD units to reduce their waste disposal costs. This could potentially result in a 100% market penetration and a subsequent increase in waste generation and environmental pollution.

Brisbane (Consultation with Programme Leader, Division of Environmental Engineering School of Engineering, The University of Queensland)

A study being carried out by the University of Queensland for the Australian Research Council is currently examining integrated household food waste and wastewater treatment in Brisbane. This study will look at combining household kitchen waste with blackwater[9] (from a PE of 60) to provide sufficient carbon source and methane production to sustain the operation of a two-stage anaerobic digester.

The city actively encourages additional biological oxygen demand (BOD) as a suitable carbon source to supplement the nutrient removal (nitrogen and phosphorus) requirements at their WWTPs, most of which have advanced tertiary treatment of the wastewater. They therefore support the incorporation of food waste with the wastewater stream. The consultee views the addition of food waste to wastewater as: 'the only foreseeable economically viable means of obtaining energy from food waste'.

3.2.4 Japan

The sale of stand-alone commercial FWDs is currently illegal in almost all municipalities in Japan: this stems from a concern over the possible adverse effects of discharging food waste directly into sewage systems. The use of in-sink units, which require permission from local authorities is rare. However, in 2003 a total of 32,382 units was imported, the majority of which were stand-alone units according to the *Marketing Guidebook for Major Imported Products 2004* (Japan External Trade Organization, 2005). A study carried out by the Water Control Department (2003) evaluated the environmental impact of the introduction of FWDs to the sewage system. (This involved the installation of disposers to 300 houses in Utanobori Cho between 1999 and 2002.) This study, which aimed to establish the official guidelines for local government to determine whether FWDs should be introduced, found the quality of the effluent from the WWTP to be 'good'. Assessment of the sewers and the long-term influence on the town's WWTP is ongoing.

3.2.5 Europe

In contrast to the United States, there is a precautionary attitude maintained with regard to FWD use in much of Europe, although this varies between countries. FWD use is greatest in the UK, where FWDs are installed in 5% of households (CECED, 2003). CECED estimate that 100,000 FWDs are sold annually in Europe and that the yearly growth rate of household saturation is <1%. In France, Germany and Austria it is compulsory for commercial premises to install and maintain food grease traps (these are different types of units to FWDs), and the use of FWDs is banned in Austria and highly discouraged in Germany and France.

3.2.6 The United Kingdom

There is no regulatory ban on the use of FWDs in the United Kingdom. In fact, they are encouraged by two local authorities as the preferred way to dispose of food waste, as the examples show below.

The British Standards Institution (BSI) included food waste disposers in its Code of Practice in 2005 as a waste-management tool for new-build projects. The new standard, BS5906:2005: Waste Management in Buildings code of practice states that:

> Food waste disposers are easily installed and eliminate the need to store biodegradable kitchen waste on the premises; they can deal with up to 15 to 20% (by weight) of the total average output of household waste.

Kitchens and Bathrooms News magazine (2005) commented that this could mean that planning applications for FWD use in new-build developments are viewed more favourably in urban areas where refuse collection can be an issue.

Two counties in the UK encourage the use of FWDs by using incentives. Herefordshire County Council and Worcestershire County Council offer anyone in the two

[9] Liquid and solid human body waste and the carriage water generated by toilet use

Figure 3.1: Worcestershire Cashback Application for Domestic FWDs

counties the opportunity to claim up to £80 cash-back towards the cost of the purchase and installation of a FWD (*Kitchens and Bathrooms News*, 2005). The aim is to increase the level of penetration locally from 6% to 50% over the next 10 years through this rebate scheme. A consultee with the Water Research Centre in Swindon (see Section 7.2) suggests that these local authorities are attempting to meet EU landfill targets by doing this.

The Department of Environment, Food and Rural Affairs (in correspondence with the Customer Contact Unit in that Department) suggest that there may be merits in using FWDs. However, she points out that:

> ... they do not reduce the amount of waste produced, but rather divert it to a different place for treatment. This raises complex issues in terms of equity, in moving waste from the responsibility of local authorities to water companies, as well as capacity. Composting provides an opportunity to obtain value from biodegradable waste and, as such, is the more sustainable option.

3.2.7 Sweden

Consultation with Waste Section, Swedish Environmental Protection Agency

In Sweden each municipality is responsible for the treatment of sewage and each decides what can be connected to the sewage system. According to a representative in the Waste Section in the Swedish EPA, no municipalities accept FWD in private households connected to the sewage system. The main reason cited is a problem with fats and particles clogging sewage pipes.

In a small number of cases larger facilities such as supermarkets, catering kitchens etc. have been allowed to install FWDs connected to the communal sewage. In those cases, the individual municipality involved decided that their sewage system and sewage treatment is designed and has the capacity for the extra load.

Grease traps are mandatory in Sweden for practically all kitchens where food is handled/cooked professionally. However, the Waste Section representative commented that studies show that FWD particles are not always easily or efficiently trapped in grease traps. He suggests that this is not the ultimate solution either.

Where the FWD is connected to a tank that is emptied regularly, FWDs can be used freely – this is frequently the case in food courts, businesses, hospital and school restaurants, etc. The waste (sometimes dewatered) is collected in a tank and transported for treatment – usually at the sewage plant where it is used for producing biogas. This system has been applied to private homes in two locations. In Malmö, at the Turning Torso (Europe's second highest apartment building with 149 apartments), each apartment has a FWD in the sink that is connected by separate lines to a common tank. Even so, regular wastewater is drained to the normal sewage system.

Sweden has a target of recovering 35% of food waste by means of biological treatment. As each municipality is responsible for both waste and sewage treatment, some advocates of FWDs have suggested that food disposed of by FWDs, transported in the sewage system and then treated to produce biogas in the sewage plant could be included in this target. However, the Swedish EPA does not consider FWD-treated food waste in sewage as recovered food waste. Efficient systems for collecting household food waste in use in Sweden are already in place, and large-scale collecting of food waste via the sewage system presents considerable difficulties within the sewage system and makes it hard to guarantee the quality of the waste.

3.2.8 Germany

Consultation with Nature Conservation and Nuclear Safety, Federal Ministry for the Environment

Within the framework of German Federal and Land legislation, almost all wastewater by-laws prohibit the discharge of waste into the wastewater system. According to the Federal Water Act, waters are to be managed in such a way as to prevent all avoidable pollution. The consultee felt that organic waste from FWDs increases the loads being transferred to the municipal sewage treatment plants considerably, increasing organic loading in final effluent discharge from the plants and resulting in additional water pollution.

According to the German Closed Substance Cycle and Waste Management Act, wastes that cannot be avoided must be recovered. Recovery of wastes takes priority over their disposal: the aim is high-grade recovery appropriate to the type and properties of the waste concerned. Food waste treated in WWTPs does not fulfil this, as the quality of biowaste collected separately (and composted or fermented) is higher than when mixed with other substances within the wastewater, even if the sewage sludge is recycled.

The combined sewerage system installed in around half of the sewage networks in Germany means than when it rains the loads reaching the rainwater-surplus disposal plants contain an increased amount of pollutants. A high expenditure of energy and water is required to discharge solid wastes into the wastewater system, to later separate them as much as possible from the water in the sewage treatment plant, and then, if possible, to return them to the natural cycle via sewage-sludge recycling. This is a questionable practice from a sustainable water management point of view according to this consultee.

Extending the capacity of WWTPs to deal with the disposal of food waste is not economically justifiable and runs contrary to attempts in Germany to manage wastewater economically while maintaining standards. It can also lead to deposits, particularly in sewage networks (which for topographical reasons were laid with gentle slopes). These deposits must be removed – at considerable cost – to keep the sewers in working order.

Disposing of biowastes through the wastewater system (i.e. the use of FWDs) conflicts with the aspects of German waste legislation concerning the obligation to make waste available to parties responsible for waste disposal, whereby domestic waste is to be entrusted to the public waste management authorities (usually districts and non-district municipalities), if producers and holders are not in a position to recycle, or do not intend to do so.

3.2.9 Denmark

Consultation with Soil and Waste Department, Danish Environmental Protection Agency

Each Danish municipality can choose whether or not to permit the use of FWDs. However, the Danish Environmental Protection Agency (DEPA) concluded from studies concerning the use of FWDs that they cannot generally recommend the use of FWDs because:

- It is estimated that the use of FWDs will increase water consumption.
- Using FWDs will cause a rise in sediment in the sewers and reduce self-cleansing.
- WWTPs would need extra capacity to treat the increased levels of organic material from FWDs. Biogas production at the WWTP is required in order to allow the utilisation of the energy in the organic waste. Otherwise, the energy needed to dissolve the organic waste in the wastewater would increase the energy use and treatment costs at the plant significantly.
- An increased impact on the recipient/environment is expected, for example, a risk for an increasing pollution of heavy metals.

The DEPA is concerned that other types of waste besides organic waste could be disposed of in the FWDs, jeopardising many years of its work to reduce pollution at source. Furthermore, it might give a poor-quality sludge at the WWTP, unsuitable for agricultural use.

The DEPA feels that if the general introduction of FWDs would bring socio-economic benefits, it would demand a more detailed study to allow them to examine the possibility of this. However, from existing studies of FWDs and their environmental and economic impacts, the DEPA cannot recommend this technology. FWDs are therefore rarely used in Denmark.

3.2.10 The Netherlands

Consultation with Organic Management, SenterNovem (agency of the Dutch Ministry of Economic Affairs)

Each Dutch municipality is responsible for granting licences for draining effluent to the sewerage system and the control and maintenance of these licence conditions. The Dutch government advocates a system of source separation for organic waste, and the practice of composting is regarded as better for environmental reasons: sending food waste to sewer is not seen as a form of waste recovery. The use of FWDs in all municipalities has been banned since the 1960s: this was based on a concern with the obstruction of the sewer system and a deterioration in the treatment of wastewater.

3.2.11 Belgium

Consultation with Brussels Environment and Public Flemish Waste Product Society

FWDs are not banned although there are restrictions on their use. De-watering units, which collect and crush food particles, are permitted and food collected in this manner can subsequently be brought to composting plants. Article 4 of national legislation (3 August, 1976 relating to discharges of the water used in ordinary surface water, in the public sewers and of rain water run-off) however prohibits ‘the discharge of solid waste subjected beforehand to a mechanical crushing, or water containing such crushed matters in ordinary surface water and the public sewers’. This means that food can be ground but not flushed away through the sewers. Additional reasons for this prohibition include the contribution of solid waste from in-sink FWDs to pipe blockages and the development of putrefaction and odours in the sewers.

3.2.12 Italy

In Italy, initially a 1997 law (the 'Ronchi' decree 22/97) was introduced banning the use of FWDs across the country. However, in 2002, the Italian senate lifted the ban on FWDs. The reasons given were:

- Insufficient grounds for a ban in Italian law (Articles 5,6, and 32).
- The need for alternatives to organic waste collections, which experienced difficulties in some regions (CEDED, 2003) most likely due to problems with storage and collection of food waste in the hot regions.

Each municipality now decides on whether FWDs are permissible or not. Indeed, some municipalities have made it mandatory for FWDs to be installed in all new homes. The Lombardy region is examining wider support for FWDs, and in some cities (e.g. Capri and Trezzano), a subsidy is given to citizens installing a FWD, or waste collection taxes are reduced by up to 20% (ISE and KAL, 2002 and CEDED, 2003).

