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Our ref.:

EPA
Main File ✓
Public File ✓
Evaluation File ✓
Date 28/7/99

The Manager
Environmental Protection Agency
P.O. Box 3000
Johnstown Castle Estate
Co Wexford

23rd July 1999

Re : Bord na Mona Application for IPC License for Allen Group of Bogs

ENVIRONMENTAL PROTECTION AGENCY
27 JUL 1999

Dear Sir

Further to the above application by Bord na Mona for an IPC License, I now enclose a submission and report on behalf of the IFA and a group of concerned farmers in the catchment area of the Figile River and its tributaries.

The report highlights some background information on the problems to date and our concerns in the future with increased peat production.

We would like to meet you at some later stage to discuss this submission and would be willing to elaborate further on any items including farm losses, etc.

Yours sincerely

James J Gaynor

Agronomist

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& Associates ltd.
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Our ref.:

REPORT ON PEAT SILT POLLUTION OF FIGILE RIVER & TRIBUTARIES

AND

COMMENTS & PROPOSALS REGARDING BORD NA MONA ALLEN GROUP IPC LICENSE APPLICATION

Prepared by James J Gaynor M.Agr.Sc.
Agronomist

Date : July 1999

INTRODUCTION

At the request of the Irish Farmers Association (IFA) and on behalf of some local farmers, I have been asked to prepare a report and submission to the Environmental Protection Agency (EPA) arising from the application by Bord na Mona for an Integrated Pollution Control (IPC) license for the Allen Bog Group.

I inspected a number of sites along the Figile River. I met Bord na Mona personnel and inspected some of the mill peat production areas and silt settlement tanks. I also met Bord na Mona at their offices and discussed various documents submitted to the EPA for the license. For the benefit of the IFA and the affected farmers, I enclose copies of these documents in appendices to this report.

I have spoken with various personnel in the EPA and have carried out research into related works in the UK and Finland.

BACKGROUND

Peat excavation in Ireland commenced in the 16th Century on a very small scale. In 1934, the Turf Development Board was formed and this was changed to Bord na Mona in 1946. Various bogs were acquired by Bord na Mona for sod and subsequently milled peat production. One of the most notable being the Allen group in Counties Kildare and Offaly which drains into the Barrow via the Figile river and other tributaries. The total area is 21,150 hectares. Bord na Mona purchased all of these between 1946 and the late 1980's. Bord na Mona estimate the net production area for milled peat production at 9,200 hectares.

The two main types of production are (1) milled and (2) sod peat. Our greatest concern is with milled peat production because of the additional silt produced.

The Barrow Drainage Board are responsible for cleaning the Barrow River and its main tributaries including the Figile River. The river is cleaned out approximately every six/seven years. The rivers are cleaned by dragline. The silt, stones, debris, etc. are dumped in the fields parallel with the river (see photographs - Appendix 1).

The damage done to the fields by this spoil and how to manage it are the main problems concerning the landowners.

NEW PEAT-FIRED POWER STATION

In the early years of Bord na Mona's existence, the bogs in this area were mainly used for sod peat production. It would appear over the last twenty years that an increasing percentage of the area of bog is being used for mill peat production.

Farmers adjoining the Figile River Group believe this has led to increased levels of silt in the river.

In addition to the above, Bord na Mona now propose to supply Edenderry Power Station with one million tonnes per annum of milled peat.

The bogs designated to supply the power station are the Derrygreenagh and Lullymore Group (largely the Allen Group). Details are given in Appendix 2. Most of the existing sod peat production areas are now being converted to mill peat production.

Sixty to sixty five percent of the bogs supplying the station utilise gravity drainage. The remaining areas are drained using lift pumps.

About 75% of bogs which will supply the new power station are in the River Barrow catchment area. A short summary of Edenderry Power Station is given in Appendix 2.

Based on experience to date, farmers now believe that the production of 75% of one million tonnes of milled peat for Edenderry Power Station in the Figile River group catchment area will seriously increase the level of silt in these rivers and the associated problems for them.

INTEGRATED POLLUTION CONTROL LICENSE (IPC) - BATNEEC GUIDANCE NOTE

The Environmental Protection Agency (EPA) have produced a guidance note called BATNEEC to assist people applying for an Integrated Pollution Control (IPC) license (copy of which is included in Appendix 3).

The extraction of peat in the course of a business in an area exceeding 50 hectares requires an IPC license. The applicant will be required to achieve the emission limit values and to demonstrate that waste minimisation is a priority objective and to put in place adequate abatement measures to minimise emissions.

BATNEEC means "the best available technology not entailing excessive costs".

The BATNEEC approach used is based on plans to eliminate emissions and waste minimisation by means of site extraction.

Reducing and controlling emissions can be achieved by :

(1) Load minimisation.

(2) Containment.

(3) Recovery/Recycle.

(4) Emission reduction.

(5) Waste treatment and disposal.

All of this is to do with good management and operating techniques for peat production. This includes silt ponds, internal drains, dust control, surface water run off control, etc. BATNEEC sets out emission limit values as per Page 10 of Appendix 3. The limit for suspended solids is 35 mg/l.

IMPACT OF PEAT EXTRACTION ON WATER QUALITY

It is generally accepted that increased levels of peat extraction affect the quality of run off water into catchment rivers and increase the levels of peat silt and nutrient content. Colour of water and pH is also affected.

Undisturbed bogs contain over 90% water. This water is held by the natural fibrous material and by poor drainage outlets. The construction of planned open water courses throughout the developed bogs provides the outlets to release this water. The bog naturally shrinks and oxidisation processes begin releasing nutrients, e.g. nitrogen and phosphorus. The phosphorus is a very available type and can encourage algal growth in rivers. The open drains also facilitate quick run off from bogs and result in flash floods in catchment rivers. Peat milling operations by nature create a lot of small particles which readily enter the drainage systems either by surface run off, dust or general erosion. Discoloration of water discharged from bogs is normally associated with iron levels and not just a result of erosion of particles.

Our main concern is with increases in suspended solids from peat milling operations. The release of nutrients changes in pH and colour are of less importance. Studies in Finland have shown that increase in peat silt in rivers does affect fish life in rivers especially at the hatching and survival at the early stages. There have also been increases in bacteria plankton due to releases of the nutrients, nitrogen and phosphorous.

Silt ponds are the most common system for preventing suspended solids being released into the catchment rivers and this is the system being proposed by Bord na Mona. Appendices 7 and 9 deal with the specification, location and code of practice proposed by Bord na Mona. The success of silt ponds depends largely on the retention time of the water in the pond and the cleaning interval. The water must remain in the pond sufficiently long so that the particles settle on the bottom. I am not in a position to assess the silt ponds as specified by Bord na Mona in Appendix 7 or to estimate whether they have sufficient capacity to deal with the run off from the Allen group of bogs. I feel the EPA should examine this area before granting a license. Also, an inspection should be done of all the ponds to check their dimensions and condition of maintenance. Bord na Mona claim they clean out the ponds twice per year. As the capacity, design and maintenance of silt ponds is so critical to the concentration of suspended solids being released into the Figile River group, it is vitally important that some independent body monitor these silt ponds on a regular basis.

Detailed studies have been done in Finland on silt ponds and other aspects of bog drainage and systems. See Appendix 10.

IMPACT ON LANDOWNERS

I understand the Barrow Drainage Board are responsible for maintaining the Figile River and its tributaries. This Board has extensive powers to clean out rivers and dump the spoil on the land without compensating the owners for the damage. I also understand that Bord na Mona contribute some money to the Barrow Drainage Board for the cost of cleaning the rivers. Presumably this is an acceptance that they are partly responsible for the peat silt in the Figile River group.

The rivers are cleaned every six to seven years. The spoil consists of peat silt, debris and parts of the river bank and bed.

The Barrow Drainage Board use a very outdated and old dragline system. This is difficult to operate and control and results in removal of stones and rocks from the river bed and banks. This is mixed with the peat silt, various roots, gravel, bushes and debris.

Tests which I carried out on this spoil in 1996 (Appendix 12) show approximately 30% organic matter. In ordinary soils, I would expect 4/5% organic matter. This indicates a high level of peat silt. There was also a lot of carbonate material probably originating from calcareous lime. The quantity of spoil removed varies along the river. See photographs Appendix 1. Parts of the Figile River flow more rapidly than others. In certain stretches, the river is very flat and meanders with sharp bends. These are the areas worst affected by silting. Flash flooding has occurred over the past decade causing serious losses and damage to crops in the fields. The risk of flash flooding is also increased by the extensive drainage system of the bogs as water is released much more quickly into the Figile River. Flash floods will also carry more suspended solids especially where silt ponds are not properly maintained.

Our big concern is, with the increased production to supply one million tonnes of milled peat to Edenderry Power Station, the level of peat silt will increase in the Figile River group resulting in more frequent cleaning and more problems with spoil on farms. Bord na Mona has put forward plans and a Code of Practice to control silt discharges into the Figile River. Experience has shown that while the intentions may be good, the end result is that there is a serious problem with silt deposits in the river and landowners are suffering losses as a result. It would appear that much more stringent controls are needed to prevent silt entering the internal drainage systems in the bogs. On the date of our visit, the level of dust control was very poor. Silt pond management is also an area that needs to be monitored. Similar controls will be needed on other producers of peat in the area.

OPTIONS TO DISPOSE OF SPOIL

1. Spread and grade it across the land.

2. Load, remove and bury in a hollow or low area (Appendix 1).

3. Create a bund or raised area at one or more locations on the farm.

4. Leave in a mound parallel with the river (Appendix 1).

The content of the spoil makes is almost impossible to use Option 1. The high percentage of stones and roots would create endless problems for farming afterwards. Also, continuous raising of the ground along the river bank would impede natural run off and drainage.

Options 2 and 3 are expensive to implement. Option 2 requires a suitable depression to dump the spoil. This is often not available within a reasonable distance. It also involves loading and transporting of the spoil.

Creating a bund or raised area involves sacrificing an area of land. Care would need to be taken to bury any stones and roots. Otherwise, it would be impossible to control weeds and manage the bund.

Option 4 is to leave the spoil parallel with the river where it is removed by the Barrow Drainage Boars (see photographs Appendix 1). This is most unsightly and is certainly not in keeping with the spirit of rural environmental protection. These banks are largely unmanageable. Weed control is very difficult and costly. This is also a source of weed seeds for damaging other lands. The owner is losing the use of the land under the ridges of spoil as well as a severed strip between the spoil and the river bank.

QUALITY OF WATER IN FIGILE RIVER GROUP

A study published by the EPA called Water Quality in Ireland 1995-97 explains the extensive surveys and tests carried out by them on rivers and lakes throughout Ireland and publishes their results. A few extracts from this report relevant to this study are included in Appendix 11. The study highlights varying levels of pollution in our rivers. The Figile River is listed as seriously polluted (Class D) as per Table 2.4. The suspected cause is industry. It should be noted that this is not an intensively farmed area. The farming enterprises are mainly drystock cattle and sheep with a small level of tillage.

While intensive farming often causes pollution of rivers, this study identifies peat harvesting as another source. In Page 1-3 it states that "eutrophication of surface waters may be also encountered in areas where land is disturbed for peat harvesting". Eutrophication means waters rich in nutrients.

This study does not identify the source of pollution of the Figile or other rivers. There are other industries in the catchment area of this river apart from peat production.

The Biological Survey of River Quality 1997 carried out by the EPA shows unsatisfactory conditions in the Cushina and Phillipstown Rivers with sensitive species absent and weed and algal growths excessive.

The Figile River was similar and was very heavily silted.

This report comments on the design of internal drains to prevent erosion and caving in. Internal drains properly designed can also help remove silt before it gets to the silt ponds. Allowing natural vegetation, e.g. grasses and weeds, to develop in these drains also helps remove silt.

CONCLUSIONS

1. There are serious problems from peat silt pollution in the Figile River and its tributaries. This is evident from independent studies, frequency of dredging and examination of dredged spoil.

2. Bord n Mona are by far the largest producer of milled peat in the catchment area. Other small producers are mainly involved in sod peat production.

3. The EPA guidance note for extraction of peat, BATNEEC, requires producers to implement proper controls to prevent peat silt entering rivers. While Bord na Mona have set out a detailed list of proposals and a Code of Practice, our observations at present are that these guidelines are not being implemented in full at production source.

4. We would strongly request that some independent body be responsible for monitoring the controls. A detailed study should be done on all of the silt ponds including a check on size and maintenance.

5. BATNEEC also requires that measures be taken to deal with waste treatment and disposal. We believe that the spoil from the dredging of the Figile River and its tributaries is largely peat silt originating mainly from the Bord na Mona Allen group of bogs. This silting problem is likely to increase with increased production of milled peat for the power station.

   As a condition of IPC license, a Code of Practice should be drawn up between Bord na Mona and the local farmers along the Figile River and its tributaries. This Code of Practice should deal with the management and disposal of the spoil from the dredging of the rivers. Bord na Mona should be responsible for the cost of disposing and treating this waste together with any damage done to land and farm losses.

6. The Barrow Drainage Board should be encouraged to use more modern and efficient equipment to minimise the amount of river bank and basin being removed. The powers of this body should also be reviewed particularly with reference to compensating for damage to lands.