3.2.13 Ireland

Ireland has no national ban or regulation on the use of FWDs currently, but some local authorities choose to restrict their installation commercially by licensing their use. Food and catering establishments (FCEs) are required by local authorities to obtain a Trade Effluent Licence (TEL), which sets limits on nutrient and solids discharges to sewer, often making it difficult to use a FWD and keep within the limits set. The increase in the application of this licence was prompted by the increased occurrence of sewer blockages, thought to be from fats, oils and greases (FOGs) being put down sinks. There was also concern that the use of FWDs contributes to extra loading on WWTPs. Some examples of local authorities efforts to restrict FWD use are as follows:

- Cork County Council's TEL (Cork County Council, 2006) states that it: 'does not permit the discharge of any solid matter such as: food wastes (cooked or uncooked, plate scrapings), oil of any type, glass or packaging. It is an offence to do so' (p. 3).
- Cork City Council states that:

  In the absence of a positive case being made to the City Council of benefits or lack of negative effects of discharge of macerated solid material to the public sewer, Cork City Council does not authorise the installation of macerators/ food disposal units.

- Section 19 (Guidelines for Grease Traps and Food Macerators) of Dublin City Council 'Greater Dublin Regional Code of Practice for Drainage Works' (2005, p. 16) states that the use of under-sink macerators/ food grinders for processing and discharging waste food to the drainage system is not permitted for private drainage.
- A notice[10] advertised on the Kilkenny County Council website outlines the council's sanitary services engineers' objections to disposal of food waste to the sewerage system. It notes that 'increased loadings from copious amounts of food waste, fats, oils and greases, is causing serious problems at the City sewage treatment plants at Purcellsinch and elsewhere in the County' and that 'Food wastes block pipes and manholes, and disrupts treatment processes'.
- Both of the most recent Waste Management Plans for the Midlands and Dublin regions 2005–2010 (pp. 53 and 103 respectively) state that: 'additional legislation is needed to provide an effective remedy to the current negative trend towards the use of … in-sink macerator units … which cause[s] pollution'. It advises the general public to avoid the use of in-sink macerators for organic waste.

Nevertheless, as outlined in Section 2, there is a growing penetration of domestic and commercial FWDs in Ireland and a lack of any guidance or awareness on their technical and environmental implications.

This section examines the compatibility of domestic and commercial FWDs with Ireland's current waste-management policy for organic waste management.

4 Irish Policy Issues and FWDs

4.1 Policy Discussion for Organic Waste Management

Irish policy and waste management plans are based on the EU Waste Management Hierarchy, which prioritises waste prevention, minimisation, reuse and recovery over waste disposal. The preferred policy approach is to separate and collect organic waste at source from the mixed waste stream. Home composting of this type of material is also encouraged, although this option has limitations and is rarely considered by commercial food operators. Domestic and commercial use of FWDs as an alternative to traditional organic waste disposal gained popularity since the mid-1990s. The introduction of use-related waste charges and increases in landfill gate fees during this period has benefited the promotion of FWDs.

The *National Strategy for Biodegradable Waste* (2006) comments that FWDs pass on the treatment and management of organic waste to the wastewater system and their use is closer to disposal than recovery. It also expresses concern in relation to the use of FWD units and the possibility of the overloading of treatment plants, particularly if there is high market penetration from the commercial food sector. The wastewater sector, according to the DEHLG, is not readily amenable to monitoring and control, and with capacity at plants around the country being limited or in some cases already at a maximum there is a strong possibility of a negative impact of extra loading from FWDs. In general discussion with the manufacturers of FWDs, they have disputed this viewpoint.

4.1.1 Irish Policy towards Application of Polluter Pays Principle

There is concern regarding the consequent implications associated with FWDs and the equitable application of the 'Polluter Pays Principle' [11] to the domestic and commercial sectors. This is an established European Union (EU) principle regarding cost allocation and action by public or private waste collectors (DEHLG, 2006): it specifies the allocation of the costs of pollution to producers and consumers rather than to society at large – those individuals responsible for the generation of waste should pay for its collection, treatment and disposal. *Sustainable Development: A Strategy for Ireland* (1997) adopted the principle in order to achieve its aims of an environmentally sustainable Ireland.

Source separation of municipal waste is currently working under this principle. Householders and commercial businesses are charged for the amount of residual waste they dispose of, and flushing large quantities of organic waste to the local sewer by means of a FWD is inconsistent with the policy. In such cases, the cost of waste treatment is not borne by the generator and there is no incentive for the polluter to reduce the amount of waste they are producing.

A study carried out by the Sydney CRC (CRC, 2000) notes that:

> The implementation of FWD units would reduce the waste minimisation incentive generated by Council as it transfers the responsibility of waste generation and disposal away from the household. This would potentially lead to an increase in waste generation within the Waverly area … The government is focused on resource recovery opposed to ocean disposal.

[11] PPP Council Recommendation 75/436/Euratom, ECSC, EEC of 3 March 1975.

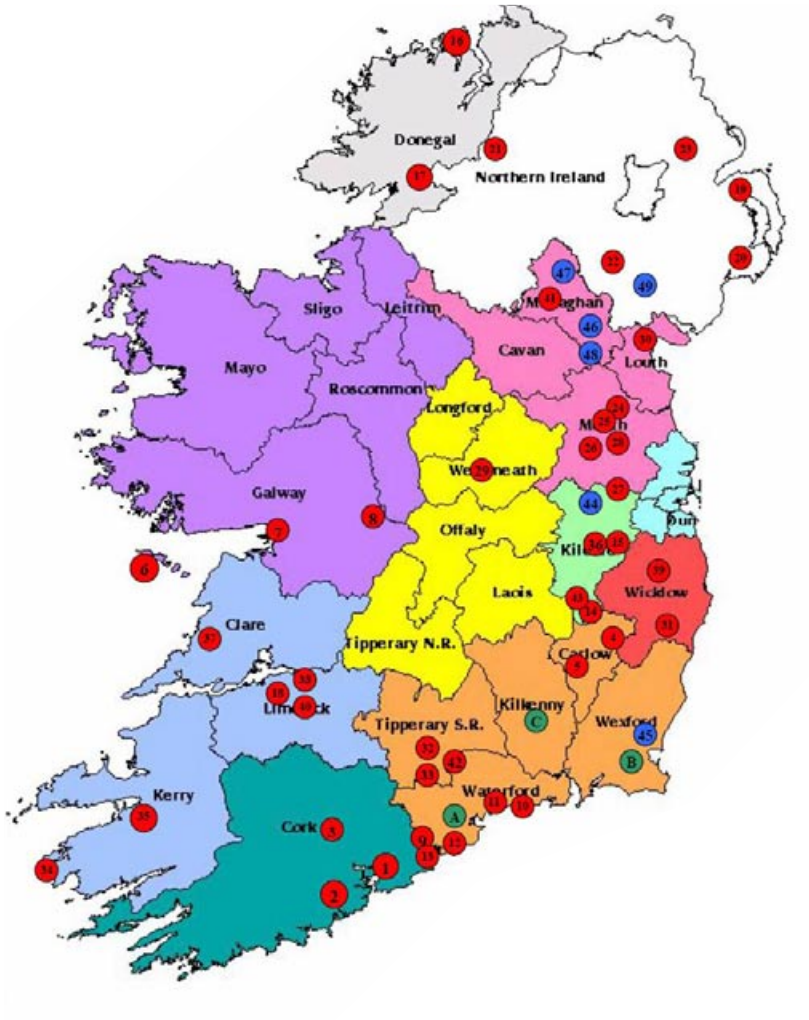

Figure 4.1: Operational Composting Facilities in Ireland, July 2006
Source: http://www.cre.ie

4.1.2 Policy in Relation to Nutrient Removal in Wastewater Treatment

Nutrient removal is carried out in many wastewater treatment plants in Ireland. This is necessary because of Receiving Water compliance standards and particularly where discharges are into designated 'sensitive waters' under the Urban Wastewater Treatment regulations. In some instances, the provision of nutrient removal at WWTPs has generated a need for additional carbon inputs into the wastewater system, a situation documented in Brisbane, Australia (see Section 3.2.3). However, the need for additional carbon inputs is specific to the local conditions of the wastewater system and treatment plant. There is currently no need for additional carbon inputs into the existing wastewater collection systems and treatment plants in Ireland.

4.2 Current Irish Waste Management Practice for Domestic and Commercial Organic Waste

Irish waste legislation and policy supports the provision of separate kerbside collections of mixed dry recyclables and organic wastes from householders and businesses.

Household dry recyclable collections are now in place in nearly all local authority areas and the next step is to implement separate collections for organic wastes. Separate organic waste collections of food and garden waste – the 'brown bin' collection system – have been rolled out in some local authority areas in recent years. The brown bin can take any type of food waste (cooked and uncooked), including those not recommended for home composting (cooked food). Most regional waste-

management plans have set objectives to expand the brown bin system within the next few years. Twelve local authorities reported the separate collection of just over 20,000 tonnes of organic waste from households through kerbside schemes in 2004 and a further 41,500 tonnes were collected from commercial sources (EPA, 2006). The DEHLG (2006) point out however that there is a need to improve the performance of the separate collection schemes – in terms of the range, quality and quantity of materials recovered.

According to the EPA's *Compost Facilities 2005* report (2006), 39 composting facilities were in operation in Ireland in 2005 (with a treatment capacity of 495,900 tonnes); 7 commenced or are due to commence operations in 2006, with a further capacity for 130,800 tonnes.[12] This shows the government's commitment to treat this type of waste through the solid-waste stream by using source separation. The majority of waste composted at the waste-management facilities surveyed in the report was 'green' [13] waste and household organic waste (an estimated 79,396 tonnes) in 2005 and the amount of commercial kitchen and canteen waste treated was 4,207 tonnes. There is a high demand from composting facilities for the organic material collected from the household kerbside collection schemes and commercial sources and the EPA (2006) state it is the 'best category of organic waste to produce the best quality of compost'.

Figure 4.1 displays the locations of 45 operational composting sites in Ireland (6 of which include mushroom composting). The map also includes the locations of three anaerobic digestion plants in Counties Waterford, Wexford and Kilkenny.

The DEHLG (2006) suggests that increases in landfill gate fees are a driving factor in the steady growth in commercial organic waste recycling (from 16.7% in 1995 to 50.1% in 2004 for both food and garden waste). According to the DEHLG, it is now more cost effective for enterprises to separate recyclables for recovery rather than dispose of them in landfills as a mixed-waste stream.

In addition, the practice of home composting of organic and garden waste has grown in recent years. The DEHLG (2006) estimates that at least 6% of Irish householders had compost bins in the period 2002–2003. This figure is now expected to have increased in response to the introduction of household Pay-by-Use waste disposal charges.

[13] Garden waste, e.g., grass or hedge trimmings. This type of waste does not include food waste.

5 Issues and Impacts Associated with FWDs

5.1 Introduction

This section explores the potential environmental, waste and social issues associated with FWDs in detail. Contrasting opinions prevail concerning the merits of FWDs and their use in dealing with organic waste; the differing positions are most obvious between European and American studies. This section aims to explore the contrasting viewpoints. It also considers the alternative of using a separate collection for food waste.

It is important to note that there is a lack of independent scientific studies on FWDs over a sustained period of time. Several of the FWD studies currently available have been initiated and funded by a FWD manufacturer, and have taken place over a short time period (less than 24 months). Some studies reaffirm this point:

- The Swedish Association of Local Authorities (Karlberg and Norm, 1999) questions whether the location of a study they initiated is particularly well suited to exploit the use of FWDs, or whether the project has succeeded because of careful planning (e.g., extensive inspections of sewer lines were carried out before the study to determine suitability). It also concludes that a longer investigation period (results for the report were gathered after approximately 12 months) is needed.
- In its conclusions CIWEM (2003) would like to see additional independent research to further expand the growing body of evidence about FWDs. There is still a notable lack of such research.

Figure 5.1 provides an illustrative overview of possible receptors that could be affected by the introduction of FWDs. The potential and actual impacts of FWDs are expanded further in Sections 5.2 to 5.4 below and in Section 6.

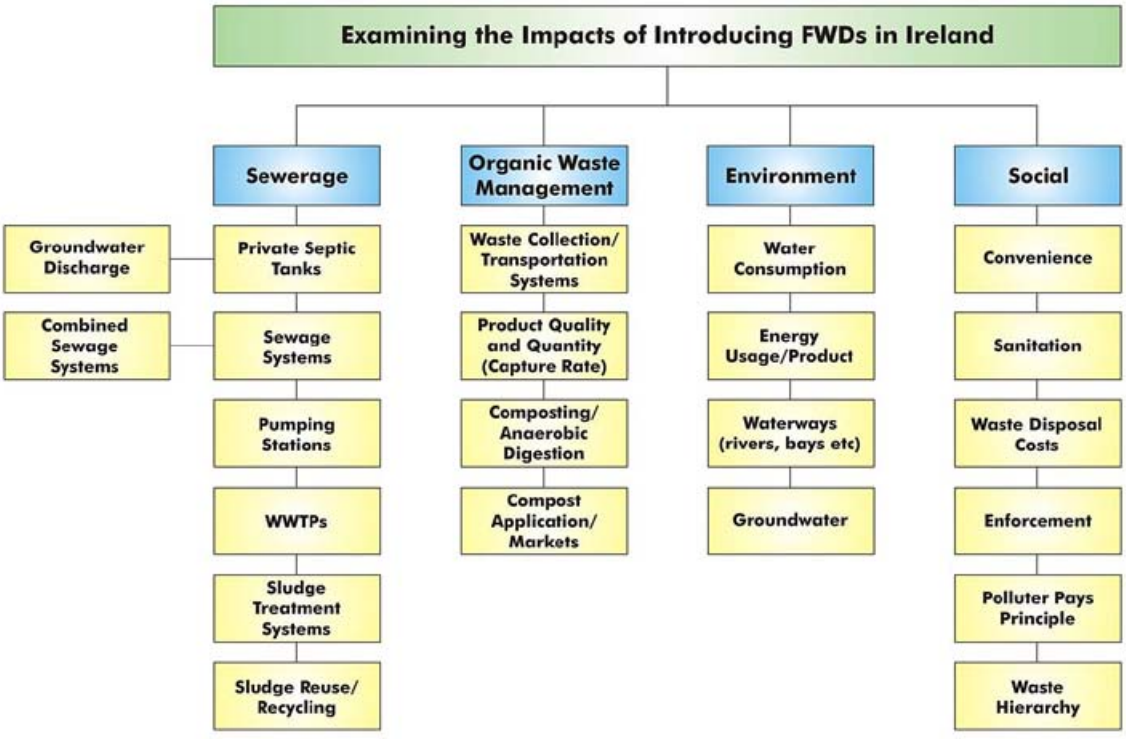

Figure 5.1: Impacts of FWDs on Environmental, Waste and Social Issues in Ireland

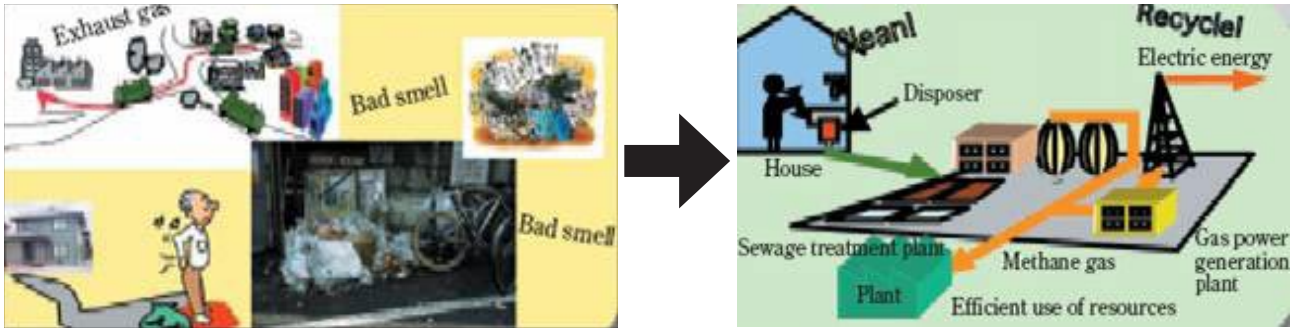

Figure 5.2: Advert for FWDs Highlighting Issues Associated with Solid and Wastewater Systems
Source: Water Quality Control Department, Japan, 2003

5.2 Sustainable Management of Organic Wastes

5.2.1 Waste Management Costs and Systems

The introduction of FWDs as a solution to organic waste management can have both positive and negative impacts on our environment. Figure 5.2 compares the issues associated with organic waste systems and schematically highlights the benefits of FWDs from a study by the Japanese Water Quality Control Department, which promotes the use of FWDs. Some studies point out that the householder is more likely to use FWDs than to separate via the solid waste system because it reduces their waste disposal charges. Other studies (ISE and KAL, 1998) mention that householders can also dispose of food waste that would not be considered suitable for home composting – for example, raw and cooked meat and bones – and which would otherwise be sent to landfill. These studies also identify refuse-collection vehicle emissions, noise during transportation, and storage issues associated with organic waste collection through the solid waste system. They state that FWDs are clean and convenient for householders and for solid waste collection agencies. Studies examining waste systems for disposal of food waste that give a positive view on FWD use include:

- De Koning and van der Graaf (1996) found that food waste disposers could potentially recover more energy, cause less global warming and acidification while composting systems generate less eutrophication and produce less amounts of sewage sludge.
- Marashlian and El-Fadel (2005) examined the possibility of introducing FWDs as a waste minimisation option within urban waste-management schemes, taking the Greater Beiruit Area as a case study. They found that the use of FWDs could reduce the total solid waste to be managed by 12 to 43% under market penetration ranging between 25 and 75%, respectively.

It should be emphasised that disposing of food waste in this manner must be managed by water and sewerage companies further down the line, and can cause negative environmental impacts by taking food waste out of the solid waste stream. These impacts will be outlined in Section 5.3 below.

5.2.2 Resource Efficiency

Where practicable, home composting is regarded as the most resource-efficient solution to organic waste disposal. This is because of its proximity to the origin of the waste generation and because it needs the least amount of energy and water to treat the waste compared with other methods. Centralised composting by waste collectors entails sorting organics at source before transporting them to a pre-processing plant for contamination removal. However, this requires an effective organic collection scheme to be successful and to produce a high-quality product.

Diggelman and Ham (2003) examined whether household food waste should be disposed of in the wastewater system or the solid waste system based on environmental impact. They found that composting has the lowest material and

water inputs and generates the least wastewater and waterborne waste, whereas food waste disposed of by kitchen FWDs had the highest amount of food waste and carrier water relative to the total throughput over its design life.

On the other hand, promoters of FWDs have suggested, in general discussions with them, that issues associated with transporting solid waste by refuse collection vehicles (RCVs) – for instance, fuel emissions and traffic congestion – will be reduced with the increase of the installation of FWDs. However, Karlberg and Norm (1999) point out that the transportation of waste by RCVs will not be reduced in direct proportion to the number of FWDs; their introduction would need to be widespread for this to occur. In general most separate collection systems for organic waste in Ireland are carried out on an alternating-week basis and therefore do not create a major additional traffic load.

However, even in countries with a long history of source separation, contamination of organic waste can lead to problems when trying to produce a quality product.

- In The Netherlands organic waste collection in some regions has not been mandatory since 2002 (e.g. city municipalities in Amsterdam and Rotterdam). This was prompted by concerns regarding poor organic waste quality, especially in inner-city areas (personal communication with Peter Aarts, 2006).
- De Koning (2004) suggests that areas where, for environmental and/or economical reasons, the separate collection is abandoned, FWDs might replace the current system on a voluntarily basis.

An appropriate and efficient organic waste collection system needs to be established dependent on the type of dwelling, socio-economic profile of the area, awareness level, etc. before it can be successful. The current demand for FWDs may then decrease.

Figure 5.3: Brown Bin Collections of Food Waste
Source: Hospitality Solutions Consulting and Clean Technology Centre

5.2.3 Materials Accepted for Composting

The organic waste 'brown bin' can accept any type of food waste (vegetable and fruit peelings, cooked and uncooked scraps, etc.) and also garden waste. The contents of this can then be composted in a centralised facility into a useful resource. Home composting has limitations (compared to the brown bin), as it cannot accept raw and cooked meat, bones, poultry and fish, dairy products and oily/greasy foods for composting. However, paper and cardboard, sawdust and wood shavings and animal manure can be added.

InSinkerator advise users on their website that standard FWDs should not grind large amounts of bones, fruit pits, fibrous materials (celery, corn husks, artichokes) or vegetable peels. Therefore, if a separate organic collection system is not used in conjunction with FWDs, some organic material must still go to landfills.

In addition, the inability of FWDs to dispose of all types of food waste is supported by the Swedish report (Karlberg and Norm, 1999), which suggests that 20% of the food waste suitable for composting is not suitable for grinding in a FWD (i.e., that described above by InSinkerator). Orenco, a USA wastewater engineering company, found that homeowners tend to dispose of more organic material when FWDs are available for their use (in consultation with Geoff Salthouse, Orenco, 2006).

Therefore, the use of FWDs is not a complete solution to organic waste disposal as some food waste ultimately will have to be composted or, if that is not an option, put into the residual waste.

5.2.4 End Products

Traditional composting systems and treatment of organic waste at WWTPs produce different types of end products. Compost is typically produced when organic waste is collected through the solid waste system and treated at a specific biological facility, whereas biogas and sludge are generated when organic waste is treated at a WWTP.

The proposal for the Soil Framework Directive (COM [2006] 232), which forms part of the EU's Thematic Strategy for Soil Protection, was published in September 2006. The Sewage Sludge Directive (86/278/EEC), which entails a reduction in maximum permitted levels of contaminants in sludge, is due to be revised. This will detail protection measures for soil, including legislation in relation to the land-spreading of sludge. This is of particular interest to Ireland – The Netherlands and Switzerland have already banned sludge spreading and the procedure is also discouraged in France, Germany and Sweden.

Many of the studies that campaign for FWD technology suggest that the methane generated by anaerobic digestion of organics at WWTPs can be recovered as a renewable energy source (biogas) and that biosolids generated can be used in agriculture and for land-reclamation purposes. This is only the case, however, in modern WWTPs with the facility to digest anaerobically (Diggelman and Ham, 2003). At present there is a limited number of Anaerobic Digestion (AD) plants in operation in Ireland treating municipal waste. The Chartered Institute of Water and Environmental Management (CIWEM) (2002) believe that if a WWTP does not have anaerobic digestion or if it is unable to use the biogas, there is nothing to offset the additional treatment cost at these plants. If there is large-scale use of FWDs, serious consideration needs to be given in relation to WWTP and sewer system upgrading.

A German consultee from the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (see Section 3 above) pointed out that because the shredded organic waste mixes with other substances in the wastewater and in the sewage treatment plant, high-grade recycling is no longer possible. Concerns over WWTP sludge quality were also raised in the Danish analysis. Therefore, the recycling rate of organic waste from FWDs is lower than when collected separately.

5.3 Environment

5.3.1 Water and Energy Consumption

In order to flush the grinded food waste from the FWD unit into the sewer, water needs to be poured into the sink, most typically by running the cold-water tap (Figure 5.4). Energy is also used to power the unit electrically. This has the potential to place a burden on the Irish water supply, especially during summer months, if there is a large market penetration.

Figure 5.4: Water and Energy Required to Operate Domestic FWD

Table 5.1 below gives an outline of the water and energy required to operate a FWD efficiently. As is evident from the table, studies vary on the amount of running water and energy required to allow them to work effectively. This depends on whether the report was commissioned by a FWD manufacturer or others.