ACKNOWLEDGEMENTS

We wish to acknowledge with thanks the assistance, both by way of discussions and reports, from :

1. The Environmental Protection Agency

2. Bord na Mona

3. Edenderry Power Limited

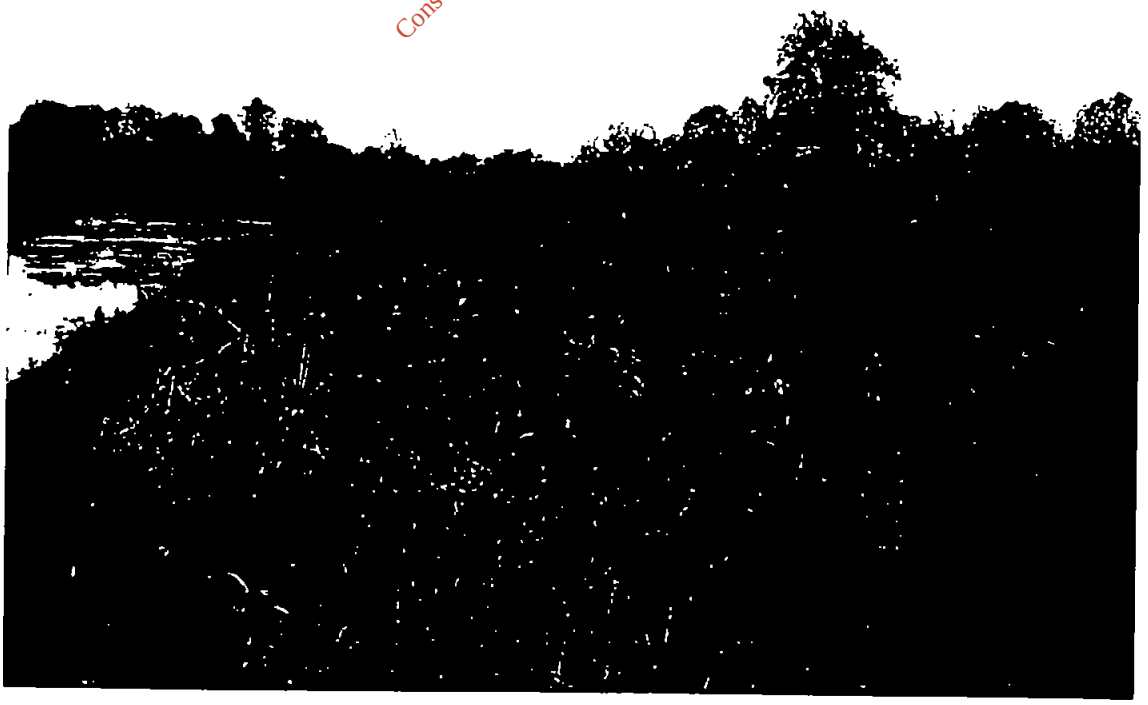
4. Finish National Board of Waters & the Environment

5. Teagasc

6. Peter Close, Department of Environment, Belfast

APPENDIX 1

APPENDIX 1



ALLEN GROUP IPC LICENSE

Bord na Mona have applied in early June 1999 for an IPC licence for the Allen group of bogs.

They have submitted many documents and maps to the Environmental Protection Agency (EPA). I met representatives from Bord na Mona and they were most helpful in explaining their application and supplying some extracts. I attach a copy of some general information from Bord na Mona in Appendix 4 including information on peat formation, names of bogs in group and peat production. I also attach a general map of the Allen Group in Appendix 5 and a sample site map for Ballycon/Cloncreen in Appendix 6 showing drains and silt ponds.

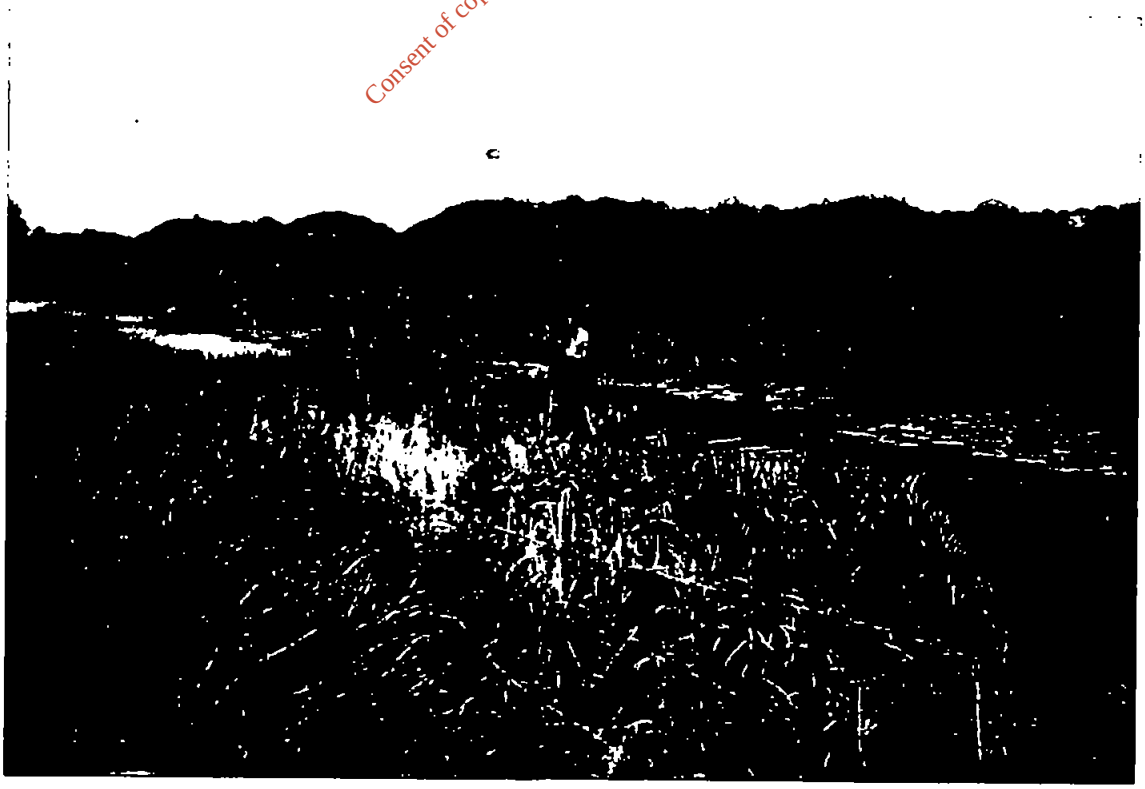
Our main concern is with milled peat production. Table 8.3 of Appendix 4 summarises the emissions as "Major - discharge of peat particles to silt ponds via surface water drainage network".

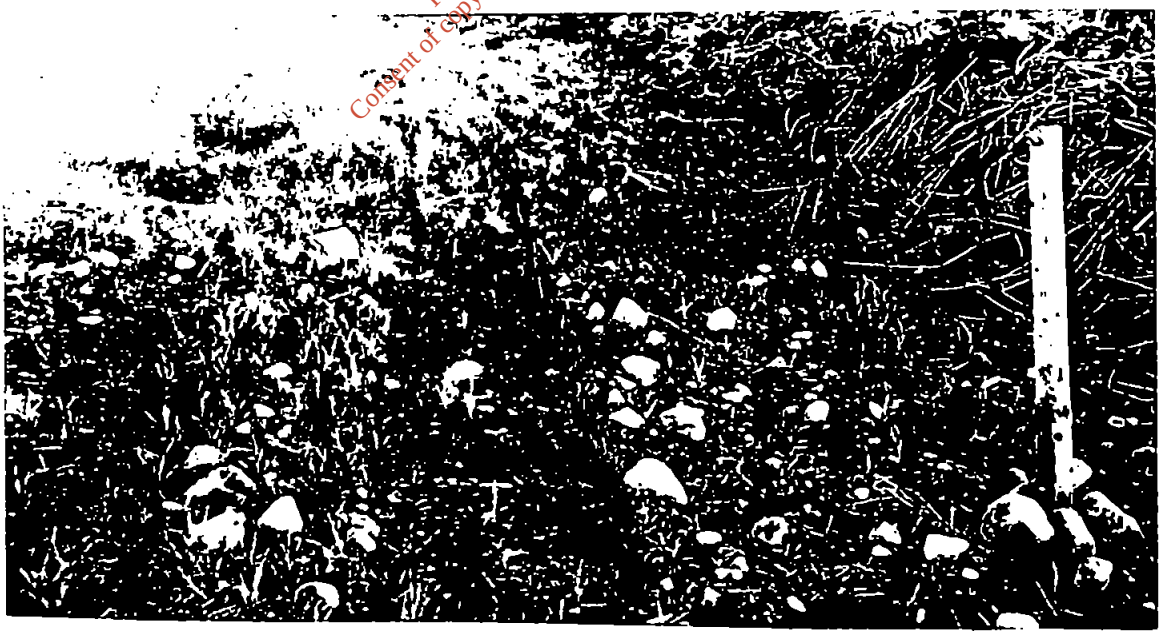
Dust is also a serious problem and is described as major for harrowing, ridging and harvesting operations. On the date of my visit to one of these bogs with Bord na Mona personnel and members of the farming committee, we also witnessed serious dust problems during harrowing and ridging operations. This problem increases in windy weather. A scum of peat silt could be seen on the surface of the river on the outfall side of the silt ponds.

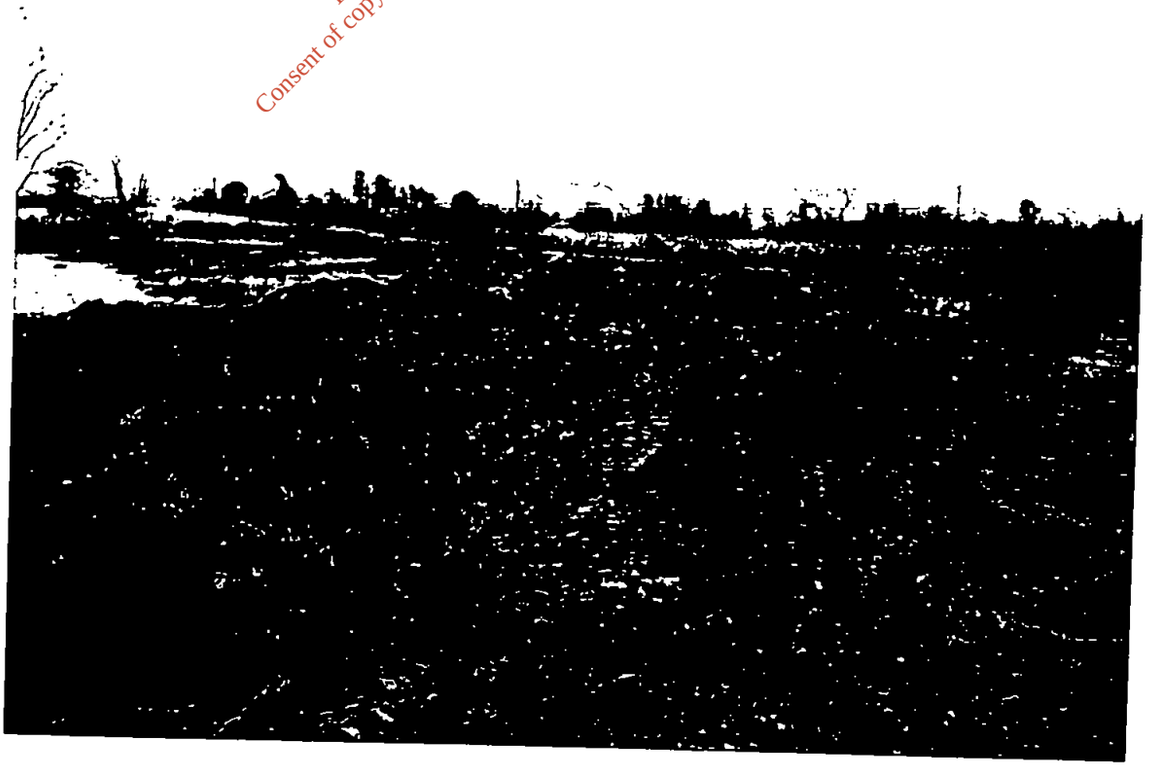
Appendix 4 also deals with their railway and transportation system. Again, we would be anxious that adequate controls to avoid dust problems be implemented during loading and movement of these wagons.

Bord na Mona use silt ponds to control the level of silt being discharged into the Figile River and its tributaries. These ponds collect the discharge from the drainage network throughout the bogs. The location, number and capacity of these ponds are outlined in Appendix 7.

A sample drawing showing a typical Bord na Mona silt pond is included in Appendix 8 and Appendix 9 outlines Bord na Mona's Environmental Code of Practice for peat energy works.







APPENDIX 2

New Peat-fired Power Station

Edenderry Power Limited

In January 1998, IVO, a Finnish owned international energy group with widespread experience in power generation, was selected by the Irish Government as the preferred bidder to build, own and operate a new peat-fired power station. The power station, which will require an investment of £100 million, has been approved for £21 million of capital grant funding under the EU Regional Development Fund. Bord na Móna researched, developed and promoted the concept of the new power station and welcomes the economic opportunity it represents for the Midlands region.

IVO has established Edenderry Power Ltd to build and operate the new station. The power plant will be located near Clonbulloge, Co. Offaly at a site which optimises peat transport, grid connection and cooling water considerations.

The plant will employ state-of–the-art technology incorporating a bubbling fluidised bed boiler with reheater and a condensing steam turbine. Cooling will be by mechanical draught cooling towers.

Expected plant performance at 100% load is shown below.

Expected Plant Performance at 100% Load

Performance Indicator	Rating
Boiler fuel input (thermal)	307MW
Boiler net efficiency	91%
Gross output at generator terminals	129MW
Net output to National Grid	118MW
Plant net efficiency	38.4%

The plant will be fuelled by 1 million tonnes of milled peat annually.

Supplying Bogs

Bord na Móna possesses sufficient developed fuel peat reserves to fuel the plant for over 30 years. It is intended to transport approximately 90% of the peat supplied by the company's internal narrow gauge railway and the remainder by road.

All of the bogs designated to supply the station and inter-connected by

railway are located in counties Kildare and Offaly. All of these bogs have been in sod peat or milled peat production for many years with the exception of Daingean bog which has been drained and developed for a number of years, and on which milled peat production is to commence in 1998.

All of the former sod peat bogs are being re-developed for milled peat. The peat depth remaining for production in all the designated bogs varies from about 3.5m to 1m, except for Daingean which is about 5.5m.

A summary of the supplying bogs is given below:

Bogs supplying the new power station

Bog Group	Bog	Status
DERRYGREENAGH GROUP	Ballycon	All of these bogs have been in milled peat production for several years
	Mountlucas	
	Cloncreen	
	Ballykeane	
	Clonad	
	Daingean	Developed for milled peat production in late seventies
	Garryhinch	All former sod peat bogs which have been redeveloped for milled peat
	Garrymore	
	Derrylea	
	Clonsast North	
LULLYMORE GROUP	Glashabaun South	All of thes bogs were in milled peat production for several years supplying Lullymore Briquette Factory (now closed)
	Glashabaun North	
	Derrybrennan	
	Killinagh	
	Bulge	
	Barnaran/Lullybeg/Cappanarigid	
	Ballydermot North	All former sod peat bogs which have been redeveloped
	Ballydermot South	
	Blackriver/Killyguire	
	Codd North	

	Codd South	for milled peat
	Ticknevin	
	Lodge	
	Timahoe South	Former sod peat bogs which will be redeveloped for milled peat
	Timahoe North	

There are other bogs in the Derrygreenagh Group which are currently in production and which could become available in the future giving a total production resource of over 30 million tonnes of peat all of which can be transported by railway.