Table 5.1: Water and Energy Consumption from FWD Studies

Author of study	Water consumption
Karlberg and Norm (1999)	3–6 l/household per day
Diggelman and Ham (2003) [14]	1 l per day on average
NILIM (2005) [15]	0.7 l/100g
Hickman (2006) [16]	Studies show as high as 16 l per use (equivalent of 2 toilet flushes)
Marashlian and El-Fadel (2005)	Increase in domestic water consumption and corresponding increase in wastewater flow rates are relatively insignificant
Frigerio and Schieppati (1998)	Increase 2.1 m^3 per year per typical family (2.7 individuals) or 3.5/4 l per resident per day (single toilet flush)
	Energy consumption
Karlberg and Norm (1999)	Annual requirement: 3–4 kWh/household
AMEDEA (2004)	Annual requirement: 3–4 kWh/household
NILIM (2005) [2]	<0.001 kWh of electrical power consumption for each use. At 100% household FWD installation rate estimated 4 tonnes/year increase in CO^2 and a 144 GJ increase in energy consumption

[14] University of Wisconsin study partly funded by the National Association of Plumbing-Heating-Cooling contractors, of which ISE is an affiliate member.

[15] Town of Utanori, Japan.

[16] *The Guardian*, 8/8/2006.

To put the data in Table 5.1 into context, the average consumption of household water is 140 l per person per day. The average water usage due to FWDs ranges from 1 l–16 l per household per day.

What also needs also to be taken into consideration is the energy consumption during installation of an FWD and when treating the additional influent, sludge and chemical loading at the WWTP. In comparison, energy consumption is low for composting but competitively high for source separation when collection and treatment of organic waste are taken into account. However, in the long term the reduction of potentially harmful impacts on the environment and wastewater system, when compared to FWD use, would offset this energy expenditure.

5.3.2 Water Policy Issues

Water conservation is an active policy of the Irish government. In 2003 over €276 million was allocated for the first round of the nationwide Water Conservation Programme. This investment built on 15 initial fact-finding water conservation schemes, carried out by selected local authorities since 1996. The programme was designed to identify and substantially reduce the levels of unaccounted-for water in Ireland's water supply network (DEHLG, 2006). Local authorities currently devote significant resources to leak detection (Figure 5.5), rehabilitation of old mains, and awareness programmes such as the TapTips website.[17] As noted above, FWDs need water to operate efficiently, which places an extra demand on Irish water resources.

Figure 5.5: Water Leak Reduction Team in Limerick

5.4 Social

5.4.1 Convenience and Sanitation

User convenience for any waste-management system encourages continued use – make it easy for people to use and they will use it. This is important to note when assessing current organic-waste collection systems. Historically, the FWD has been sold as a consumer-convenience appliance, and may therefore be considered (for example, by Diggelman, 2003) the most likely method for organic source separation by the user. However, the EU Waste Management Hierarchy prioritises waste prevention and minimisation, thereby conflicting with this trend.

5.4.2 Health and Safety

Promoters of FWDs also cite health and safety issues – for instance, the prevention of vermin and flies. Space restrictions are also highlighted – often citing the Australian Capital Territory's (2005) amendment of their water and sewerage regulations to permit the installation of FWDs in medium-density dwellings or the rescinding of the FWD ban for domestic use in New York. In addition, modern units now have safeguards against accidents, and injuries are very rare, according to the FWD manufacturer consultees.

5.4.3 Economic

FWDs provide householders and businesses with an indirect financial incentive to use this technology, as the user does not have to pay waste charges. However, it is worth noting again that this is simply passing the costs of waste management to the wastewater system (the management and maintenance cost of which is borne by local authorities). Consideration needs to be given as to how this should be passed onto the waste generator, if that is indeed possible. Cost-sharing mechanisms would have to be explored but these can be quite complex (Section 6 examines this further). Other issues also need to be considered, such as:

- The corporate social responsibility principle challenges Irish businesses to improve their impact on stakeholders and act responsibly through their business processes. Good environmental practices are an important element of this – including being financially responsible for the disposing of food waste. Accountability for the possible impacts of FWD use further down the line is also an issue.
- In terms of individual responsibility, the EU Polluter Pays Principle means that charges for waste services should be borne by the individual in proportion to the waste arising in the home. Whether the private or public sector provides these services, the implementation of the policy means an improved waste-management infrastructure and a direct economic incentive for waste reduction and recovery. This will not be achieved if waste generators use FWDs to put organic waste down the sink to be macerated and sent to sewer for free.
- In the short term, waste-disposal costs associated with the solid waste system appear higher than those of disposal into sewers. Nonetheless, the cost savings may not outweigh the possible negative environmental effects — for example, environmental loadings on WWTPs.
- FWDs act as a disincentive for reducing generation of food waste or for separating food composting. Without a separate organic waste-collection system, advocates of FWDs argue that these units increase the life of the landfill. However, this is at the expense of the life of the WWTP in terms of capacity loss and pressure on the environment arising from an increased biological and nutrient load to receiving waters as well as increased sludge loads for reuse to land spreading and other outlets. In addition, there will be increased loads of screenings to landfill from inlet work-screening plants because of the increase in organic waste collected at the entrance to plants.

6 Irish Wastewater Collection and Treatment Systems

Disposing of food waste through the sewerage system transfers a significant volume of this waste stream from the solid waste disposal system to the wastewater system. Extra SS loading (which has been estimated in Section 2 above) means that:

- The wastewater infrastructure will have to cope with the extra physical loading of sewage contributed by household and commercial food waste.
- Food solids add nitrogen, phosphorus and organic matter to wastewater, potentially decreasing water quality because of increased nutrient in the discharge; over-burdening WWTPs; and shortening the life of sewerage systems.
- Depositing food waste in this manner will also discharge oils, fats and greases to sewers, which could cause or contribute to blockages.
- The volume and characteristics of sludge generation will change, with potential environmental and economic implications.

6.1 Wastewater Strength

To varying degrees, studies indicate that the use of FWDs can have a significant effect on wastewater characteristics and can cause additional loads of BOD,[18] COD,[19] and TSS[20] in particular. Some studies have also found that there is an increase in nitrogen and phosphorus. By measuring these constituents it is possible to determine the strength of wastewater discharges. In addition to costs to WWTPs to treat these extra pollutants, there are also additional costs for treating and using (or disposing of) the extra sludge created.

Table 6.1 shows the impact of household FWDs on wastewater strength assuming that the average per capita flow is 380 l/day (Metcalf and Eddy, 1991). The values below have been converted from pounds to grams and so have been rounded off.

The increase per capita in contribution of BOD and SS in Table 6.1 shows that FWDs can have a substantial effect on the wastewater strength if their use is widespread in a community. Metcalf and Eddy (1991) comment that the resulting loads will increase the sizes of solids-handling facilities and biological treatment units. The study also

Table 6.1: Extra Organic and Nutrient Loading of Wastewater Attributed to FWDs*

Normal domestic wastewater:	BOD g/capita/day		SS g/capita/day	
	Range	Typical	Range	Typical
Without contribution from ground kitchen wastes	59–109	81.7	59–113	90.7
With contribution from ground kitchen wastes	82–118	99.8	91–150	117.9
% Increase per capita		25		33

Source: Metcalf and Eddy, 1991
*Nutrient (P and N) values were determined to be approximately the same for both types of wastewater.

[18] Biochemical Oxygen Demand is a measure of how much oxygen is required to biologically decompose organic matter in the water.

[19] Chemical Oxygen Demand is a measure of how much oxygen is required to biologically decompose organic matter in the water.

[20] Total Suspended Solids is the total amount of suspended materials.

Table 6.2: Quantity of Waste Discharged by Individuals on a Dry Weight Basis

Constituent	g/capita/day			% Increase load
	Range	Typical without ground-up kitchen waste	Typical with ground-up kitchen waste	
BOD	50–120	80	100	25.0
COD	110–295	190	220	15.8
TSS	60–150	90	110	22.2
Oil and grease	10–40	30	34	13.3

Source: Crites and Tchobanoglous, 1998

highlights that existing treatment plants often become overloaded as new developments are served, and in some communities in the USA (unspecified where) FWDs are not permitted because of their potential impact on the existing treatment plants.

Crites and Tchobanoglous (1998) had similar findings (Table 6.2) when they compared constituents of dry weight discharged from households to sewer. The percentage increase load of TSS solids from FWDs is slightly lower than that in Table 6.1.

Table 6.3 below outlines findings from other reports. It should be noted that the results were taken from both independent and FWD-manufacturer commissioned studies.

Table 6.3: Additional Wastewater Pollutant Loadings due to FWD use to WWTPs

Author of study	Average discharge volume from FWD to sewer	COD increase	BOD increase	TSS increase	Other increase
NILIM[21] (2005)	0.7l/capita/day when used average of 2.3 times/day/ household	20%	20%	20%	N:10% P:10%
De Koning[22] (2004)		95g/pers./day	66g/pers./day	60g/pers./day	N:2.1g/pers./day P:0.3g/pers./day
Marashlian and El-Fadel (2005)			17–62%	1.9–7.1%	
Nilsson *et al.* (1990)				33%	
De Koning and der Graaf (1996)	2.5–5% (to sludge thickeners and digesters)[23]				
Rosenwinkel and Wendler (2001)	5-10% (0.8-1.6mg/capita/day)				
US EPA (2002)		20–65%		40–90%	FOGs:[24] 70–150%
Karlberg and Norm[25] (1999)	12% (org. matter)		16%		N:2.6 % P:4.5%

21 Town of Utanobori, Japan, study carried out 2000–2003.

22 Results from raw wastewater before treatment, extra FWD loading at WWTP PE 100,000.

23 Found to have a negligible impact on Dutch sewers.

24 Increased risk of clogging in the soil adsorption field of septic tanks.

25 Theoretical load due to FWD usage in 1,100 households.

The Public Health Code of the State of Connecticut (State of Connecticut, 1998) states that 'wastes from garbage grinders are extremely high in settleable solids … also very high in grease, due to ground-up foods, and BOD resulting from organic decomposition in the septic tank'. It also comments that they should not be used since they significantly increase nitrate levels in the sewage effluent.

According to a wastewater engineer from Orenco (a US wastewater engineering company), septic tank-effluent filters, which are used to reduce SS, are considered vital when FWDs are used, because of the increase in TSS concentrations. The company also increase the size of the septic tank by about 25% for increased hydraulic retention when FWDs are used. This increases the time for the macerated material to settle out in the primary treatment phase.

The US EPA (2002) found that the states that allow FWD use advise additional septic tank volume, service requirements or other conditions (e.g. multiple tanks, larger infiltration fields) to address the higher BOD and TSS loadings. However, outside the USA, these provisions are frequently not applied when designing WWTPs.

6.2 Sludge Production at WWTPS and Septic Tanks

The volume and strength of sludge increases with the increased use of FWDs, as there is an associated increase in BOD:

- The NILIM (2005) study in Japan determined that the amount of waste sludge clearly increased with the number of increased FWD users.
- The Catering Equipment Suppliers Association (CESA) and the Association of Manufacturers of Domestic Appliances (AMDEA) (2005) state that in broad terms it can be estimated that 100% usage of FWDs in a catchment would increase sludge production at the WWTPs by 50%.
- The US EPA (2002) found that FWDs cause a more rapid build-up of scum and sludge layers in septic tanks and an increased risk of clogging in the soil adsorption field owing to higher concentrations of SS in the effluent.

6.3 Sewer Networks

The National Urban Wastewater Study found that 13% of mechanical and electrical plants at 640 pumping stations within the sewerage networks have experienced serious deterioration or have failed (DEHLG, 2004). The Department has put in place a significant investment programme to address these infrastructural deficits.

6.3.1 Sewer Blockages and Food Particulate Loading

The additional loading from food waste being added to sewers in addition to the normal domestic and commercial effluent may cause or contribute to blockages, as sewers are not typically built with this extra loading in mind.