Existing Bord na Móna horticultural bogs in counties Laois, Kildare, Offaly, Meath and Westmeath will also become available for milled peat production in future years. Peat supplied from these bogs will be transported by road.

Conservation

As all of the peatland areas that will be used to supply fuel to the proposed power station have already been drained and developed by Bord na Móna, the development of the project will not conflict with the aims of the Heritage Service and other bodies to conserve pristine examples of intact Midland raised bogs.

None of the peatlands to be used are listed as being of scientific or heritage interest.

Within the East Midlands catchment area, a number of peatlands have been identified and listed as worthy of conservation. Raheenmore Bog (SAC No. 582) lying to the south of Tyrrellspass, was purchased by Bord na Móna and handed over to the National Parks and Wildlife Service for protective management. Two other areas, Ballynafagh Bog (SAC No. 391) west of Prosperous and Mouds South (NHA) north of Newbridge, both of which are in private ownership, have also been identified as being candidates for conservation.

In order to ensure that none of the peat used to fuel the new power station can be harvested from listed areas, the EU Grant Agreement, signed by the Developer (Edenderry Power Ltd.), contains a warranty that the generator will not seek or knowingly accept peat from the protected peat areas.

An agreement signed between Bord na Móna and the developer (Edenderry Power Ltd.) contains a provision that none of the bogs that

Special Areas of Conservation or as Natural Heritage Areas.

The Future Landscape of the East Midlands Bogs

Cutaway bog is the term used to describe areas of peatland from which it is no longer possible to extract peat economically. Cutaway bogs contain various peat types and depths which overly complex subsoils with differing drainage potential.

The future landscape of the industrial peatlands serving the new power station will be one of variety, where open areas of grassland will be surrounded by hardwood and coniferous forestry and interspersed with lakes and wetlands. Some of the bogs overlay substantial depressions where it will be possible to put in significant areas of relatively deep water which could be suitable for a range of water based sports and leisure pursuits. The peatland areas in Kildare will be relatively close to the population centre of the greater Dublin area. With water based activity as the core amenity then the extension of all the ancillaty amenities becomes possible.

The future possibilities can only be realised by the removal of the remaining peat cover from the bogs which will be used to supply the new power station. The extractable depths of peat remaining on the peatlands vary from 1m in the most developed bogs to 5m in those least developed. The consequence of this is that the first areas ready for after-use will not become available until 2010 while many areas will not be available for several decades after this.

When planning the future landscape the three key factors which must be taken into account are:

a. Drainage (by gravity or pumping)
b. Depth and type of peat remaining
c. Subsoil type

Sixty to sixty-five percent of the bogs supplying the new station utilise gravity drainage; thirty-five to forty percent are drained using lift pumps. From a future use point of view a number of options are possible on the gravity drained areas, whereas the future use possibilities are limited where drainage is by pumping because of the costs involved.

Due to the horizontal nature of peat removal and the undulating nature of the underlying mineral soil deposits, the peat depth remaining after production ceases will vary from as little as a few centimetres up to 1.5m. These factors combine with considerations of sub-soil type to determine the most appropriate future land use.

The research and pilot scale developments carried out by by Bord na Móna over the past three decades has allowed it to build up the technology to designate the appropriate use to each of the distinct areas

which will be found amongst the cutaway peatlands.

Water Quality

The milled peat harvesting cycle begins with milling or breaking up the surface of the bog to a depth of 10 to 15mm. The peat crumb generated is air dried to approximately 45% moisture content before being gathered into ridges and collected into stockpiles where it is stored until required. If heavy rain interrupts the harvesting cycle, fine particles of peat may be washed into the production field drainage system. These field drains feed into piped outfalls which carry drainage water into the local arterial drainage system. If there were no treatment, suspended peat particles would be carried into the local river system and settle out at bends of streams, at the confluence of streams and rivers and at other slow-moving parts of the river system.

Bord na Móna is committed to providing treatment of peatland drainage water which it achieves by the installation of sedimentation or silt ponds in the drainage network. Silt ponds are designed to reduce the flow rate of peatland drainage water sufficiently to cause suspended peat particles to settle out. Silt ponds have the capacity to store all silt generated in their serviced production areas based on the twice yearly cleaning of each pond.

About 75% of the bogs which will supply the new power station are in the River Barrow catchment area, with the remaining 25% in the River Boyne catchment.

Socio-Economic Impact of the New Power Station

As part of a feasibility study for the new peat-fired station carried out by Bord na Móna, the socio-economic impact of the new power station on the east Midlands region was assessed by Jonathan Blackwell and Associates. This appraisal indicated that the area was agriculturally disadvantaged and had difficulty in attracting inward industrial investment owing to it's poor communications and infrastructure. The region suffered from above average unemployment and possessed limited resources with development potential..

The study concluded that while the focused attention of numerous State agencies may succeed in creating around 300 jobs in alternative activities by the end of a 20 year period, the impact of the proposed power plant was significantly greater. During the life of the power station more than 200 permanent employees and more than 200 seasonal workers will be engaged in producing one million tonnes of peat per annum from Bord na Móna peatland areas.

APPENDIX 3

ENVIRONMENTAL PROTECTION AGENCY

BATNEEC GUIDANCE NOTE

Class 1.4

EXTRACTION OF PEAT

(DRAFT 3)

Page

1. INTRODUCTION

This Guidance Note is one of a series issued by the Environmental Protection Agency and is designed to provide guidance to those applying for integrated pollution control licences under the EPA Act. It should also be read in conjunction with *Application Guidance Notes*, available under separate cover.

It should be noted at the outset, that noise is not included within the scope of this work and guidance on this parameter has been issued separately.

This Guidance Note is comprised of seven main sections and an appendix. Following this introduction, Section 2 contains a general note on the interpretation of BATNEEC. The industrial activity covered by the terms of this note is given in Section 3. In Section 4, the technologies to control emissions are tabulated and in Section 5 the specific emission limit values (ELVs) are given. Section 6 contains comments on compliance monitoring requirements.

The Appendix gives the main sources of emissions, and the principal releases from such sources.

All applicants for Integrated Pollution Control licences, in the sector covered by this note, should carefully examine the information laid down in this Guidance Note, and should use this information to assist in the making of a satisfactory application for an Integrated Pollution Control licence to the Agency. It should be clearly understood that achieving the emission limit values does not, by itself, meet the overall requirements in relation to IPC. In addition to meeting such values the applicant will also be required to demonstrate that waste minimisation is a priority objective and to put in place particular abatement measures to reduce overall mass emissions and pollutant load where this is necessary to protect the ambient environment.

The technologies and the associated emission limit values (ELVs) identified in this Guidance Note are, at the time of writing, regarded as representing BATNEEC for new activities. BATNEEC is not a static quality and will change as technologies, environmental factors and costs alter with the passage of time. The Agency may amend or update the guidance contained in this note should such amendments seem appropriate. The information contained in this Guidance Note is intended to be used only as a tool to assist in determining the BATNEEC for an operation in this sector and should not be taken to be a definitive authority on the BATNEEC for this sector. This Note should not be considered as a legal document.

2. INTERPRETATION OF BATNEEC

BATNEEC means '*the best available technology not entailing excessive costs*'. The technology in question should be **Best** at preventing pollution and **Available** in the sense that it is procurable by the industry concerned. **Technology** itself is taken as the techniques and the use of the techniques, including training and maintenance etc. **NEEC** addresses the balance between environmental benefit and financial expense.

The objective of the Best Available Technology Not Entailing Excessive Costs (BATNEEC) Guidelines is to provide a list of technologies which will be used by the EPA to determine BATNEEC for a scheduled activity. The BATNEEC identified in this Guidance Note is used as a basis for setting emission limit values. It is intended to update these guidelines as required in order to incorporate technological advances as they occur.

In the identification of BATNEEC, emphasis is placed on pollution prevention techniques, including cleaner technologies and waste minimisation, rather than end-of-pipe treatment.

Technologies identified in the BATNEEC guidelines are considered to be current best practice for the purposes of setting emission limit values. These technologies are representative of a wide range of currently employed technologies appropriate to particular circumstances. However, the guidance issued in this note in respect of the use of any technology, technique or standard does not preclude the use of any other similar technology, technique or standard which may achieve the same emission. The entire range would not necessarily be appropriate in specific cases. The specific choice depends on a wide range of circumstances but the crucial factor is that the selected regime achieves BATNEEC. In applying BATNEEC, Environmental Quality Objectives (EQOs) must be respected where set. Measures such as in-plant changes, raw material substitution, process recycling and improved material handling and storage practices, may also be employed to effect reductions in emissions. As well as providing for the installation of equipment and the operation of procedures for the reduction of possible emissions, BATNEEC will also necessitate the adoption of an on-going programme of environmental management and control, which will focus on continuing improvements aimed at prevention, elimination and/or progressive reduction of emissions.

As described in the EPA Act of 1992, BATNEEC will be used to prevent, eliminate or, where that is not practicable, limit, abate, or reduce an emission from an activity which is listed in the first schedule to the Act. The use of BATNEEC is construed in the Act to mean the provision and proper maintenance, operation, use and supervision of facilities which are the most suitable for the purposes.

In determining BATNEEC for an activity, regard shall be had to :

- the current state of technical knowledge;
- the requirements of environmental protection;

- the application of measures for these purposes, which do not entail excessive costs, having regard to the risk of significant environmental pollution which, in the opinion of the agency, exists.

For existing facilities, additional regard shall be had to :

- the nature, extent and effect of the emission concerned;
- the nature and age of the existing facilities connected with the activity and the period during which the facilities are likely to be used or to continue in operation, and
- the costs which would be incurred in improving or replacing these existing facilities in relation to the economic situation of activities of the class concerned.

The technologies and the associated emission limit values (ELVs) identified in this Guidance Note are regarded as representing BATNEEC for a *new* activity. However, it is also generally envisaged that *existing* facilities will progress towards attainment of similar emission limit values, but the specific ELV requirements and associated time frames will be identified on a case by case basis when the licence application is being processed. Furthermore, for *all* facilities, additional and more stringent requirements may be specified on a site-specific basis whenever environmental protection so requires. Hence the BATNEEC guidelines are not the sole basis on which licence emission limit values are to be set, since information from other sources will also be considered, including site-specific environmental and technical data, plant financial data and other relevant information.

3. SECTOR COVERED BY THIS GUIDANCE NOTE

This Guidance Note covers SECTOR 1.4 of the activities specified in the First Schedule to the EPA Act, 1992. These are:

1.4. The extraction of peat in the course of business which involves an area exceeding 50 hectares.

4. CONTROL TECHNOLOGIES

4.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BATNEEC but obviously does so in the absence of site-specific information. Accordingly, it represents the requirements expected of any new activity covered by the Note, but does not exclude additional requirements which may form part of the granting of a licence for a specific site.

The approach to be used in selecting BATNEEC is based on the following hierarchy:

- Operation design / redesign changes to **eliminate** emissions and wastes that might pose environmental problems.

- Demonstration of waste **minimisation** by means of site extraction etc.

The existing or possible measures for reducing and controlling emissions are described in this section.

(i) Load minimisation
(ii) Containment
(iii) Recovery/recycle
(iv) Emission reduction
(v) Waste treatment and disposal.

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly or in combination, the measures represent BATNEEC solutions when implemented in the appropriate circumstances. The circumstances depend on site scale, nature of the raw material etc. A summary of the treatments for various emissions is given at the end of the section.

Note that where flammable/explosive vapours or dusts are handled, safety procedures (acceptable to HSA) should be adopted and nothing in this note should be construed as advice to the contrary.

4.2 TECHNOLOGIES FOR LOAD MINIMISATION

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Inventory control.
- Separation of contaminated and uncontaminated storm water run off in order to permit appropriate treatment options.
- Selection of extraction equipment and methodologies to minimise particulate emissions.
- Removal of extracted material as soon as feasible.
- Optimisation of extraction area to reduce dust blow off.

4.3. CONTAINMENT OF EMISSIONS

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Bunding of tanks.
- Minimisation of rain ingress, wind entrainment etc.
- Covered vehicles for offsite road transport.
- Collection of all contaminated water from extraction and storage areas.

4.4 TECHNOLOGIES FOR RECOVERY AND RECYCLE:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Interceptor tanks.
- Recycle of interceptor/WWTP sludges to processing plant.

4.5 TECHNOLOGIES FOR TREATING AIR EMISSIONS:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).
(Symbols refer to table 4.1).

- Water spray suppression during dry windy weather where appropriate to prevent nuisance carryover (T1).

4.6 TECHNOLOGIES FOR TREATING WATER EMISSIONS

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).
(Symbols refer to table 4.2).

4.6.1 Treatment

- Coagulation/flocculation (F1).
- Sedimentation/filtration/flotation (F2).

4.7 TECHNOLOGIES FOR THE TREATMENT AND DISPOSAL OF WASTES:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

4.7.1 Sludge Treatment

- Gravity thickening.
- Drying.

4.7.2 Disposal

- Engineered landfill of wastes.
- Landspreading of wastes (as soil conditioner).
- Recycle of interceptor/WWTP sludges to processing plant.

Table 4.1 - Summary of Technologies for Treating Emissions to Air
(Symbols refer to section 4.5)

Emission Type	Technology
Particulates	T1

Table 4.2 - Summary of Technologies for Treating Water Emissions
(Symbols refer to Section 4.6)

Emission Type	Technology
Suspended Solids	F1, F2

5. EMISSION LIMIT VALUES

5.1 Releases to Water

All releases to waters are subject to a licence from the Agency. However, any discharge to a sewer will require the consent of the local authority or sewerage undertaker. BATNEEC to minimise the release of substances will generally include minimisation at source and either specific treatment of contaminated waste streams to remove particular substances or co-treatment of combined effluent streams or both. The Emission Limit Values for effluent discharges to waters are set out in Table 5.2.

5.2. Reference Conditions

The limit values for discharges to water are based on 24 hour flow proportional composite samples unless otherwise specified.

Table 5.2 - Emission Limit Values for Discharges to Water*

Constituent Group or Parameter	Limit Value	Notes
pH	6 - 9	-
BOD	25 mg/l	-
Suspended Solids	35 mg/l	-
Toxic Units	1	1
Total Nitrogen(as N)**	>80% Removal **or** 15 mg/l	3
Total Phosphorus (as P)**	>80% Removal **or** 2 mg/l	3
Fish Tainting	No Tainting	2

* All values refer to daily averages, except where otherwise stated to the contrary, and except for pH which refers to continuous values. Values apply to effluent prior to dilution by uncontaminated streams e.g. stormwaters, cooling waters, etc.

** Only applicable to waters subject to eutrophication. One or both limits may apply, depending on the sensitivity of the receiving water.

Notes for Table 5.2:

1. The toxicity of the effluent shall be determined on an appropriate aquatic species. The number of Toxicity Units (TU) = 100/96 hr LC50 in percentage vol/vol. so that higher TU values reflect greater levels of toxicity.

2. No substances shall be discharged in a manner which, or at a concentration which, following initial dilution, causes tainting of fish or shellfish, interferes with normal patterns of fish migration or which accumulates in sediments or biological tissues to the detriment of fish, wildlife or their predators.

3. Reduction in relation to influent load. Total nitrogen means the sum total of Kjeldahl-Nitrogen plus nitrate-nitrogen plus nitrite-nitrogen.

6. COMPLIANCE MONITORING

The methods proposed for monitoring the emissions from these sectors are set out below.

6.1 WASTE WATER DISCHARGES:

1. Establish existing conditions prior to start-up, of key emission constituents, and salient flora and fauna.

2. Daily monitoring of flow and volume, continuous monitoring of pH. Monitoring of other relevant parameters as deemed by the Agency taking account of the nature, magnitude and variability of the emission, and the reliability of the control technologies.

3. Monitoring of influent and effluent from the waste water treatment plant to establish an early warning of any difficulties in waste water treatment plant, or unusual loads.

4. The potential for the treated effluent to have tainting and toxic effects should be assessed and if necessary measured by established laboratory techniques.

6.2 SOLID WASTE MONITORING:

1. The recording in a register of the types, quantities, date and manner of disposal of all wastes.

APPENDIX 1

MAIN EMISSIONS

1 INTRODUCTION:

In this section, the major sources of emissions to air and water are identified, as are the principal sources of waste from the sector. It should be borne in mind that the identified list of sources is not all encompassing, nor will every plant falling within an individual sector have every one of the emissions which are associated with the sector as a whole.

Some of the emissions are considered to have little potential environmental significance and these are designated as minor (m). (However, obviously there could be specific sites where this designation of minor may not be correct. Such emissions must then be examined on a one-off basis).

2. SOURCES OF EMISSION TO AIR FROM: (SYMBOLS REFER TO TABLE A1)

- Fugitive emissions of particulate matter from extraction storage and loading (S1).

3. SOURCES OF EMISSIONS TO WATER FROM: (SYMBOLS REFER TO TABLE A2)

- Contaminated stormwaters (E1)
- Contaminated drainage water (E1)
- Fuel tank leaks (m)

4. SOURCES OF WASTE (SYMBOLS REFER TO TABLE A3)

- Sludges from WWTP (W1)

Table A1 - Summary of Sources and Emissions to Air
(Symbols refer to Section 2.2 of Appendix)

Source	Emissions
S1	Particulates

Table A2 - Summary of Sources and Emissions to Water
(Symbols refer to Section 3.2 of Appendix)

Sources	Emissions
E1	Suspended Particulates

Table A3 - Summary of Other Releases
(Symbols refer to Section 4 of Appendix)

Source	Emission
W1	Peat

APPENDIX 4

The registration office of the company is:

Bord na Móna Allen Peat Limited
Main Street
Newbridge
Co. Kildare

The company's number in the Registration Office is:

303311

GENERAL OVERVIEW

Peat excavation commenced in Ireland around the 16th century as the forests were cut down and peat was used as the principal fuel. This peat excavation was small scale and turf was cut primarily for private use in the home. The potential to utilise bogs on a large scale for economic benefit was recognised in the early 19th century by the bog commissioners. The commission on bogs which was established in 1909 declared that it would be possible to drain nearly all the large bogs in the country naturally, and that such systematic drainage would open the way to proper development of the bogland resource.

In 1934 the Turf Development Board was established under the guidance of T.S. Andrews. The Board took over many small scale peat operations and undertook fact-finding missions to Russia and East Germany to investigate industrial peat production and utilised this knowledge at home. The advent of the Second World War put an urgency on the Board to develop bogs quickly because of fuel shortages and in 1938 surveys of the bogs of Ireland were being planned. In 1946 the Turf Development Board became Bord na Móna. Bord na Móna subsequently changed from sod peat to milled peat production because of the high costs associated with sod peat production.

Various bogs were acquired under Bord na Móna's first and second development programmes. The third development programme (1974) was implemented as a result of the oil crises of the 1970's. The government wanted to reduce dependency on imported fuels and asked Bord na Móna to increase production.

DESCRIPTION OF ACTIVITY

Overall schematic diagram of the peat extraction processes taking place within the Allen Group are illustrated in Figures 5.1 (milled peat production) and 5.2 (sod peat production).

MILLED PEAT PRODUCTION

Drainage

It can take up to five years to bring a bog from its undrained state (virgin bog) to a state where milled peat can be produced on it. Virgin bogs have a water content of approximately 95%. Bogs are typically drained in order to reduce the water content of the surface and increase bearing capacity. This permits the use of larger and, therefore, more economical machines in the production process and also substantially reduces the amount of water that has to be removed from peat during the drying process.

Before development work starts on a bog, the area is surveyed and a drainage plan is designed to suit the subsequent production system. The drainage plan generally involves a network of parallel open drains 15 m apart. The strip of bog between two drains is called a field. If a normal deep drain is opened within virgin bog its sides will collapse because of the soft nature of the bog. To overcome this difficulty the drains are deepened gradually. Progressively deeper ploughs are used every few months in order to lower the water content of the bog surface to a stage where it is firm enough to support normal open drains. After the bog has been drained it is levelled. This step removes vegetation and gives the area a gentle slope towards the nearest drain. This allows machinery to work at maximum efficiency and facilitates run-off of rainwater from the bog surface.

Drainage of water by gravity is not always possible in some of the low lying peatlands. Many of the bogs historically formed in lakes below the present river levels and pumping (Archimedean screw pumps which were previously used have been replaced by modern submersible pumps) is necessary for drainage of water.

Peat Milling Operations

For milled peat production the bog is laid out in a series of rectangular drying fields around 730 to 1830 m long and 14 m wide with drains located between. There are essentially four operations in milled peat production:

- Milling
- Harrowing
- Ridging
- Harvesting.

Milling

Special milling machines work their way along the field. The miller itself consists of a number of rotating drums fitted with pins to cut the peat. The rotating drums cut a thin layer of peat about 15 mm deep. This layer of peat is called a crop. Typically the water content of the crop is about 80%.

Harrowing

In the course of drying, the layer of peat is turned a few times to make the best use of available drying. This is achieved with a machine called a harrow. The milled peat is left to dry until its moisture content is down to between 40 and 50% which takes two or three days during good weather conditions.

Ridging

The dry milled peat is then scraped into long ridges running down the centre of each field. This is done with a ridger, a machine consisting of a series of blades in the shape of a V that opens the full width of the field.

Harvesting

Two production systems are used to stockpile peat:

- Peco
- Haku

In the Peco system every eleventh field is used to stockpile the peat and it receives the output of the five fields on either side. In the Haku system the output of each field is transported in trailers to large central stockpiles.

The process unit steps of milling, harrowing, ridging and harvesting are repeated for each crop and are collectively described as a cycle. In an average year 12 crops or production cycles are achieved.

TRANSPORT OPERATIONS

Milled peat produced is subsequently transported via rail from the peatlands to one or more of the following outlets:

- Power Stations (ESB)
- Briquette Factories (Bord na Móna Fuels Ltd)
- Horticultural Factories (Bord na Móna Horticulture Ltd)

SOD PEAT PRODUCTION

The production operations for sod peat production are stripping, cutting and spreading, harvesting/windrowing, turning, collecting and stockpile/protection.

ALLEN GROUP

The bogs designated to Allen Group are situated in counties Kildare and Offaly and are generally bounded by the Grand Canal to the North, the Barrow River and tributaries to the South, Naas to the East and Tullamore to the West (Drawing 2.2). These bogs comprise most of the bogland area that was formerly referred to as the 'Bog of Allen'. The Allen Group comprises the former sod peat bogs, Ballydermot, Clonsast, and Timahoe, the former milled peat bog at Lullymore and part of the old Derrygreenagh milled peat bog. Bord na Móna purchased all these bogs between 1946 and the late 1980's. The total acquired area is 21.150 hectares. The net production area assigned to Allen Peat Limited as part of the Allen Group when all the areas are developed for milled peat production is 9.200 hectares.

The Allen Group currently employs 160 permanent and 40 seasonal workers.

Operating Hours

Transport operations are carried out on a six day cycle throughout the year – each day 8 – 9 hours

Production operations are typically carried out over a 7 day week (weather permitting) for 12 to 15 hours duration per day.

BALLYDERMOT BOG, CLONSAST BOG, TIMAHOE BOG

The total aquired area encompassing Ballydermot bog, Clonsast Bog and Timahoe bog is 10,800 hectares. These bogs were purchased between 1946 and the early 1960's and were at peak production in the mid 1960's. The total sod peat production target at that time was 550,000 tonnes at 30% to 35% moisture content, for supply to Allenwood and Portarlington power stations and private customers. All these bogs are now designated for production for supply to the new power station at Edenderry. This excludes an area in Timahoe North which is still producing sod peat for Bord na Móna Fuels Ltd. The budget production target for 1999 is approximately 30.000 tonnes. This area will become part of Allen Peat Limited when it becomes cutover for sod peat.

LULLYMORE BOG

The total aquired area of the Lullymore bog is 1.100 hectares. Part of this bog was in milled peat production from the mid 1930's and supplying a small briquette factory. This was a private venture before the formation of Bord na Móna in 1946. Lullymore bog was subsequently in milled peat production supplying Lullymore briquette factory until its closure in 1992.

DERRYGREENAGH (ORIGINAL GROUP OF BOGS)

The total aquired area of the Derrygreenagh group of bogs is 9.250 hectares. All these bogs are in milled peat production since the mid 1950's supplying Rhode power station and Croghan briquette factory as part of the Derrygreenagh Group. The bogs that are not designated to the Allen Group as (Bord na Móna Allen Peat Limited) are reserved to supply the requirements of Rhode power station and Croghan briquette factory.

8.1 GENERAL OVERVIEW

Areas where peat accumulates are called peatlands, bogs or mires. In Ireland peatland originally covered 16.2% or 1.34 million hectares of the land area. Ireland has the third largest percentage peatland coverage in the world after Canada and Finland respectively. However, since the onset of mechanical extraction of peat and with more efficient and large scale drainage of peatlands for agriculture and forestry, the level of intact peatland has been dramatically reduced to 8% of the original amount of raised bog and 18% of blanket bog in the Republic of Ireland.

Peat is a biogenic deposit consisting of partly decomposed plant remains accumulating in an area where surface features cause water retention. In these wet conditions, which are characterised by low levels of oxygen, complete microbial aerobic decomposition of plants and other sources of organic matter cannot occur. The dead partially decomposed organic remains accumulate as an organic carbon source, i.e. peat. A combination of climatic and geomorphological factors has combined to make peatland formation particularly favourable in Ireland.

There are three major types of peatland in Ireland.

- Fen Peat
- Raised Bog
- Blanket Peat

These peat types can be classified according to their water source. Raised and blanket bogs are ombrogenous, that is, they receive their nutrients and moisture from atmospheric precipitation. Conversely fens are topogenous as their development is controlled by topography and groundwater. The formation of the various peat types is discussed briefly here.

8.1.1 FORMATION OF PEATLANDS

(i) Fens

When the last ice age ended about 10,000 years ago water accumulated in river valleys and poorly drained hollows. At the edges of these newly formed lakes, beds of reeds developed first, followed by rushes, sedges, grasses and herbs. As the vegetation grew the lake gradually became infilled and became a fen (Figure 8.1). The vegetation growing on a fen receives nutrients from the groundwater underneath, but as plants die

their dead remains accumulate on the fen surface and make it more difficult for roots of growing vegetation to reach groundwater. At this point an important development takes place as certain species of Sphagnum mosses able to survive on rain water which contains few nutrients, colonise the fen. As this happens the fen plants are gradually replaced by species which can survive in the much poorer, acidic conditions and a raised bog is formed (Figure 8.1).

(ii) Raised Bogs

Raised bogs have developed from fens as already discussed above and as the peat continues to accumulate it forms a flattened dome slightly higher than the surrounding countryside hence the name (Figure 8.1). They may be 9 – 12 m in thickness in their undrained state. Sphagnum mosses are the main component of raised bogs. Some form hummocks which may be up to a metre high capped by heathers and different mosses, while others are found in hollows and pools which occur beside the hummocks. The hummocks and hollows together with the variation in colour of Sphagnum mosses give raised bogs their characteristic appearance.

(iii) Blanket Peat

Moving from the raised bogs in the central plain of Ireland to the west the characteristics of the peatland change due to the high relief and increased rainfall. In general, when the rainfall exceeds 1,200 mm and falls on more than 250 days per year a blanket bog forms. In these conditions, commonly found on the west coast, the climate is so wet that peat may form directly on mineral soil without the initial formation of topogenic fen peat (Figure 8.1). Consequently, the entire landscape, except for very steep slopes with good drainage, is covered with peat.

Blanket bog can be divided into two categories.

- An Atlantic or lowland sub-type
- A Montane or mountain sub-type

Along the west coast of Ireland the division between the two types is made at the 150 m contour based on different plant species debris found contributing to the growth of the peat above and below this level.