A four-year study in Utanobori, Japan (NILIM, 2005) reported that the frequency of occurrence of sewer deposits from FWD usage was 1.3 to 3.0 times higher, and the number of deposit sites 2.7 to 3.8 times higher following the introduction of FWDs. This study also found the sulphide content of wastewater which included ground kitchen waste became higher at pumping stations than that of normal wastewater when retained for 48 hours of more. They also found that 40% of users had problems with clogged pipes at some stage of their use. Further, there is no guarantee that users will not flush with hot water, which just carries FOGs further into the network before it cools and coagulates.

6.3.2 Fats, Oils and Greases (FOGs)

As food waste can contain FOGs there is an increased possibility of blockages in sewer pipes if coagulation occurs. This is why FWD manufacturers recommend the use of cold water to dispel the macerated waste from sink to unit to be flushed to sewer. However, as one distributor of grease traps stated, 'if the food waste being disposed of is hot, the FOGs will coagulate anyway' (as illustrated in Figure 6.1). Blockages are particularly problematic where pipes are sloping gently or where the pipes are unusually small. FOG accumulation can also occur at pipe bends.

Galway County Council has experienced problems with FOGs from restaurants and fast-food outlets clogging the sewers that lead to the Mutton Island WWTP (*Galway Advertiser*, 2005). As of 2006 the council was trying to enforce installation of grease traps in commercial businesses. County councils in other areas also experience similar sewer blockages related to FOGs, including Kinsale and Kilkenny (towns with a high proportion of restaurants and hotels).

The Water Services National Training Group, as part of a collaborative project with the Water Research Centre in Swindon, is carrying out a pilot project in Cork. This identifies the main producers of FOGs in Midleton, Co. Cork. Of the 16 establishments identified, however, 15 of which were food service establishments, none used FWDs to dispose of organic waste. FOGs were attributed to the pouring of oils down the sink into the drain or the washing of greasy dishes. This underlines that while FOGs can be a contributory factor to problems in sewer networks, problems with FOGs cannot be attributed solely to FWDs.

Figure 6.1 shows pieces of solidified fat removed from the Ballincollig sewer system, which mostly services domestic housing. Sewer blockages are primarily due to FOGs and have been a particular problem in the area. A consultee of the Water Services in Cork County Council has also noted increased BOD and TSS loadings at the Ballincollig WWTP.

Figure 6.1: Solidified Fat Pieces Removed from Ballincollig Sewer System in Co. Cork

Source: Cork County Council

6.3.3 Combined Sewer Overflows

Combined Sewer Overflows (CSOs)[26] are in widespread use in Ireland and carry surface water runoff and wastewater from houses to local treatment plants. Overflow points within CSOs networks allow for the discharge of wastewater and surface water during flood events. Receiving waters such as rivers and streams in Ireland are at widespread risk of pollution from overflows during flood events. FWD discharges to CSO systems containing SS and organic particles will place additional organic loadings on a receiving water body during flood events.

With reference to FWD use, an investigation by the CIWEM (2003) found that if the CSO design is such that particles smaller than 2 mm accumulate on other debris and result in blockage, this reduces the time to blockage. In this same report it states that the UK Environment Agency normally requires that solids greater than 6 mm in any direction are removed from CSOs and that sewage is not macerated upstream of a CSO. As noted in Section 2.1, a study by Karlberg and Norm (1999) found that particles of up to 20 mm were common and that pieces up to 40–50 mm could be found after onion and potato peelings were disposed of in a FWD. Discharges containing shredded food particles (2 mm–20 mm in size) can have a significant negative impact on water bodies because of the increased level of carryover at CSOs.

Figure 6.2: Foul Sewer and Stormwater Overflow in Irish CSO

[26] A combined sewer overflow (CSO) is a control structure or chamber that allows the discharge of a diluted mixture of storm water and domestic wastewaster when the flow capacity of a sewer system is exceeded during storm events.

Table 6.4: Risk Categories for CSOs on Water Bodies

2b Probably not at risk	2a Not at Risk	1b At Risk	1a Probably at Risk
No CSOs	CSO operates <6/year	CSO operation frequency unknown	CSO operates >6/year

Table 6.5: CSO Risk Assessment for Irish Water Bodies

Risk category	1a	1b	2a	2b
River water bodies	27	104	16	4319
Lake water bodies	0	1	0	744
Transitional water bodies	7	30	10	149
Coastal water bodies	2	1	1	45

6.3.3.1 National Urban Wastewater Study

In the National Urban Wastewater Study (2004) an inventory was carried out of all sewerage catchments of 2,000 PE or more (excluding the Greater Dublin Area). It was found that there was 5,592 km of gravity sewers in 170 catchments (60% of the catchments examined), with a total of 450 CSOs. A Water Services Section presentation by the DEHLG (2005) suggested that it was likely that the number was significantly higher than reported. It also stated that CSOs:

- Cause significant visual or aesthetic impact.
- Cause deterioration in receiving water quality.
- Give rise to failure to meet regulatory requirements.

Finally, the inventory concluded that the presence of macerated food from FWDs mean that there is additional carryover at CSOs in the event of flooding.

6.3.3.2 River Basin Projects

Work was carried out by the River Basin District projects in 2004/5 to assess whether anthropogenic activities are putting Irish waters at risk of not achieving Water Framework Directive (WFD) objectives. Each water body (WFD management unit) can be assigned one of four categories of risk for each pressure type. In relation to CSOs, risk assessment is determined using a conservative design standard for combined storm overflows of six spills per annum; a CSO with discharges in excess of this number is considered to be at risk (DEHLG, 2004b). These categories are shown in Table 6.4 and refer to all River Basin Districts (RBDs).

Table 6.5 gives a national breakdown of the results of the CSOs risk assessment for rivers, lakes, transitional (estuarine) and coastal water bodies. This indicates that of the total water bodies examined that have CSOs in their catchments (i.e. 60%), 18.1% are at high risk (1a), where CSO operates >6/year and 86.4% are at risk (1a and 1b) from pollution from CSOs.

6.3.3.3 Greater Dublin Strategic Drainage Study

The following issues reported by Dublin City Council (2005b) outlines the fragility of Dublin's sewer system:

- The existing sewer system has serious problems, including excess inflow and infiltration, frequent spills from CSOs to streams, rivers and Dublin Bay and an increased probability of flooding due to inadequate sewer capacity.
- Much of Dublin's drainage is on a combined system with overflows to watercourses. This is a source of pollution. Surface water discharges to watercourses also carry possible pollutants and there is a risk of ex-filtration from foul sewers causing pollution of ground waters.
- The inclusion of FWD discharges in the wastewater stream could therefore have a dramatic impact on receiving waters because of increased discharges

of more potent overflow volumes to watercourses. This is particularly the case when food particles from FWDs are of a small size (<6 mm), which will carry over in the overflow volume.

6.4 Irish Wastewater Treatment Plants

Of the 143 WWTPs (serving 141 catchments) examined by the DEHLG in 2002 (2004b), 11% of the civil engineering and/or building items were assessed to be 'suffering serious deterioration' or to have 'failed'; 13% of the mechanical and electrical plants were in a similar condition. In addition, 28% of the WWTPs assessed were found to have inadequate capacity in terms of load to be treated. The DEHLG expect this figure to increase to 49% by 2022 if upgrading work is not carried out. These WWTPs are not designed to treat the potential additional loads from FWD use. This could give rise to further difficulties at plants already constructed. The following case studies document common loading and related problems typically identified at WWTPs in Ireland.

Case Study: Ringsend WWTP, Dublin City Council

A study carried out by Dublin City Council on behalf of the Dublin Region Local Authorities (2005) examined the issues and possible solutions to impacts of economic development on Dublin's WWTPs. It found that:

- Capacity is limited in the existing systems for development beyond the existing zoned areas, especially to the west and southwest of the city.
- Upgrading works will be required at all of Dublin's existing WWTPs.

Existing loads from industry will have to be reduced at the main WWTP at Ringsend. Capacity will be strained by loadings from new developments. The increased load from FWD use will result in an exasperation of the current situation and will lead to an increased capacity requirement of treatment plant upgrading projects.

6.5 Irish Wastewater Treatment Profile and Policies

The Urban Wastewater Treatment (UWWT) Regulations, 2001 (SI 254 of 2001), place a responsibility on local authorities to provide treatment of urban wastewater; to monitor discharges from communities; and to make available such results of monitoring to the EPA. Where discharges to sensitive water bodies occur, the regulations specify emission limit values for total phosphorus and/or total nitrogen in addition to values for BOD, COD and TSS, which apply to discharges generally (EPA, 2004).

The EPA's *Urban Wastewater Discharges in Ireland Report* for *2002* and *2003* (2004) states that in 2003 there were 443 communities with a PE greater than 500 whose

Case Study: WWTP in Rural Communities

There is a fundamental lack of representative loading data for many urban and rural WWTPs in Ireland. An inflow and load survey of wastewater was carried out by the RPS Water Section at a WWTP in a rural Irish town. This survey was carried out over two time periods of a month each in 2005. Elevated concentrations of BOD, COD and TSS were found but it was not possible to attribute the cause of the variable loading. A significantly higher PE than designed for was also noted. These highly variable elevated loads are causing concern with the local authority in question, especially for the activated sludge, as biomass cannot be adjusted in time to counteract unpredicted elevations in loadings. The results from this case study are considered to be representative for many WWTPs in Ireland although this is based on anecdotal evidence rather than quantitative data.

wastewater was treated before discharge. It also reports that, of the 40 plants of 15,000 PE or greater, only 27 of these had secondary treatments installed and operational by the end of 2003. Only 29% of secondary treatment plants serving communities between 2,000 and 15,000 PE met the effluent quality standards set by the regulations. Again, only 22% of secondary treatment plants serving communities less than 2,000 PE met these standards, illustrating the persistent problem with the operation, maintenance and management of smaller secondary treatment plants in Ireland.

In this report the EPA also state that the poor performance of any WWTP is a cause for concern as even smaller plants can have a significant impact on water quality in the waters to which their effluents discharge. They report that 18% of wastewater arisings in Ireland received no treatment, 13% received preliminary treatment, 2% primary treatment, 58% secondary treatment, and 9% nutrient reduction in addition to secondary treatment. Almost all of Ireland's urban wastewater, irrespective of the level of treatment, is discharged to estuaries and freshwaters. Because of this, it is important to understand the potential detrimental impacts that FWDs could have on Irish waterways – especially in areas where wastewater receives only primary or no treatment.

The DEHLG, in their *National Urban Wastewater Study* (2004) found that 40% of effluent load was discharged to sensitive waters and 43% of all effluent was discharged effectively untreated. It also reports that the capacity of receiving waters to assimilate effluent was found to be limited at 85% of the 105 sites assessed. It found that nearly 90% of the catchments examined recorded performance failures in terms of pollution (Figure 6.3), sewer collapse and/or flooding.

6.5.1 Animal By-Products Regulation

In relation to organic-waste-related legislation provisions, the Animal By-Products Regulation (EU 1774/2002) requires biogas and composting plants to gain approval from the Department of Agriculture and Food for the processing of catering/kitchen waste that includes animal by-products. This legislation also controls the land

Figure 6.3: Kerry County Council Notice Highlighting Water Pollution

spreading of material derived from animal by-products (SI 612 & 615 of 2006) and in particular with respect to applying a 21-day rest period before allowing farm animals access to land where such soil improvers have been applied. While the scale of potential impact is not easily quantifiable, it is important to note that where in-sink macerators are in use there is no such protective measure in place for the discharge of organic matter (which contains animal by-products) to sewers and ultimately to sewage sludge.

6.5.2 Investment

Under the National Development Plan 2000–2006, the Water Services Investment Programme 2003–2007 provided for 899 water and sewerage schemes up to the end of 2007, involving an investment of €5 bn. The objectives of the government's Water Services Investment Programme included the protection of natural resources, which are a basis for growth and competitive advantage in the tourism, food and aquaculture sectors. Building on this, the Water Services Investment Programme for 2007–2009 announced by the Minister for Environment, Heritage and Local Government in September 2007 includes 955 individual schemes to be advanced over the period of the National Development Plan 2007–2013 and beyond. The programme sets out specific targets for when construction starts up to the end of 2009.