8.2 PEAT PRODUCTION

A detailed description of the processes and operational procedures involved in peat extraction within Allen Group are presented in Figures 8.2 and 8.3.

8.2.1 DRAINAGE

In its virgin state, a peat bog ranges in moisture content from 95% near the surface to 90% in the deepest layer. The sphagnum mosses and other plants at the surface will only survive in these very wet conditions, depending, as they do, on rainfall alone for their nutrients.

Because of the high moisture content, a bog will not support heavy machinery. Efforts at reclamation or peat removal subsequently worked progressively from the edges as drainage was carried inwards. For large scale industrial production it was necessary to drain the whole bog systematically. Bogs are, therefore, drained in order to reduce the water content of the surface and increase bearing capacity. This permits the use of larger and, therefore, more economical machines in the production process and also substantially reduces the amount of water that has to be removed from peat during the drying process. Reducing the water content of the surface of a bog from 95% to 80% removes more than 75% of the water from the surface layer.

TABLE 8.1: MILLED PEAT PRODUCTION DRAINAGE (DITCHING) PROCESS - EMISSIONS & WASTE GENERATED		
IN **Materials Used**	**OUT** **Emissions**	**Waste/Disposal**
Peat	Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

In order to drain the bogs special tracked machines were designed with very low ground bearing pressure (< 2 psi). The drainage plan typically involves a network of parallel open drains 15 m apart (the strip of bog between two drains is called a field). Drains are first opened by towing a plough which cuts a drain 50 cm deep, simply by turning the sod over. The surface water is subsequently removed and the bearing pressure improves over time. After a year it is possible to deepen the drains further using a disk ditcher (Plate 8.1) or wheel ditcher (Plate 8.2) which scatters the spoil over 10 to 12 m of the adjacent ground. The drains are progressively deepened in this way over a period of 5 – 7 years until a stable drain 1.5 m deep is established and the

bearing pressure of the bog surface allows the use of heavier machines for levelling and subsequent peat production. The smothering of the vegetation by the spoil combined with the drainage prevents any further growth and the 'field' i.e. the 15 m or so between drains can be levelled and cambered in order to facilitate rainwater run off from the bog surface.

Depressions in the bog, which are identified during survey work, are also drained and piped to provide an outlet for the drainage water. Outfalls from the bog are developed and deepened along existing inadequate channels connecting the drainage to the river system.

Drainage of water by gravity is not always possible in some of the low lying peatlands. For sod peat operation where deep excavation is an intrinsic part of the process, pumps had to be installed to effect drainage. Archimedean screw pumps powered by electric motors were used, lifting the water up to 6 m. Power supply was available from the network installed to supply the electrically driven bagger excavator. Many bogs historically formed in lakes below the present river levels and pumping is necessary for drainage. In recent times, the Archimedean screw pump has been replaced by modern submersible pumps. Because of the remote bog locations power supply is expensive, therefore, the use of wind power is currently undergoing consideration. Historically this was not economical but the rapid advances in wind power technology may make it possible in the future.

For sod peat production trenches were initially machine dug at 250 yard centres with smaller drains (subs) at 125 yard centres. The trenches were typically dug to 1.5 - 2.0 m depth. Cross drains were also dug and piped to drain trenches. It should be noted that this drainage step is a once off process step carried out to drain the bog prior to sod peat production.

TABLE 8.2: SOD PEAT PRODUCTION DRAINAGE PROCESS - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Emissions to surface water Minor - Noise	None

8.2.2 BOG PREPARATION

Screw levelling operations of bog areas are carried out approximately every three years. Selected bog sections are screw levelled annually in order to maintain the cumber on the production fields. This operation is carried out using a screw leveller or grader (Plate 8.3). This is a spiral type machine unit, towed and powered by a tractor, which screws out the raw bog from the edge of the field drain to the centre of the field. Levelling turning grounds is effected by a bulldozer. Railway drains (which run each side of permanent rail lines) and boundary drains are drains (which are around the edge of production bogs) are opened and cleaned by hydraulic digger.

TABLE 8.3: MILLED PEAT PRODUCTION BOG PREPARATION - EMISSIONS & WASTE GENERATED		
IN Materials Used	**OUT Emissions**	**Waste/Disposal**
Peat	Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

Bog preparation for sod peat production simply involves the levelling of the spreading ground, prior to the cutting process, using a bulldozer unit.

TABLE 8.4: SOD PEAT PRODUCTION BOG PREPARATION - EMISSIONS & WASTE GENERATED		
IN Materials Used	**OUT Emissions**	**Waste/Disposal**
Peat	Minor - Noise	None

8.2.3 PEAT PRODUCTION AND PROCESSING

8.2.3.1 Milled Peat Production

The product milled peat is the term used to describe peat in a powder or crumb form. It has a mean particle size of about 6.0 mm in diameter ranging from about 15.0 mm to fine dust. Milled Peat is generally used for electricity generation, and also as the raw material for the production of peat briquettes. While the production system is basically the same milled moss is the term used to describe peat which is used in the horticultural industry (peat of larger particle size). Milled moss is used as the raw material for a wide variety of products which require further processing.

Most milled peat has a loose bulk density of between 120 and 400 kg/m^3 or an average of 270 kg/m^3, (depending on the degree of decomposition of the peat). In general for fuel peat the higher density is preferred, but for binding and suitable ash content, peat of e.g. humification H^6 to H^8 on the "Von Post" scale, is preferred for briquetting and electricity generation (~ 270 kg/m^3). It is desirable that anhydrous ash content should not exceed 5%. Anhydrous milled peat has an average calorific value of 21.95 Mj/kg.

(i) Peco System

Milled peat is a very economical system of peat production, but very dependant on weather conditions. What is known as the "Peco System" is used by the Bord na Móna. The bog layout for this system is shown on Figure 8.4. The Peco System harvest cycle is based on 2 to 3 consecutive days of solar drying which gives an average of 12 harvests per year, yielding 185 tonnes per net production hectare at an average of 50% moisture content.

For the purpose of the Peco production system the production area is divided into units of eleven fields, comprising a central stockpile field with five production fields on either side. The stockpile field can accommodate up to 20 harvests of milled peat.

The production operations for the Peco system i.e. ditch edge milling, milling, harrowing, ridging, harvesting, stockpile protection, loading and transportation are described.

Ditch Edge Milling

Before production begins the fields are cambered along the drain edges by a machine known as the Ditch Edge Miller (Plate 8.4), which consists of a pinned roller mounted on the three point linkage of a 140 hp tractor. The power driven roller is set at an angle of 60° to the drain edge, so that the peat which is removed from the drain edge is directed towards the centre of the production field, and undergoes the remaining production processes.

The purpose of offset milling is to ensure that the fields are cambered towards the drains to provide effective run-off for rainfall.

Light Pin Milling

Milling is the operation which cuts a thin layer about 12 mm (1/2") of peat from the surface of the production field by means of a power driven pinned roller (Plate 8.5). The miller unit is powered and towed by a 140 H.P. tractor, and has a cutting (milling) width of 7.0 m. thus requiring two runs of the attachment for each production field. The attachment is supported on ground rollers and has a hydraulically operated depth control.

TABLE 8.5: MILLED PEAT PRODUCTION MILLING PROCESS - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Dust (emission is minor given the high moisture content of the peat) Minor - Noise	None

Harrowing

In order to speed up the solar drying process on the open peat surface, a spoon harrow (Plate 8.6) spanning the full width of the production field and towed by a 65 H.P. tractor, is used to turn over the milled peat a number of times. The effect of this process step is to increase the area of the peat layer exposed to the drying elements and therefore increase the rate of drying. The correct result can only be achieved if the harrow unit is travelling at the correct speed. In dry anticyclonic weather conditions the number of harrowings per crop will vary from two to five depending on drainage conditions and the rate of evaporation. The harrow consists of 88 No. steel spoons mounted uniformly over the total width. The main objective of the harrowing process is to reduce the moisture content of the peat from 68% to 72% after the milling process to an acceptable 45% - 50% moisture content.

TABLE 8.6: MILLED PEAT PRODUCTION HARROWING PROCESS - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Dust Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

Ridging

When the moisture content of the peat has been reduced to between 45% and 50%, the peat is moulded into triangular shape ridges in the centre of each production field. The operation is performed by a ridger unit (Plates 8.7 and 8.8), towed by a 140 H.P. tractor. The ridger unit has two blades supported on a tracked frame. The blades form a V-shape in plan behind the tractor, and are set at an angle of 30° to direction of travel. The blades are made of aluminium with stainless steel sole-plates which are constructed in hinged sections to facilitate the surface contours of the production field. The two blades span the full width of the production field, and are hydraulically operated.

TABLE 8.7: MILLED PEAT PRODUCTION RIDGING PROCESS - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Dust Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

Harvesting

A harvesting unit (Plate 8.9) towed by a 140 H.P tractor, sometimes fitted with half-track, follows the ridger to pick up the milled peat ridge in the centre of the field and transfer it to the centre of the adjacent field. The harvester picks up the peat by means of a potato chain pick up system, and delivers it onto the jib-belt which transfers it to the centre of the next field. This process is then repeated, field by field, until the peat on the five fields each side of the designated stockpile field are transferred onto the stockpile. Because harvesters are designed with the jib positioned on the left hand side you have a one-way anti-clockwise harvesting cycle around the stockpile. The potato chain pick up unit is hydraulically operated and can be raised to facilitate idle travel of the harvester unit.

TABLE 8.8: MILLED PEAT PRODUCTION HARVESTING PROCESS - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Dust Minor - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

This operation completes the production cycle, which is repeated continuously with the commencement of the milling operation in favourable weather conditions.

Stockpile Protection

The stockpiles are compacted, on either side, by large rollers drawn by 65 H.P. tractors. This counteracts high winds and heavy rainfall and aids in the exclusion of air. The roller assembly is articulated so that the rolling unit can follow the profile of the stockpile. This operation is usually carried out every third harvest which also reduces the actual size of the stockpile.

TABLE 8.9: MILLED PEAT PRODUCTION STOCKPILE PROTECTION - EMISSIONS & WASTE GENERATED		
IN **Materials Used**	**OUT** **Emissions**	**Waste/Disposal**
None	Minor - Discharge of peat particles to silt ponds via surface water drainage network Minor - Dust, Noise	None

Polythene Covering of Stockpiles

At the end of the production, selected stockpiles are covered with polythene film (250 - 350 gauge sheets ranging in width from 7.0 m to 12.0 m x 100.0 m long). The polythene sheets are rolled out over the stockpiles and secured in position by spreading evenly over it a layer of high moisture content milled peat (Plate 8.10).

TABLE 8.10: MILLED PEAT PRODUCTION POLYTHENE COVERING OF STOCKPILES - EMISSIONS & WASTE GENERATED		
IN **Materials Used**	**OUT** **Emissions**	**Waste/Disposal**
Peat Polythene	Minor - Discharge of peat particles to silt ponds via surface water drainage network Minor - Dust (emissions may occur on placement of milled peat on the polythene cover) Minor - Noise	None

The purpose of polythene covering is to keep stock dry, to protect it against wind erosion, and to inhibit spontaneous combustion in certain types of peat by the exclusion of as much air as possible.

Stock Survey and Quality Control

Immediately after the end of the production season, a stock pile survey is conducted. Samples are taken at pre-determined locations for moisture content, density, and ash content. Samples of the peat are extracted by a steel tube specially designed for this purpose and laboratory analysed. From this data, charts are prepared of each production area showing the stockpile peat quality, i.e. moisture, density, ash. This information is essential for quality control when drawing up a dispatch programme.

(ii) Haku Production System

In the late 1980's the "Haku" production system was introduced in some areas, especially where peat shallows were appearing, i.e. subsoil appearing on the field surface, and the normal "eleven field production system" could not continue.

The primary difference between the "Haku" and "Peco" system is the method by which the peat is harvested and stockpiled.

In the Peco system the peat ridges are moved laterally from field to field by self-loading harvesters until it eventually reaches the stockpiles, which run parallel to the production fields. These stockpiles are normally 3 to 4 m high x 1000 to 3000 m long. Using the Haku system the dried peat (40% - 50% moisture content) is lifted from the single ridges into 18 m^3 sidetipping tracked trailers (Plate 8.14) and towed by 110 H.P tractors to large stockpiles convenient to road or rail transport. These stockpiles can be as high as 15.0 m and containing >10.000 tonnes of milled peat.

8.2.3.2 Sod Peat Production

Manual Production: Manual hand cutting of peat was the traditional method of producing peat (turf) for domestic fuel over the centuries in Ireland, and it is still continued in some areas. It is very labour intensive, as all operations involved in cutting and saving the turf are carried out by hand.

Machine Production: Attempts to mechanise sod peat production in Ireland date back to the middle of the last century, but it was not until the acquisition of a German turf cutting machine by the Turraun Peat Works in 1924 that machine turf production became a real possibility. Following the establishment of Bord na Móna in 1946, a large scale sod peat production programme was adopted. After carrying out many modifications and re-design work the German machine called a "Bagger" was capable of

coping with the varying peatland conditions and operational problems associated with the Irish Midland Peat Reserves. At peak sod peat production in the mid 1970's the Board operated 42. No. Standard Baggers and 6 No. Lilliput Baggers to produce 900,000 tonnes of dried sod peat per annum.

Figure 8.5 shows the bog layout for standard Bagger sod peat production. The output from these Baggers yields 12 to 16 tonnes per hour of sod peat at about 35% moisture content and an annual output of 20,000 tonnes per machine. The drying process is aided by other specialised machines which turn the sods and arrange them into rows ready for transfer to stockpiles.

(i) German Bagger

The production operations for Bagger sod peat production i.e. stripping, cutting and spreading, harvesting/windrowing, turning, collecting and stockpile/protection; are outlined.

Stripping

Stripping involves the removal of the overburden of mossy peat from the surface of the cutting trench. The stripping machine designed for this purpose travels on tracks powered by a 45 H.P diesel engine.

TABLE 8.11: SOD PEAT PRODUCTION STRIPPING PROCESS - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Discharge of peat particles to surface water drainage trenches Minor - Noise	None

Cutting and Spreading

The "Bagger" is a fully automatic excavator cutting a two metre wide face 3 - 4 m deep. It is a full track machine, weighs 45 tonnes, with a ground bearing pressure of 2 lbs/inch^2. It is electrically driven, the supply being brought to the machine by means of a flexible trailing cable coupled to a 3 phase overhead power line system operating at 3.3 K.V.

TABLE 8.12: SOD PEAT PRODUCTION CUTTING & SPREADING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	**OUT Emissions**	**Waste/Disposal**
Peat	Minor - Discharge of peat particles to surface water drainage trenches Minor - Noise	None

The macerator is the kernal of the Bagger. It consists of a casing which houses twin counter shafts revolving at 182 R.P.M., each carrying an assembly of transport screws and mixed blades made of special design to mix, macerate and extrude the peat onto the spreader arm.

Harvesting/Windrowing

The development which made the most significant contribution to increasing productivity in the sod peat industry was the mechanisation of harvesting operations. In 1952 Heseper Torfwerk carried out successful trials in Germany with a windrowing machine. This machine was adopted by the Board. It is fully automatic, operated by one person, and has an output of 20 tonnes of dry turf/hour.

TABLE 8.13: SOD PEAT PRODUCTION HARVESTING/WINDROWING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	**OUT Emissions**	**Waste/Disposal**
Peat	Minor - Noise	None

Turning Machine (not carried out under normal drying conditions)

Heseper Torfwerk also designed and built a turning machine to work in conjunction with the windrower. This machine has an output of 20 tonnes of dry turf/hour. Bord na Móna Engineers re-designed this machine which increased its output to 40 Tonnes/hour.

Collecting

With the advent of windrowing and turning machines the sod collector was re-designed and fitted with pick up elevators along the collecting conveyor. The elevators pick up the sods which have been placed in rows by the turning machine. The automatic collector has an output of 40 tonnes per hour, and operates with a crew of two people, compared with a crew of 21 people on the previously used hand fed collector.

TABLE 8.14: SOD PEAT PRODUCTION COLLECTING PROCESS - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Dust (only occurs during extremely dry weather conditions) Minor - Noise	None

Stockpile Protection

Sod peat is stored in stockpiles on the bogs, and must be protected from the weather during the winter months and early spring in order to control the moisture content. The stockpiles are covered with 350 gauge clear polythene, secured by a cord and peg system. A polypropylene cord (with a 275 lb breaking load) is used. The pegs securing the cord measure 3 cm x 3 cm x 75 cm.

TABLE 8.15: SOD PEAT PRODUCTION STOCKPILE PROTECTION - EMISSIONS & WASTE GENERATED

IN Materials Used	OUT Emissions	Waste/Disposal
Peat Polythene Polypropylene cord	Minor - Noise	None

(ii) Small Sod Peat Production Machines

Small sod peat production machines with outputs of 3000 to 6000 tonnes per annum of air dried peat (at about 35% moisture content) became available in the mid 1980's. These machines can be powered by standard large agricultural tractors 60 - 80 H.P. and are very suitable for small production operations. Some of the various types available are: Chainsaw Type, Surface Machine and Field Press Machine.

Chainsaw Type

This machine has a digging blade 1.0 M to 1.7 M long, with spoons attached, which carries the peat into the macerator/extrusion chamber. The peat is then extruded through, up to 10 No x 10 cm diameter square outlets with outputs of about 5.0 tonnes per hour of air dried turf.

Surface Machine

This machine has a combined horizontal feeding screw and a vertical cutting disc. Peat extraction is from the top 10 cm to 30 cm of the bog. Output is from 3 to 4 tonnes per hour of air dried peat. The peat quality is normally low density and rather poor turf.

Field Press Machine

This is a self propelled or tractor drawn extrusion machine, which is fed by an excavator operating from a face bank. The "Field Press" mixes, macerates and extrudes the peat in continuous sod form on an adjacent spread area. Output is 3 to 4 tonnes per hour of air dried turf.

8.2.4 Peat Loading, Transfer & Unloading Operations

In accordance with the dispatch programme, and in order to maintain a proper blend and continuity of supply to the customer, loading and haulage are carried out from a number of stockpiles at any given time. Loading to wagons is carried out by a hydraulic excavator (Plate 8.11). This peat is subsequently transported by rail (Plate 8.12) into the transport yard where the peat is unloaded by rotary tippler (Plate 8.13) into the power station/briquette factory/horticulture works peat bunker. The peat is then taken to the generating station/factory unit by conveyor belt.

Table 8.16: Milled Peat Production Peat Loading, Transfer & Unloading Operations - Emissions & Waste Generated

IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Discharge of peat particles during loading operations to silt ponds via surface water drainage network Major - Dust (during loading & transfer operations on the bog and during unloading operations at the tippler area) Minor - Noise	Polythene (removed from peat stockpiles during loading operations at the bog) material

TABLE 8.17: SOD PEAT PRODUCTION TRANSFER OPERATIONS - EMISSIONS & WASTE GENERATED		
IN **Materials Used**	**OUT** **Emissions**	**Waste/Disposal**
Peat	Major - Dust (during loading operations on the bog and during unloading operations at the works yard area) Minor - Noise	Polythene (removed from sod stockpiles during loading operations at the bog)

8.2.4.1 Railways

All transportation of harvested peat from the surface of the bogs to the receiving facilities is by narrow gauge (0.90 m) railway. A typical milled peat train would consist of 15 to 20 wagons of 16 m^3 capacity or 75 to 100 tonnes net weight of peat per train.

(i) Total Length of Track

The total length of Board track is now over 1300 km. of which about 800 km is permanently laid, the remaining 500 km of temporary track may be laid and lifted up to 12 times in a year to allow haulage of peat from about 3500 km of stockpiles.

(ii) Type of Rail

Most of the track is in 35 lbs/yd/B.S.R. Rail. i.e. 35 Lbs weight per linear yard of rail. British Standard revised type. A small amount of track is in 30 lbs/yd, and rail approaching receiving facilities is in 50 lbs/yd (older lines are 50 - 60 lbs/yd). The rail is laid on steel trough sleepers, using a rail layer (Plate 8.15), which is attached by steel rail-clips and clip-bolts. The rails are attached to each other longitudinally by steel fish-plates and 4 No. fishbolts per connection. Track is prepared in standard lengths of 30 feet and weights about 1200 lbs (545 kg). There are over 2000 No. turnouts or switches within the system, the turnout angle is generally 1/4, but 1/3 and 1/6 is also in use. Rail switches are left hand or right hand, but occasionally two-way or three-way switching is required, i.e. left hand right hand and straight through, and also cross-overs are sometimes required.

(iii) Design of Rail System

Curves on permanent track are rarely less than 300 feet radius, and on temporary track usually 150 ft radius. Gradients on permanent track less than 1/150 are not recommended. Gradient is a very important factor from haulage and safety viewpoints, since both traction and breaking are proportionate to hauling locomotive weight. Before the design and layout of any rail system commences, a detailed topographic survey is carried out. Where crossings of rivers, streams or roadways are involved then a detailed assessment of any future alterations or excavations is necessary, e.g. Local Authorities may have plans to re-align roadways or deepen inverts of rivers etc. There is almost always a drainage problem when crossing under a roadway by an underbridge, because the design rail level is usually 4.0 m below the roadway surface level, and at this level it is unlikely that gravity drainage is available except when the site is at an elevated roadway location.

(iv) Level Crossings

At locations where crossings by underbridges was not feasible due to ground topography, level crossing with gates were constructed. Level crossing gates were designed for each particular crossing, as the angle of crossing and foundation material always varied from one location to another. Standard level crossing lamps with light sensors that switches to light on when daylight fades are fitted to all crossing gates. Catch points are also fitted into the railway track on either side of level crossing gates. This is standard safety practice in order to de-rail any runaway trains before the reach the level crossing.

(v) Track Maintenance

Continuous inspection and maintenance of railway track and rail beds is essential in order to prevent de-railments and other accidents. Operating a rail system with a large volume of rolling stock requires constant supervision and safety precautions must always be to the forefront.

8.3 ALLEN GROUP

The bogs designated to Allen Group are situated in counties Kildare and Offaly and are generally bounded by the Grand Canal to the North, the Barrow River and tributaries to the South, Naas to the East and Tullamore to the West (Drawings 2.2, 8.1a - 8.1d). These bogs comprise most of the bogland area that was formerly referred to as the 'Bog of Allen'. The Allen Group comprises the former sod peat bogs, Ballydermot, Clonsast, and Timahoe, the former milled peat bog at Lullymore and part of the old Derrygreenagh milled peat bog. Bord na Móna purchased all these bogs between 1946 and the late 1980's. The total acquired area is 21,150 hectares. The net production area assigned to Allen Peat Limited as part of the Allen Group when all the areas are developed for milled peat production is 9,200 hectares.

The total area has peat depths typically ranging from about 6.0 metres to 9.0 metres and an average depth of 7.50 metres, comprising younger and older sphagnum mosses, sedge peat, woody fen and reed swamp peat.

About 85% of the general area is in the River Barrow catchment and the remaining 15% in the River Boyne catchment. Drainage is divided between gravity and pumped drainage, and the percentage pumped varies according to the particular bogs in production.

8.3.1 BALLYDERMOT BOG, CLONSAST BOG, TIMAHOE BOG

The total aquired area encompassing Ballydermot bog, Clonsast Bog and Timahoe bog is 10,800 hectares. These bogs were purchased between 1946 and the early 1960's and were at peak production in the mid 1960's. The total sod peat production target at that time was 550,000 tonnes at 30% to 35% moisture content, for supply to Allenwood and Portarlington power stations and private customers. All these bogs are now designated for production for supply to the new power station at Edenderry. This excludes an area in Timahoe North which is still producing sod peat for Bord na Móna Fuels Ltd. The budget production target for 1999 is approximately 30,000 tonnes. This area will become part of Allen Peat Limited when it becomes cutover for sod peat.

Ballydermot Works, ClonsastWorks & Timahoe Works

Operations take place at Ballydermot, Clonsast and Timahoe works include repair, maintenance and routine fuelling of machinery.

8.3.2 LULLYMORE BOG

The total aquired area of the Lullymore bog is 1,100 hectares. Part of this bog was in milled peat production from the mid 1930's and supplying a small briquette factory. This was a private venture before the formation of Bord na Móna in 1946. Lullymore bog was subsequently in milled peat production supplying Lullymore briquette factory until its closure in 1992.

8.3.3 DERRYGREENAGH (ORIGINAL GROUP OF BOGS)

The total aquired area of the Derrygreenagh group of bogs is 9.250 hectares. All these bogs are in milled peat production since the mid 1950's supplying Rhode power station and Croghan briquette factory as part of the Derrygreenagh Group. The bogs that are not designated to the Allen Group as (Allen Peat Limited) are reserved to supply the requirements of Rhode power station and Croghan briquette factory.

CUTAWAY ACREAGE

Due to sod and milled peat production over many years, some bog areas are now cutaway, other areas are cutover in relation to sod peat production and are being prepared for milled peat production. Other cutaway or cutover areas are leased to Coillte Teoranta and planted.

Other suitable areas were reclaimed to grasslands in the old Derrygreenagh milled peat bog and Lullymore bog.

ENVIRONMENTAL POLICY STATEMENT

Bord na Móna is a commercial semi-state body with responsibility to develop Irelands peat resources in the national interest.

Bord na Móna is committed to gather and make available information on all aspects of its environmental impact and to help improve understanding among the public generally of its role and of the importance of Irish peatlands.

Bord na Móna recognises the importance of peatland conservation.

Bord na Móna will leave behind all areas it owns as either an economically or socially integrated resource of a high environmental value.

Bord na Móna. Allen Peat Ltd. seeks to conduct all aspects of its business in an environmentally sensitive value.

Bord na Móna Allen Peat Ltd. will establish an environmental management system specifically addressing the following impacts:

- Discharges to water
- Emissions to atmosphere
- Waste disposal
- Use of natural resources
- Noise. vibration, odour, dust and visual effects
- Natural environment and eco-system

The environmental management system will be monitored. maintained and continually improved.

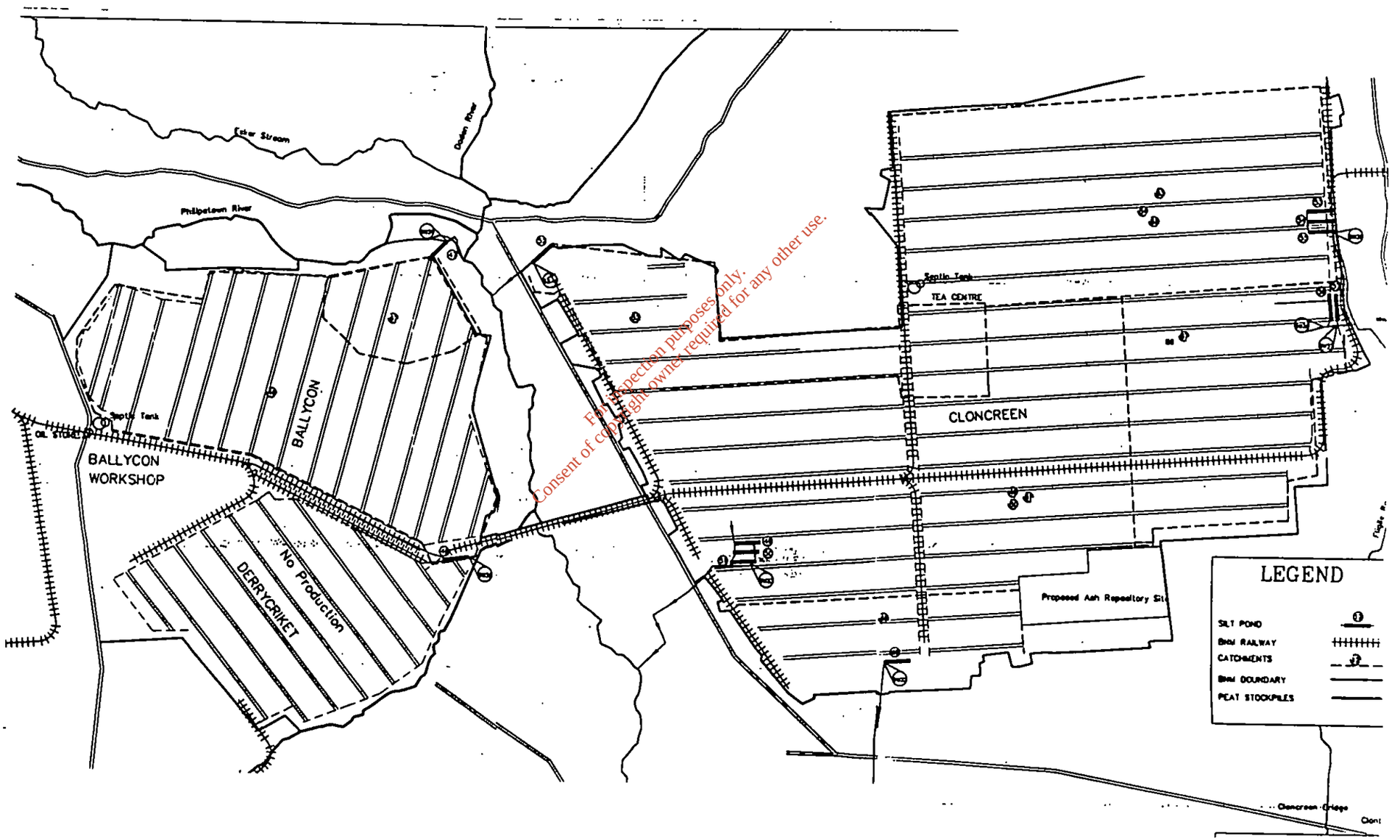
A system of regular environmental audits will be put in place.