6.5.3 International Case Studies

Karlberg and Norm (1999) suggest how in recent years several Swedish municipalities have shown an interest in disposing food to sewer in waste-disposal systems. Swedish local authorities have long maintained a restrictive attitude towards FWDs. This is because of fears of increased oxygen consumption at the WWTP and because, in principle, they believe it wrong to first mix food waste with water to have to remove it later from the sludge. A pilot study (Karlberg and Norm, 1999), carried out in the town of Surahammar (a town of approximately 1,500 households), found that of households where FWDs were installed, about 40% were connected to the municipal sewage system and Haga wastewater treatment plant. It showed that the sewage system exhibited no problems during the investigation period and that no increase in the amount of incoming nitrogen, phosphorous or BOD from the water analysis at the WWTP was detected. Even so, Karlberg and Norm (1999) emphasised that in order for a study of this type to provide any further information, the investigation period should be considerably longer and characterise the situation during stable operating conditions (a decrease in load occurred during the investigation period). They also highlighted that FWDs were not in any way considered for use in areas where WWTPs were not equipped with digestion tanks and as a result are incapable of gas extraction.

7 Stakeholder Consultation

Consultation was carried out with the following bodies, which included the most relevant stakeholders in the waste and wastewater management sectors:

- Twelve local authorities in relation to Trade Effluent Licences (Sanitation and/or Environment Sections).
- Officer for Environmental Enforcement (OEE).
- Building Regulations, Dublin City Council.
- Mains Drainage Division, Dublin City Council.
- Sanitation Section, Kilkenny County Council.
- Water Services and Environment, Cork County Council.
- Water Section, North Tipperary County Council.
- Water Section, RPS Consulting Engineers.
- Ringsend WWTP.
- Water Services Section, DEHLG.
- Water Services National Training Group.
- South West and East River Basin District Projects.
- Water Research Centre (WRc), Swindon.
- Grease Division, Dyno-Rod (drainage service company) and Kent Stainless (grease trap supplier).

Stakeholders were contacted by phone and email and questioned about their views on the profile, impacts and possible restricted measures required to control the use of FWDs. The data provided and viewpoints made are those of the consultees alone.

RPS also contacted three FWD suppliers in Cork, Waterford and Dublin (see Section 2.2.3) to discuss their products and particularly their market growth in the last few years. They were:

- Ekologically Ltd.
- Highway Wholesalers Ltd.
- Kitchen Accessories Ltd.

7.1 Organic Waste Management and Commercial FWDs

Consultation with personnel from the Ringsend WWTP, the OEE and the Mains Drainage Division in Dublin City Council highlighted the increasing use of FWDs in the commercial industry with the following points:

- Organic waste discharge to sewer is more prevalent from the commercial than domestic sector in Ireland. Historically, hotels would store food waste in slop buckets at the rear of the building, causing nuisances with odours and flies. The introduction of the FWD has eased these issues, giving rise to their popularity.
- The domestic sector could also be problematic if this technology becomes increasingly more popular. The industrial sector is less problematic because they are currently well regulated by stringent licensing.
- Additional loadings from commercial and domestic FWDs at the Ringsend plant could be attributed to lifestyle changes in modern Ireland. More people are eating out more frequently, increasingly in fast food outlets, and there is a higher generation of waste with the generation of wealth and both domestic and commercial kitchens are being modernised.
- Avoidance of waste-disposal charges is also a contributing factor for the popularity of this new technology. There is a fixed charge for commercial discharge to mains, which should be changed to variable charge to incentivise alternative means of disposal.

7.2 Pipe Blockages

Consultation with personnel from the Building Regulations and Mains Drains Division in Dublin City Council and Cork County Council provided information on possible problems and solutions arising from sewer blockages associated with FWDs:

- A programme has been established in Dublin City Council to monitor FOGs discharges from all 4,000 Food and Catering Establishments (FCEs) in the city using the Trade Effluent Licence, by requiring all to have adequate grease control equipment (grease traps). Currently more than half do not have adequate, if any, such equipment, according to the DCC consultee. FWDs will also be controlled under the same programme and DCC will not grant licences if effluent discharge is deemed to be high in FOGs, BOD, COD or SS (samples will be taken). Consultants have been appointed by Dublin City Council and this programme is under way. An initial 2,000 premises will be identified, licensed and monitored over a three-year period followed by a further 2,000 thereafter.

- FOGs are a particular problem for sewer networks and pumping stations in Midelton, Co. Cork, which collect at these places before reaching the WWTP. FOGs being deposited are giving rise to high annual costs for maintenance and removal of deposits (€39,600 per annum). This is thought to be due to lack of adequate or unmaintained grease traps. Moreover, many grease traps installed at commercial premises are inaccessible and property owners are not aware they are in place.

- A four-year collaborative research programme on FOGs is being carried out by the Water Research Centre (WRc) in Swindon, between water companies in the UK and Ireland. The results and recommendations of this research are expected to be published in 2008. A consultee from the WRc stated that the TEL in the UK is not being used as extensively in the UK as in Ireland, and it is more often used to control large industrial FOG discharges. They comment that licensing is the easiest form of enforcing FOG control, as legislation does not have to be altered in Ireland. The installation of grease separators could be included in national Building Regulations it is suggested, although this could only be used for new builds and is not retrospective.

- A three-year programme has recently commenced in Dublin aimed at controlling FOG discharges from food-service establishments. By the end of the project it is hoped to have 2,000 establishments within the city centre registered and operating under the system.

- Grease coagulating in sewer pipes is a particular problem in small pipes that are <4" or 6'', as it reduces the ability to carry normal effluent. The increase in BOD loading means the cost of running WWTPs also increases. This can be expensive for local authorities who have contracts with private operators to manage the plants.

- Both the largest drain service company in Ireland and one of the main Irish suppliers of grease traps recommend that macerators should not be connected to grease traps. By filling up space in the trap with food waste from the FWDs, the retention time required for the water to cool and the FOGs to separate is reduced, thereby rendering the interceptor ineffective. It will also require the interceptor to be serviced more frequently for removal of debris, increasing maintenance costs.

7.3 Stakeholders of WWTPs

Consultation with those involved in the wastewater sector, including Dublin City Council, Ringsend and Kilkenny WWTPs, the Water Services National Training Group and the OEE produced the following findings:

- Dublin City Council are opposed to in-sink macerators and are concerned with the increase in the availability of these units for commercial and domestic use, as the effluent from these are having a negative impact on sewers and WWTPs. Many of the consultees believe that information is critically needed from FWD loading at WWTPs. It is felt that commercial loading in particular should be monitored and measurements should be taken at the point where organics are put down the drain.
- A consultee from Ringsend WWTP in Dublin regards FWDs as an unwelcome addition to treatment loads. He says that it is difficult to explain the significant increase in BOD loading at the plant over the past number of years, even when taking into account loading from population, tourism and industrial growth alone. The PE at Ringsend is now 300,000–400,000 more than anticipated; the plant is running approximately 15% above design level and more treatment capacity is needed already. There is a concern that whatever spare capacity is made available for the future will be used quickly. The extra loading attributed to FWDs units is not accounted for in investment projections of WWTPs in Ireland.
- Based on the Urban Wastewater Directive, 60 g BOD per day is currently the accepted amount at WWTPs in Ireland. However, this was established before effluent from FWDs was taken into account and it is believed this limit may have to increase to account for the effect of loadings from FWDs. The standard for other European countries or the USA can be 70 g or 80 g. There has been a noted increase in the BOD loading at Ringsend WWTP since it started operation in 2003. Pumping stations at the Ringsend WWTP are experiencing problems believed to be associated with the use of FWDs.
- In Kilkenny, additional organic loadings at the WWTP have been noted in recent years and the plant is no longer performing as efficiently. It is unclear to what these can be attributed but it is possible that these may be due to unlicensed commercial and/or domestic FWDs.
- Wastewater from dewatering units (where the liquid fraction of organic waste is removed and solids are sent to landfill) is considered to be acceptable to send to sewer. The remaining wastewater does not usually go above the standard limit of 100 mg/l for FOGs although testing to confirm concentration levels would be required.
- Most WWTPs have inlet screens that remove particles >6 mm. FWD waste has the potential to increase the amount of screenings to be removed dramatically, as the macerated food particles can often be 20 mm or sometimes up to 50 mm (Karlberg and Norm, 1999). This will increase the load of screenings to be removed to landfill and will also increase the organic load in the screenings. In addition, macerators, or cominutors, were previously common at the inlet works of many WWTPs. They are not now included in the design of inlet works at WWTPs and screens are included to remove screenings from the flow. The installation of FWDs at source is therefore a retrograde step.
- Large quantities of food waste, particularly vegetables, have also been noted at inlet works of grit removal plants. This is another location where an increase of waste load could arise and would require disposal.
- A consultee from North Tipperary County Council suggests that the increased use of these units will have a significant impact on small rural systems in particular. In many of these systems a huge increase in BOD has been noted in the effluent slurry, which may be contributed to the increase in FWD use. It is expected that their use will also have an impact on the production of biosolids.

7.4 Regulation of FWD Use

Consultations with stakeholders in the water/wastewater section from Kilkenny County Council, Cork County Councils, the EPA and an FWD supplier provide an insight into possible ways to control the use of these units both domestically and commercially:

- It was suggested during consultation that the most effective solution to control food waste going to sewer is to ban these units. However, it was also suggested that if this is not possible the only practical way to control organic waste discharge is to set a BOD limit on discharge by licensing. This would involve composite sampling over a 24-hour period (otherwise, there could be uncontrolled discharge outside of operable hours), which could be conducted by lifting manholes at points where outlets from businesses intercept the sewer mains, and then carrying out inspections.
- However, monitoring of effluent discharged using a portable composite sampler could be problematic: they can be unstable and may be difficult to manage when put down a manhole into a sewer. Preferably, this sampler should be a built-in unit, to be installed at planning stage. It is suggested that commercial premises should be obliged to show how they get rid of their organic waste in all cases.
- A licensing programme has been set up in Kinsale, Co. Cork to help reduce all FOGs and BOD, amongst other polluting parameters, discharged from the larger commercial businesses in the town. This has been established since 2004 to discourage the use of FWDs and to ensure that all FCEs have adequate grease traps. Using the TEL, limits of food waste discharge to sewer are set to 1,000 mg/l for BOD and 50 mg/l for FOGs (20 mg/l for hotels), effectively prohibiting any food waste being macerated and sent to sewers. FCEs are issued with annual certificates when they comply with the licence and the reissue of these certificates is authorised by the Environmental Department of Cork County Council. As of 2007 the council hoped to extend this programme to all towns in the county as soon as possible.
- An FWD supplier in Cork sought a meeting with Cork County Council regarding the installation of units in commercial businesses (usually costing €15,000–€20,000 to install and maintain), but was given an ambiguous response on the council's legislative stance on discharge from these to sewer. He therefore hopes that all local authorities can clarify their position on the eligibility of their use. This consultee suggests that all importers are registered, that a levy is put on the units and that they are licensed for use. In his words: 'remove the grey area: either ban or control'. According to the consultee, if FWD use is not restricted, a rigorous marketing effort will begin.
- It is suggested that the licensing and restriction of BOD discharge, or a charge for the amount of BOD discharged to mains sewer could be an adequate disincentive to put food waste down the sink. Other parameters such as SS, COD, nutrients and FOGs should also be limited. This may make source separation a financially attractive alternative. For example, Kilkenny WWTP has a capacity for a PE of 108,000 but services a population of only 25,000. A brewery in the city uses almost all of the remaining capacity, its organic waste being treated by the WWTP. The brewery, however, part-funds the management and ongoing investment in this plant. It is suggested that those responsible are charged for obtaining a licence for discharging organic waste to sewer and that there is regular monitoring of the discharge. In addition, they must comply with a licence limit set on BOD, COD and SS in the discharge. If monitoring is not carried out, a formula should be used to determine the amount of organic waste generated by a hotel, household etc.