Bord na Móna Allen Peat Ltd. will continue research and development (R & D) into all aspects of its environmental impact.

This statement is published and is available at all locations within the section and its contents are brought to the attention of all employees.

APPENDIX 9

APPENDIX 6



APPENDIX 7

Allen Group IPC Licence Silt Pond Data Sheet

Silt pond ID	Emission Pt.	Emission Pt. Grid ref.	** Catchment Area (Hectares)	Pond Capacity (M^3)	*** Norm.Daily Run-off M3/D	**** Max.Daily Run-off M3/D	***** Receiving Water	****** Discharge Pt. Grid Ref.	Additional Information
Derries									
DS1			70	720	1606.5	56000	S.P. DS2		Double
DS2	SW1	E240630 N230260	70	252	1606.5	56000	Big River (Yellow)	E241050 N231985	Double
DS3			98	343	2249.1	78400	S.P. DS4		Triple
DS4			98	553	2249.1	78400	S.P. DS5		Triple
DS5	SW2	E239570 N239440	98	392	2249.1	78400	Silver River	E238000 N231650	Triple
DS6	SW3	E238742 N230980	7	280.8	160.65	5600	Silver River	E238000 N231650	Single
DS7	SW4	E238902 N231280	17	324	390.15	13600	Silver River	E238000 N231650	Single
DS8	SW5	E239070 N231717	35	482.4	803.25	28000	Silver River	E238000 N231650	Single
DS9	SW6	E239380 N231950	30	532	688.5	24000	Silver River	E238000 N231650	Single
DS10	SW7	E240395 N231820	35	600	803.25	28000	Silver River	E238000 N231650	Single
Rathdrum									
RD11			125	1022	2868.75	100000	S.P. RD12		Triple
RD12			125	1078	2868.75	100000	S.P. RD13		Triple
RD13	SW8	E244050 N228600	125	1141	2868.75	100000	Grand Canal	E245200 N227860	Triple
RD14			93	1015	2134.35	74400	S.P. RD15		Double
RD15	SW9	E241219 N229960	93	252	2134.35	74400	Big River (Yellow)	E245200 N227860	Double
RD16			125	540	2868.75	100000	S.P.RD17		Double
RD17	SW10	E243880 N228450	125	540	2868.75	100000	Grand Canal	E245200 N227860	Double
Clonad									
CL18			198	1711.5	4544.1	158400	S.P. CL19		Double
CL19	SW11	E247665 N225480	195	1617	4475.25	156000	Philipstown River	E247560 N225590	Double
CL20	SW12	E247500 N225500	50	1533	1147.5	40000	Philipstown River	E247560 N225590	Single
CL21			70	252	1606.5	56000	S.P. CL21		Double
CL22	SW13	E245750 N223120	70	1015	1606.5	56000	Tullamore River	E245550 N222250	Double
Ballykean									

[redacted]

Silt pond ID	Emission Pt.	Emission Pt. Grid ref.	Catchment Area (Hectares)	Pond Capacity (M^3)	Norm.Daily Run-off M3/D	Max.Daily Run-off M3/D	Receiving Water	Discharge Pt. Grid Ref.	Additional Information
BK23	SW14	E250850 N219880	29	864	665.55	23200	Cushina River	E252840 N218480	Single
BK24	SW15	E250033 N220160	22	62.4	504.9	17600	Cushina River	E250090 N219530	Single
BK25			75	823.2	1721.25	60000	S.P. BK25		Double
BK26	SW16	E249480 N220320	75	472.5	1721.25	60000	Cushina River	E250090 N219530	Double
BK27			95	673.2	2180.25	76000	S.P. BK28		Double
BK28	SW17	E250990 N221810	95	396.8	2180.25	76000	Cushina River	E250090 N219530	Double
BK29			109	86	2501.55	87200	S.P. BK30		Double
BK30	SW18	E25030 N21986	109	60	2501.55	87200	Cushina River	E250250 N219790	Double
Mountlucas									
ML31			103	375	2363.85	82400	S.P. ML32		Single
ML32	SW19	E253220 N225500	103	321	2363.85	82400	Philipstown River	E250050 N225550	Double
ML33				408	0	0	Philipstown River	E253900 N227450	Double
Cavemount									
CM34	SW20	E251715 N229475	116	714	2662.2	92800	Esker Stream	E251660 N229710	Single
CM35	SW21	E251626 N229782	140	1030.4	3213	112000	Esker Stream	E251660 N229710	Single
CM36	SW22	E251319 N229948	96	1646.4	2203.2	76800	Esker Stream	E251440 N229820	Single
CM37	SW23	E252350 N229530	44	2110	1009.8	35200	Esker Stream	E252370 N229410	Single
Esker									
EK38	SW24	E254246 N229727	108	738	2478.6	86400	Esker Stream	E254280 N229710	Single
EK39	SW25	E254019 N229250	72	1050	1652.4	57600	Esker Stream	E254030 N229220	Single
EK40			157	960	3603.15	125600	S.P. EK41		Triple
EK41			157	1020	3603.15	125600	S.P. EK42		Triple
EK42	SW26	E255790 N228210	169	1887	3878.55	135200	Doden River	E255820 N228210	Triple
EK43	SW27	E255755 N228180	169	656	3878.55	135200	Doden River	E255820 N228140	Single
EK44	SW28	E256040 N227514	70	1330	1606.5	56000	Doden River	E255970 E227330	Single
EK45	SW29	E253670 N227880	97	3444	2226.15	77600	Esker Stream	E253690 N227800	Single
Ballycon									
BC46	SW30	E255860 N225340	206	2992	4727.7	164800	Philipstown River	E255910 N225340	Single
BC47	SW31	E255695 N227050	32	1597.5	734.4	25600	Philipstown River	E255700 N227060	Single

Silt pond ID	Emission Pt.	Emission Pt. Grid ref.	Catchment Area (Hectares)	Pond Capacity (M^3)	Norm.Daily Run-off M3/D	Max.Daily Run-off M3/D	Receiving Water	Discharge Pt. Grid Ref.	Additional Information
Cloncreen									
CC48	SW32	E258110 N224800	70	546	1606.5	56000	Philipstown River	E258020 N223460	Single
CC49			300	2835	6885	240000	S.P. CC50		Triple
CC50			300	4160	6885	240000	S.P. CC51		Triple
CC51	SW33	E257390 N225320	300	3600	6885	240000	Philipstown River	E225790 N226160	Triple
CC52	SW34	E256180 N226940	115	441	2639.25	92000	Philipstown River	E255950 N226770	Single
CC53			240	2170	5508	192000	S.P. CC54		Triple
CC54			240	2170	5508	192000	S.P. CC55		Triple
CC55	SW35	E260530 N227240	240	2170	5508	192000	Figile River	E260960 N226560	Triple
CC56	SW36	E260540 N226690	70	1220	1606.5	56000	Figile River	E260960 N226560	Double Parallel
CC57	SW37	E260580 N226680	70	976	1606.5	56000	Figile River	E260960 N226560	Double Parallel
Clonsast Nth									
CTN58			45		1032.75	36000			Proposed
CTN59			45		1032.75	36000			Proposed
CTN60			45		1032.75	36000			Proposed
CTN61			262		6012.9	209600			Proposed
Clonsast									
CT62	SW38	E257085 N220311	282	700	6471.9	225600	Figile	E259500 N218600	Single
Garrymore									
GM63	SW39	E245080 N210928	70	800	1606.5	56000	Cotteners Brook	E245090 N210960	Single
GM64	SW40	E244920 N211160	150	324	3442.5	120000	Cotteners Brook	E244972 N211160	Single
GM65	SW41	E244810 N211470	110	180	2524.5	88000	Cotteners Brook	E244810 N211480	Single
GM66	SW42	E245210 N210900	210	240	4819.5	168000	Cotteners Brook	E245210 N210900	Single
Derrylea									
DL67	SW43	E257940 N214720	124	1200	2845.8	99200	Figile(Black River)	E261300 N213990	Single
DL68	SW44	E255410 N215790	296	2400	6793.2	236800	Figile(Black River)	E255450 N215884	Single
DL69			138		3167.1	110400			Proposed
Codd Sth									
CDS70			120	914.4	2754	96000	S.P. CD71		Double

Silt pond ID	Emission Pt.	Emission Pt. Grid ref.	Catchment Area (Hectares)	Pond Capacity (M^3)	Norm.Daily Run-off M3/D	Max.Daily Run-off M3/D	Receiving Water	Discharge Pt. Grid Ref.	Additional Information
CDS71	SW45	E263590 N226590	120	1384	2754	96000	Figile River	E263650 N226630	Double
Codd Nth									
CDS72			255	3600	5852.25	204000			Proposed
Clashbau N									
CBN73	SW46		423		9707.85	338400	CDN72		Proposed
Ticknevin									
TN74			95		2180.25	76000			Proposed
TN75			236		5416.2	188800			Proposed
Clashbau S									
CBS76	SW47	E268590 N228380	38	1800	872.1	30400	Cushling River	E268380 N228380	Single
CBS77	SW48	E268790 N228220	38	1800	872.1	30400	Cushling River	E268380 N228380	Single
CBS78	SW49	E269000 N228109	30	1068	688.5	24000	Cushling River	E268380 N228380	Single
CBS79	SW50	E269071 N228080	30	204	688.5	24000	Cushling River	E268380 N228380	Single
CBS80	SW51	E266430 N226760	70	240	1606.5	56000	Crabtree	E266500 N226280	Single
CBS81	SW52	E266510 N226540	70	382	1606.5	56000	Crabtree	E266500 N226280	Single
CBS82	SW53	E266700 N226370	70	264	1606.5	56000	Crabtree	E266500 N226280	Single
Derrybrenna									
DB83	SW54	E270410 N228700	30	492	688.5	24000	Abbeylough River	E270700 N228760	Single
Lullymore									
LM84	SW55	E268580 N225777	95	615	2180.25	76000	Crabtree River	E267077 N225560	Single
LM85	SW56	E268730 N225720	95	405	2180.25	76000	Crabtree River	E267077 N225560	Single
Killinagh									
KN86	SW57	E271970 N226560	16	340	367.2	12800	Slate River	E273350 N224320	Single
KN87	SW58	E271530 N226990	29	344	665.55	23200	Slate River	E275350 N224320	Single
KN88	SW59	E270450 N227110	89	232	2042.55	71200	Crabtree	E267077 N225560	Single
Lullybeg									
							S.P. LM74/75		
Lullymore E									
Lodge									

Silt pond ID	Emission Pt.	Emission Pt. Grid ref.	Catchment Area (Hectares)	Pond Capacity (M^3)	Norm.Daily Run-off M3/D	Max.Daily Run-off M3/D	Receiving Water	Discharge Pt. Grid Ref.	Additional Information
LG89	SW60	E273050 N224630	153	7200	3511.35	122400	Slate River	E273350 N224320	Double Parallel
LG90	SW61	E273017 N224570	153	5520	3511.35	122400	Slate River	E273017 N224570	Double Parallel
Barnaran									
BN91	SW62	E267950 N223672	130	4800	2983.5	104000	Figile River	E267800 N224000	Double Parallel
BN92	SW63	E267954 N223642	130	4800	2983.5	104000	Figile River	E267800 N224000	Double Parallel
Blackriver									
BR93	SW64	E266056 N225000	130	2100	2983.5	104000	Crabtree River	E266056 N225010	Double Parallel
BR94	SW65	E260010 N225000	130	2100	2983.5	104000	Crabtree River	E260010 N225020	Double Parallel
Ballyderm S									
BDS95			170	4800	3901.5	136000	Figile River		Proposed
BDS96			170	4800	3901.5	136000	Figile River		Proposed
Ballyderm N									
BDN97	SW66	E263680 N226520	209	3488	4796.55	167200	Figile		Double Parallel
BDN98	SW67	E263680 N226520	209	3488	4796.55	167200	Figile		Double Parallel
Timahoe S									
TS99	SW68	E273990 N230720	240		5508	192000	Cushaling	E273175 N230850	Double Parallel
TS100	SW69	E274010 N230706	240		5508	192000	Cushaling	E273175 N230850	Double Parallel
TS101			460		10557	368000			Proposed
TS102			560		12852	448000			Proposed
TS103			125		2868.75	100000			Proposed
Timahoe N									
TN104			260		5967	208000			Proposed
TN105			280		6426	224000			Proposed
TN106			220		5049	176000			Proposed

* Emission point of final effluent discharge from silt pond unit

** Production bog catchment area.

*** Normal daily surface run-off calculation based on the total catchment area serviced by the silt pond unit and the annual rainfall average (838mm) over 29 years (1961-1990) for Edenderry rainfall monitoring station.

**** Maximum daily surface water run-off calculation based on total catchment area served by the silt pond unit and the greatest 24 hour rainfall event (80mm) over 29 years (1961-1990) for Mullingar synoptic weather station.