8 Conclusions and Recommendations

8.1 Conclusions

The sustainable management of organic waste in Ireland is a pressing issue if long-term biodegradable municipal waste targets are to be met. The preferred policy approach is for householders and businesses to source-separate organic waste from the mixed-waste stream and reduce the level of organic waste going to landfill. The roll-out and provision of separate organic waste collections has been limited to date with schemes being operated in the functional areas of eight local authorities; two of these are on a pilot basis only. The publication of the *National Strategy on Biodegradable Waste* (2006) and the second-generation regional waste plans have emphasised the need for increased delivery and uptake of separate organic waste collections. Implementation programmes for the roll-out of collection schemes across Ireland have been set at the regional level. The use of FWDs to divert organic waste from landfill is not supported in the national strategy or in the regional waste plans. FWD use however is not currently regulated.

8.1.1 Current Domestic and Commercial FWD Use in Ireland

Domestic and commercial FWDs use has been gaining popularity in Ireland in recent years. From a household perspective, the increase in unit sales has been primarily attributed to the introduction of use-related waste disposal charges. Increased prosperity has contributed to a change in Irish lifestyles – people are eating out more and food-waste management in the catering and commercial sector has become a significant issue.

Suppliers of FWD units in Ireland have marketed them as a cost-effective and environmentally friendly solution to household and commercial waste management. FWDs are advertised as an effective way of reducing waste charges and supporting the principle of 'reduce, reuse and recycle'; public demand has grown accordingly.

FWD suppliers have continued to expand and grow their market, targeting builders and developers in particular. However, uncertainties over the future legislative status

Table 8.1: Key Data on Food Waste Discharged from Domestic and Commercial FWDs

Description	Quantity
Approximate number of domestic FWDs in Ireland	26,000 units
Indicative estimate of food waste discharged from domestic FWDs	6.8 tonnes/day[27]
Indicative estimate of food waste discharged from commercial FWDs	35.9 tonnes/day[28]
Indicative estimate of total food waste discharged to sewers	42.7 tonnes/day

Refer to Section 2.4 for more details.

Table 8.2: Key Data on Food Waste Discharged from FWDs Treated at WWTPs

Description	Quantity
Estimated total solid food waste from domestic and commercial FWDs[29]	10.7 tonnes/day
% of SS influent loading at Irish WWTPs from FWDs	2.3–8.2%

Refer to Section 2.4 for more details.

27 This figure is based on 176,632 tonnes of household food waste in 2004 (National Waste Report, 2004), 80% of which can be used in FWD and is an indicative estimate; 1,478,200 households in Ireland (Quarterly National Household Survey, September to November 2005); assuming 26,000 FWD units using Customs and Excise data.

28 Based on 100,831 tonnes hotel and restaurant food waste (EPA, 2005) and estimated potential 13% of hotels and restaurants using FWDS.

29 The solid portion of food waste is assumed to be 25%. 10.7 tonnes is 25% of the total of 42.7 tonnes of domestic and commercial food waste.

and health and safety concerns have restricted the installation of the units in certain instances.

Tables 8.1 and 8.2 outline the key data findings from the study relating to the current discharge of food waste from domestic and commercial FWDs to sewers and WWWTPs.

8.1.2 Findings on International FWD Use

Internationally, as has been shown, the highest penetration of FWDs is in the USA – almost 50% at household level, where they have been in widespread use since the 1960s. However, the use of FWDs in other countries is not as common and has been restricted either nationally or at a local level in a number of countries (refer to Table 3.1 for details). There are a variety of reasons specific to each country for these restrictions and these include:

- A system of source separation and a policy of composting being followed (e.g. Denmark, the Netherlands and Canada).
- WWTP capacity is under pressure (e.g. Germany).
- Sewer systems are at risk of blockages (e.g. Sweden, The Netherlands).
- CSO systems are used (e.g. Germany).
- Concerns over pollution from WWTP discharges to surface waters or to coastal areas (Sydney, Australia).
- Local authorities and/or municipalities in some countries have permitted or piloted the use of FWDs, but specific local conditions have been determining factors in making these decisions. Examples of these schemes are as follows:

A trial project FWD scheme was implemented in Surahammar, Sweden although specific local conditions were in place prior to the pilot project commencing. WWTP and sewer capacity was adequate; distribution pipes were checked and repaired; and anaerobic digestion was in place for biogas recovery.

In Brisbane, Australia, additional carbon is required for a system of Enhanced Nutrient Removal at WWTPs and the local authorities encouraged food disposal to sewers. Specific local conditions and the type of wastewater treatment determined the action of the local authority.

8.1.3 FWD Impacts in Ireland

8.1.3.1 Waste Impacts

Irish waste-management policy endorses and supports the delivery of source-separate collection systems for organic wastes: several schemes are currently operational and more are planned. It also recognises and implements the Polluter Pays Principle through waste charges, a system which requires that all producers of waste pay for its environmentally safe recovery or disposal.

Using FWDs to dispose of waste is at odds with these key policies for organic waste management – it means the transfer of the management of organic waste from the solid waste stream to the wastewater system. Currently, FWD users do not have to pay directly for the cost of treatment for the food waste they dispose to the wastewater system. In terms of sustainable waste-management policy in Ireland, the use of FWDs undermines the national objectives to separate at source and collect and biologically treat organic waste for recovery.

8.1.3.2 Wastewater Impacts

By transferring the management of food waste to the wastewater system there are significant environmental, operational and social issues that need to be considered. These include:

- An increase in sewer blockages caused by the sedimentation of additional organic and FOG particles.
- Additional loadings to sewer networks and WWTPs due to increased volumes of organic material and nutrient parameters.
- The increased production of biogas and sludge and the impact on the quality of the sludge material for end uses.

- The potential risk to receiving water bodies due to adverse impacts on sewer networks and CSOs.
- The extent of food waste that can be disposed, the type of resource recovery possible, and the quality of the end product.
- The issue of equitable transfer of cost for the operation and maintenance of the collection and treatment systems where food waste is discharged to wastewater collection systems.

Following a review of the Irish wastewater collection networks and treatment facilities, it is considered that these systems are not suitable for the use of FWDs. The main reasons for this are as follows:

- Existing problems with blockages in sewer pipe networks caused by FOGs and food waste reported by local authorities across Ireland.
- CSOs are in widespread use in sewer networks in Ireland and receiving water bodies are at risk from pollution from sewer overflows during flood conditions. Additional organic pollutant loadings from FWDs are a serious concern.
- The existing WWTP infrastructure in Ireland is insufficient to treat additional organic and nutrient loadings from potential food waste disposed through FWDs and the additional sludge and biogas produced.

In addition to these impacts from FWD discharges on wastewater infrastructure, local authority discharges from wastewater works are required to be licensed by the EPA in accordance with the Wastewater Discharge Authorisation Regulations 2007. The EPA now has responsibility for setting necessary emission limits to ensure that discharges are controlled and environmental objectives are achieved. Local authorities will be required to take all necessary steps to ensure compliance with the limits set down. The implementation of these regulations may have implications for the use of FWDs in a local authority area. Discharges from FWDs units could have a negative effect on the level of organic matter within the water body and cause local authority discharges to exceed the limits set by the Agency.

To summarise, the findings of this report support the recommendation that the use of FWD units should be discouraged and regulated. Source-segregated 'brown bin' collection services for kitchen and garden waste are to be rolled out for households and in some parts of Ireland schemes are already well established. The use of FWD units at the household level is more difficult to regulate than at commercial level and possible approaches for regulating the future use of these units in Ireland are set out in Section 8.3.

8.2 Statutory Instruments in Place for Regulating FWD Use

8.2.1 Europe

There is no particular policy/legislation currently established on FWD use at a European level. However, FWDs and their place in EU waste policy was addressed in the 2nd draft of the European Commission's Working Document on 'Biological Treatment of Biowaste' (2001), representing the opinion of Environment Directorate General at the time. It forms the basis for preliminary discussions on meeting the targets of the Landfill Directive 1999/31/EC and states: 'In order to avoid an unjustified increase in the quantity of sewage sludge, it should be prohibited to shred solid biodegradable waste with a view to evacuating it via the sewer.'

It recommends the separate storage and collection of organic waste in member countries and promotes the biological treatment of this waste to reduce any negative impact on the environment. This proposed Directive was not advanced and many of its requirements now form part of the Thematic Strategies on Soil Quality and Prevention and Recycling of Waste.

The EC Director of Sustainable Development has subsequently confirmed that an environmental directive is unable to ban equipment such as FWD but that member states or municipalities could ban them if they had grounds to believe that they jeopardised sewerage or wastewater treatment (CIWEM, 2003).

8.2.2 Ireland

Currently in Ireland the discharge of commercial food waste to a sewer is controlled by the Local Government (Water Pollution) Act 1977, the details of which are outlined in Sections 16 to 20 of the Act. This provides that discharges to a sewer of any trade effluent or other matter (other than domestic sewage or storm water) are subject to licensing by the relevant local authority (i.e. a Trade Effluent Licence). A DEHLG circular[30] sent to each local authority explains that:

> Effluent from restaurants and other food preparation outlets which, due to their fat or grease content or other such characteristic, could give rise to an additional treatment loading or increased risk of blockage would be subject to licensing.

Practical examples are given in the circular to describe the types of establishments to be included in this licensing. Those premises excluded from the Act include shops, schools, supermarkets, for example. It states that 'premises which, due to their fat or grease content (or other such characteristic) could give rise to an additional treatment loading or increased risk of blockage and would be subject to licensing'. This also includes premises from which discharges place an additional chemical or biological

Table 8.3: Current Regulatory Controls of Local Authorities

Local Authority	Trade Effluent Licensing (TEL)	Notes
Westmeath Co. Co.	No	No plans to license at present.
Carlow Co. Co.	Some	Will be extended to all premises soon because FWDs using up capacity at WWTPs and problems with blocked sewers.
Cavan Co. Co.	No, only licence direct pre-specified discharge to water	Will require some premises to have TEL in near future, depending on size. Due to recent upgrading of small treatment plants and concerns of high level FOGs in sewers.
Clare Co. Co.	Yes, but depends on volume discharged (>5m^3)	Checking those discharging <5m^3 for FOGs. Have extended TELs to larger hotels in urban areas but still low coverage for the county.
Cork Co. Co.	Yes, but not all. Focus on Kinsale at the moment and problem areas in county	Programme in place to license all major dischargers in Kinsale. Major dischargers as identified by area engineers when carrying out sewer inspections need TEL. Regular monitoring of grease traps and premises paying contributions based on cost of monitoring. Council strongly discourages use of FWDs.
Dun Laoghaire /Rathdown Co. Co.	Only premises with history of causing sewer blockages	Repeat offenders of sewer blockages and overflow require TEL. Pilot project is being carried out in all FCEs[31] in Stillorgan to ensure adequate grease traps in place. This will be extended to all FCEs in county.
North Tipperary Co. Co.	Yes	TELs used extensively throughout local authority area.
Kerry Co. Co.	No	Intend to begin licensing premises in near future, starting with hotels. No problems noted with wastewater infrastructure as of yet.
Dublin City Council	Yes	Anyone that is discharging to sewer is required by law to have a TEL, but limited staff resource means that not all premises can be monitored and regulated.
Waterford Co. Co.	No, grease traps adequate at present	Grease traps required in new premises at planning stage, existing premises in urban areas notified to install same. TEL used to enforce this installation.
Kildare Co. Co.	Yes, as many premises as staff can visit	Staff target hotel kitchens and fast-food outlets firstly, constantly expending to include as many FCEs. Water services inform when blockage occurs in sewer.
Galway City Council	Yes, but difficult to enforce because of staff shortages	Industry targeted first, then large FCEs that do not have grease traps. Salthill experienced problems with blocked drains, prompted council to inspect for grease traps.

[30] Local Authority circular code: L8/03 (WSP) 29 April 2003.

[31] Food and catering establishments.

load on the wastewater treatment system of a sanitary authority, i.e. restaurants, hotels, catering kitchens, etc.

The Trade Effluent Licensing system is being rolled out and implemented by local authorities. The information in Table 8.3 was obtained doing this study through telephone contact with the local authorities listed. Personnel, usually from the Sanitary, Water and/or Environment sections, were questioned on the Councils' efforts to control discharge of food waste from commercial premises. Local authorities that license the discharge to sewer carry out an ongoing programme of sampling of discharges to ensure compliance with TEL conditions. The relevant council may issue notices (under Section 16 of the Water Pollution Act), specifying measures to be taken within a prescribed period to (a) prevent water pollution and/or (b) cease the pollution of waters.

Table 8.3 shows that some local authorities in Ireland are using the current licensing system to varying degrees to control and limit effluent discharges to the foul sewer network. The implementation of the licensing system is not widespread and there are inconsistencies in licences, limit values and the overall aim of the licences. Local authorities set the conditions in the licences to minimise the potential environmental and health risk. They are primarily concerned with the sewer distribution network becoming blocked with fats, oils and greases and hence the requirement for businesses to install grease traps. They are also concerned with the health and safety of personnel who are required to clean and unblock pipes and limits are set for various parameters.

The limits put on BOD and COD are set to limit the additional organic loads that these premises can put on the local WWTPs. Normal domestic effluent is usually 300 mg/l for BOD, according to a consultee from Cork County Council. TEL limits vary (500mg/l–1000 mg/l) from one local authority to another. Many consultees have stated that it would be difficult for a FCE to keep within even the upper limits set for BOD loading, for example, when food waste is disposed through a FWD. Not all local authorities are currently aware of the potential blockages and loadings on the WWTP that can occur when disposing of food waste in this way.

The TEL has had relative success in terms of reducing the number of sewer blockages from FOGs by requiring FCEs to install a grease trap. It seems that the problem lies in particular with food and grease being washed down the sink as opposed to it being macerated under the sink. Time and staff resource constraints make it difficult to license all commercial premises. Without adequate maintenance contracts, staff training and regular local authority inspections, licensing alone will not stop discharge of food waste to sewer.

The Water Services Act 2007 includes provisions for the licensing of discharges from commercial premises to sewer. These provisions will apply to the TEL system when this part of the Act comes into force. The 2007 Act also enables the licensing of discharges to be extended to specified classes of domestic users in due course.

8.3 Recommended Measures to Promote Sustainable Management of Food Waste

In summary, this report recommends that regulatory controls are put in place for the use of FWDs at the household and commercial level. In the absence of national regulation on the use of FWDs, it is recommended that local authorities are permitted to regulate FWD use as required in their functional areas. Ireland could adopt the approach taken by many European countries which regulate FWD use at local or regional levels. The extent of the regulation should reflect the specific local waste and wastewater conditions, specifically the waste-collection arrangements in place and the status of wastewater collection and treatment infrastructure. The production of a national guidance circular on the appropriate actions/ steps would be appropriate and useful. A nationwide awareness campaign to discourage both the existing and future use of commercial and domestic FWD units is also recommended.

The following sections expand on the most suitable regulatory controls for the use of commercial and domestic FWDs and the roll-out of a national awareness campaign.

8.3.1 Commercial

According to Section 63 of the Water Services Act 2007:

> A person other than a water services authority shall not, after such date as may be fixed for the purpose of this section by order made by the Minister, discharge or cause or permit the discharge, either directly or indirectly, of any trade effluent or other matter (other than domestic wastewater or storm water) to a sewer except under and in accordance with a licence under this section granted by the water services authority.

The above definition from the Water Services Act 2007 clearly requires that commercial discharges to the public sewer are controlled through licensing. The use of the existing TEL system is the most suitable mechanism to control the widespread use of FWD units in commercial premises. The future use of units could be permitted provided the discharge meets the parameter concentrations set in the licence by the local authority. Some local authorities currently use TELs to control effluent discharges and the use of FWDs commercially but coverage of the system is limited.

Where the decision to allow and regulate the use of FWDs commercially is made by local authorities, the condition of the local wastewater infrastructure and the sensitivity of receiving water bodies need to be taken into consideration.

However, the implementation of such a licensing approach is resource intensive for local authorities and the introduction of such a regime may require additional resources and fiscal support from the DEHLG. Local authorities should also be aware that Section 16 (4)(b) of the Local Government (Water Pollution) Act 1977 (as inserted by Section 12(a) of the Local Government (Water Pollution)(Amendment) Act 1990) provides for payment by a licensee of local authority costs. Similar provisions are included in the Water Services Act 2007.

Annual Charge for FWD Use

Current legislation enables FWD use to be included in the calculation of charges for the provision of wastewater services. Detailed guidance (including model forms of agreement) has been issued by the DEHLG to local authorities to assist them in drawing up specific agreements and charging arrangements with individual consumers who place a particularly heavy loading on available capacity at a wastewater treatment plant.

8.3.2 Household

At the household level, regulating the use of FWDs is recommended and local authorities need to consider the most appropriate approach and statutory mechanism. The adopted strategy needs to consider both existing FWDs, the future use of the units, and implementing a number of measures may be required. The following provides a list of possible regulatory approaches for local authorities to consider for future regulation of FWDs.

Waste By-Laws

For local authorities that implement or arrange for the implementation of a separate collection of organic waste, domestic FWD use should be restricted to ensure the highest possible capture of biodegradable wastes to support the objectives of the *National Strategy on Biodegradable Waste*.

In Ireland some local authorities have introduced Household Waste By-Laws under Section 35(1) of the Waste Management Act 1996 and Part 19 of the Local Government Act 2001. These by-laws are typically used to control the storage, presentation and collection of household waste and place obligations on householders and collectors accordingly.

The Household Waste By-Laws could be used by local authorities to introduce a new condition regulating or restricting the use of FWDs where organic waste collections are in place. The introduction of such a condition to the by-law would demonstrate to householders the environmental preference for managing biodegradable wastes as well as safeguarding local authority investments in waste

and wastewater collection and treatment infrastructure. It is recommended that local authorities consider the legal basis of restricting FWD use in their functional area through Waste By-Laws.

Wastewater By-Laws

It is not practicable, from a resource and financial perspective, to introduce a household licensing system to regulate the use of FWDs similar to the TEL system employed for commercial premises. However, there are options open to local authorities who want to regulate the use of FWDs as part of their wastewater management programme. Section 2 of the Water Services Act 2007 defines domestic wastewater as:

> … wastewater of a composition and concentration (biological and chemical) normally discharged by a household, and which originates predominantly from the human metabolism or from day to day domestic type human activities, including washing and sanitation, but does not include fats, oils, grease or food particles ...

It is clear from the above definition that typical domestic wastewater discharges do not include the disposal of food particles to sewer. As noted above, a local authority has the power to introduce a by-law under Part 19 of the Local Government Act 2001 for the purpose of environmental protection. Specifically, Part 19, Section 199 of the Local Government Act 2001 states:

> ... a local authority may make a by-law for or in relation to the use, operation, protection, regulation, or management, of any land, services, or any other matter provided by or under the control or management of the local authority, whether within or without its functional area ...
>
> … subject to this subsection and subsection (7), a local authority may make a by-law where in its opinion it is desirable in the interests of the common good of the local community – that any nuisance should be controlled or suppressed by by-law.

Depending on the local wastewater conditions, a local authority may consider introducing measures to restrict and/or regulate FWD use or to restrict the disposal of food particles to sewer. A local authority has the power to prepare and make a by-law (through the Local Government Act 2001) in order to regulate the use of FWDs and the disposal of food to sewers by householders. It is recommended that local authorities consider the legal basis prior to restricting FWD use in their functional area through Wastewater By-Laws.

8.3.3 Alternative Regulatory Mechanisms for Control of FWDs

The Planning System

For Irish local authorities who roll-out, or arrange for the roll-out, of a separate organic-waste collection, the use of FWDs in new residential developments may be prohibited by setting out a condition in the planning permission. The implementation and enforcement of such a condition will encourage developers and architects to design new developments with sustainable waste-management systems in place. This measure will provide residents with the opportunity to maximise recycling on-site through source-separation of waste materials including organic waste.

Wastewater Discharge Authorisation Regulations

The Wastewater Discharge Authorisation Regulations 2007, SI 684 of 2007, requires discharges from local authority wastewater works (sewers or treatment plants) to be licensed by the EPA (the Agency). In accordance with the duties set out in the regulations, the Agency will be responsible for setting necessary emission limits to ensure that discharges are controlled and environmental objectives are achieved. Local authorities will be required to take all necessary steps to ensure compliance with the limits set down. The implementation of these regulations may have implications for the use of FWDs in a local authority area. Discharges from FWDs units could have a negative effect on the level of organic matter within the water body and cause local authority discharges to exceed the limits set by the Agency.

Awareness Campaigns and Initiatives

It is recommended that national and regional awareness campaigns are implemented by local authorities to promote better management of organic waste at home and at work and guidance on the use of FWDs provided.

Householders should be encouraged to adopt a more environmentally friendly approach to the management of biodegradable waste arising in the home, particularly food waste through awareness initiatives. This is especially pertinent for local authorities that are concerned about organic loading at WWTPs and the build-up of organic material in sewer networks. The roll-out of brown-bin segregated collection services for food and garden waste will afford householders the opportunity to deal with this waste in a more sustainable manner.

Awareness campaigns could be carried out on a local scale (or nationwide) prior to and during the roll-out of brown bin collection services to emphasise to householders and businesses the potential environmental impact of these units. Households with adequate garden space should also be encouraged to engage in home composting to the greatest degree possible.

Revenues from the Environment Fund could be used to support the financing of future awareness campaigns by local authorities on household organic waste management, including the impacts of FWDs use.

Finally, it is recommended that a national awareness brochure on FWD is prepared by the DEHLG and/or the EPA and circulated to all relevant stakeholders including local authorities, state agencies and made available to the public online.

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An Ghníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil agus Rialtais Áitiúil a dhéanann urraíocht uirthi.

ÁR bhFREAGRACHTAÍ

CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreail.

FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí comhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOL

- Monatóireacht ar chaighdeán aeir agus caighdeáin aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntí a dhéanamh.

RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdéan aeir agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Ghníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstiúrthóir agus ceithre Stiúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

NDP
National Development Plan 2007 - 2013

Science, Technology, Research and Innovation for the Environment (STRIVE) 2007-2013

The Science, Technology, Research and Innovation for the Environment (STRIVE) programme covers the period 2007 to 2013.

The programme comprises three key measures: Sustainable Development, Cleaner Production and Environmental Technologies, and A Healthy Environment; together with two supporting measures: EPA Environmental Research Centre (ERC) and Capacity & Capability Building. The seven principal thematic areas for the programme are Climate Change; Waste, Resource Management and Chemicals; Water Quality and the Aquatic Environment; Air Quality, Atmospheric Deposition and Noise; Impacts on Biodiversity; Soils and Land-use; and Socio-economic Considerations. In addition, other emerging issues will be addressed as the need arises.

The funding for the programme (approximately €100 million) comes from the Environmental Research Sub-Programme of the National Development Plan (NDP), the Inter-Departmental Committee for the Strategy for Science, Technology and Innovation (IDC-SSTI); and EPA core funding and co-funding by economic sectors.

The EPA has a statutory role to co-ordinate environmental research in Ireland and is organising and administering the STRIVE programme on behalf of the Department of the Environment, Heritage and Local Government.

epa
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

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SSTI
Strategy for Science, Technology and Innovation

Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government