***** Receiving water is the main body to which the output from the silt pond unit ultimately discharges to.

****** Discharge point is the first location where the silt pond output discharges to a receiving minor stream/main river water body.

Pond Classification

Single	One pond serving a single catchment.
Double	Two ponds in series serving the one catchment
Triple/quad	Three/four etc ponds in series serving the one catchment
Double Parallel	Two ponds in parallel serving the one catchment, 50% each

APPENDIX 8

ENVIRONMENTAL CODE OF PRACTICE FOR PEAT ENERGY WORKS

PRODUCTION

Silt Control

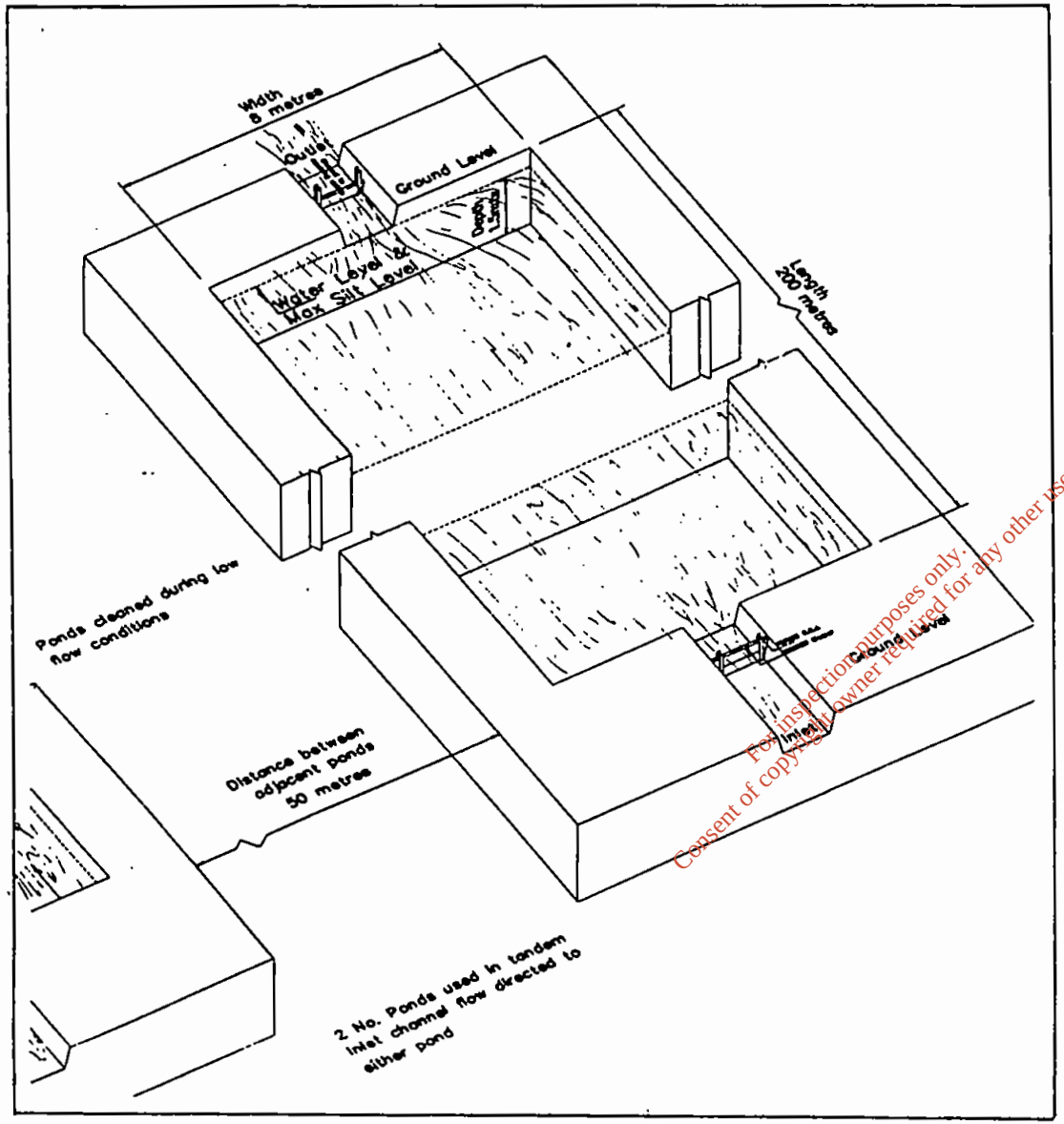
1. **Ensure that properly designed silt control ponds are on all outfalls.**
2. **Keep silt ponds properly maintained.**
3. **Keep records of silt control and maintenance.**
4. **Deal with all complaints promptly.**
5. **Install weirs on all silt ponds.**
6. **Raise weirs during heavy rain if stock is not affected.**
7. **Protect manholes and keep free of peat.**
8. **Ensure that harrows, millers, ridgers do not drag loose peat into manholes.**
9. **Have outer harrow spoons directed away from drain.**
10. **Take precautions to prevent silt run off while piping outfalls.**
11. **Clean outfalls starting upstream.**
12. **While cleaning outfalls install barrier (e.g. poles) downstream.**
13. **Ditch drains in dry weather.**
14. **Where possible block outfalls while ditching and ditch towards outfalls.**
15. **Block outlets from field drains during stockpile loading.**
16. **Ditch dry peat from drain immediately after stockpile loading.**

ENVIRONMENTAL CODE OF PRACTICE FOR PEAT ENERGY WORKS

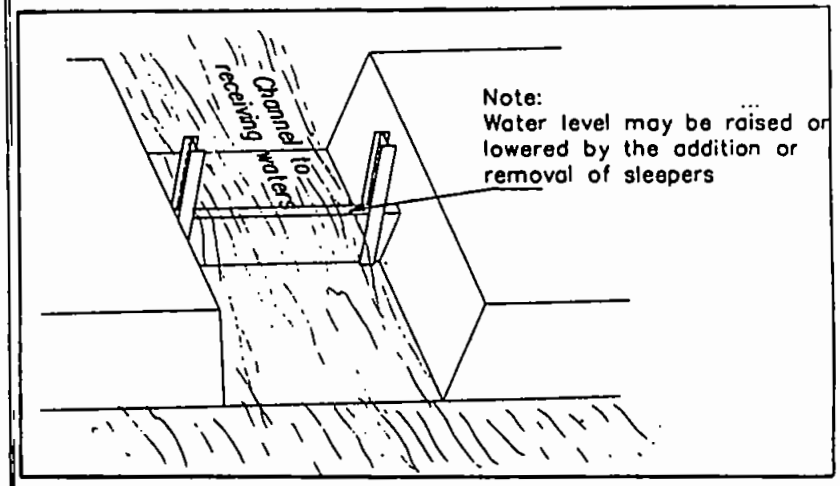
PRODUCTION

Dust Control

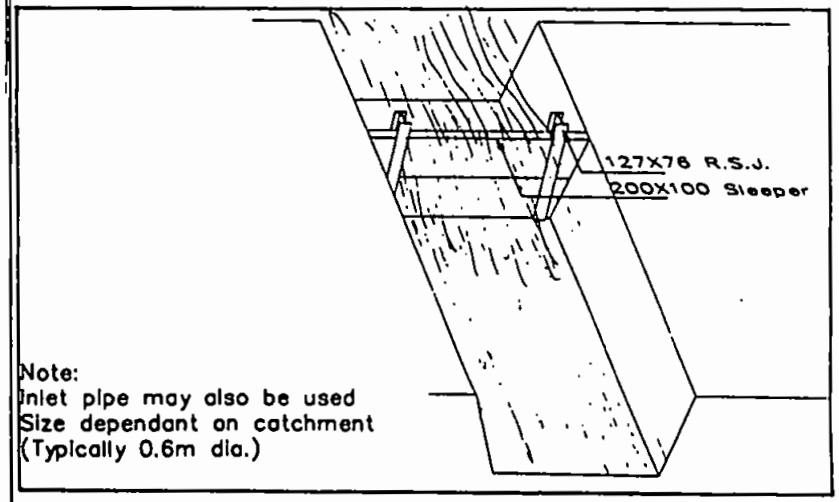
1. **Identify and record sensitive areas.**
2. **Plant shelter belts in sensitive areas.**
3. **Avoid harvesting in sensitive areas during windy weather.**
4. **Use grassed passways for machinery.**
5. **Keep headlands clean - remove loose peat.**
6. **Slow down when travelling along dusty headlands.**
7. **When harvesting keep jib low on stockpile.**
8. **Roll final harvest on uncovered stockpiles.**
9. **Plant shelter belts around outloading facilities.**
10. **Ensure lorries are adequately covered.**



General Arrangement



Outlet Detail



Inlet Detail

BORD NA MÓNA
PEAT ENERGY DIVISION

TITLE: TYPICAL SILT SETTLEMENT ARRANGEMENT FOR 100 HECTARE CATCHMENT

Drawn:	J.M.C	Scale:	Diagrammatic
Date	May'98	Drawing No.	CW—M—289

APPENDIX 9

ENVIRONMENTAL CODE OF PRACTICE FOR PEAT ENERGY WORKS

TRANSPORT

1. In planning rail routes avoid having lines close to houses.
2. Where railway lines run close to houses install screening.
3. Ensure all road transport is clean and well maintained.
4. Keep entrance/exit to outloading areas clean.
5. Ensure that no loose peat remains on top of lorries.
6. Ensure all materials are collected following lifting of temporary track.

ENVIRONMENTAL CODE OF PRACTICE FOR PEAT ENERGY WORKS

WORKSHOPS

1. Ensure oil storage tanks are adequately bunded.
2. Have in place emergency procedures for oil spillage.
3. Recycle waste oil.
4. Keep yards clean - free of oil, dust and debris.
5. Have a designated area for scrap.
6. Use bins for garbage and dispose of in County Council landfill.
7. Keep buildings clean and painted.
8. Insulate where possible and keep doors maintained to conserve energy.
9. Landscape all open areas.
10. Ensure septic tanks and treatment works are properly maintained.

ENVIRONMENTAL CODE OF PRACTICE FOR PEAT ENERGY WORKS

TEA CENTRES

1. Keep the buildings clean and painted.
2. Arrange for collection of garbage, scrap and waste oil.
3. Ensure public road access is free of hazards.
4. Bund oil tanks.
5. Ensure septic tank is properly maintained.

ENVIRONMENTAL CODE OF PRACTICE FOR PEAT ENERGY WORKS

After Peat Production

1. **Prepare plans for the future use of all areas.**

2. **Encourage participation in this process.**

Polythene

1. **On removal take polythene to headlands and bale in preparation for recycling.**

Archaeology

1. **Have a system in place for the reporting and recording of any finds of archaeological interest.**

APPENDIX 10

FINNISH NATIONAL BOARD OF WATERS AND THE ENVIRONMENT

SUPERVISORY GUIDELINE NO 64 FOR WATER PROTECTION IN PEAT MINING AREAS

April 1990

Helsinki, April 19 1990
Nº 1079/500 VYH 1990
Ref. Water and Environment Districts

INTRODUCTION

As stated in Section 1, Paragraphs 3 and 4 of the Decree on Water and Environment Administration (151/87), the National Board of Waters and the Environment shall develop the execution of duties coming within the sphere of its authority in the water and environment administration, and direct in general and integrate and supervise the operations of the water and environment districts. With this in mind, and having deliberated the matter in session, the National Board of Waters and the Environment has decided to issue the following supervisory guideline concerning water protection in peat mining. The National Board of Waters and the Environment has revoked supervisory guideline Nº 45 of 12 December 1990, which also dealt with water protection in peat mining.

This supervisory guideline is intended to be used by water and environment districts as a general standard for guidance and advice in water protection. The guideline will be applied in the first place to peat production requiring advance notification. However, the guideline may also be applied as appropriate to the supervision of peat mining areas in production and household peat winning, if these activities have caused or may cause surface water or groundwater pollution as referred to in the Water Act. Opinions expressed in the guideline are not binding but are intended as examples of the technical and other measures with which the objectives of water protection can be reached. Individual solutions are to be considered case by case. The guideline is valid until 31 December 1994.

Commercial peat production as referred to in this guideline includes the preparation of the production area with its outlet ditches, and peat winning for other than household use, and the aftercare of the production area. Should the household use of peat be expanded into a business activity, this guideline shall be applied.

The extent and methods of peat production in Finland are dealt with in Appendix 1 of this supervisory guideline

B1. LEGISLATION

A peat production area with its outlet ditches or the waters issuing from the area during preparation and production or after production may alter or pollute surface waters or groundwater as referred to Chapter 1, Sections 15, 18, 19, 20 and 22 of the Water Act (264/61). The prohibition in Chapter 1, Section 15 of the Water Act also applies to the consequences arising from the peat mining area or its drainage that alter the water or bottom of the watercourse, unless the procedure is one referred to in Chapter 1, Section 19 of the Water Act.

In several decisions and precedents of the Supreme Administrative Court (e.g. KHO 1984 A II 105, KHO 1985 A II 98, KHO 1985 II 99 and KHO D:2391/47/85, A:4.9.1986, T:3305, FIILEX), the conducting of water during the drainage and production of the peat mining area has been considered as the conducting of waste water. Therefore, the pollution prohibition referred to in the Water Act, Chapter 1, Section 19 is currently

applied when assessing the impacts of peat mining areas and, accordingly, it is required that a permit to conduct waste water to a watercourse be applied for when the need arises. This implies that commercial peat production areas should be added the list given in the Decree on Advance Measures, Section 3 (283/1962, amended 816/1989).

Prohibition to pollute watercourses

The threshold for the application of the permit referred to in the pollution prohibition mentioned in the Water Act, Chapter 1, Section 19, is exceeded if the quality of the water or the bottom of the watercourse may alter due to the digging of the outlet ditch, the extraction of peat or the aftercare of the production area either immediately or if the activities continue, and which:

1. manifests itself in inconvenient shallowing of the watercourse;
2. alters harmful the aquatic environment or its function or causes obvious damage to fish stock;
3. endangers health;
4. significantly impairs the amenity of the environment or cultural values or the suitability of the watercourse for water supply or recreational use; or
5. may violate other public or private interest comparable to the above.

Issues pertinent to the preparation of the peat mining area and the outlet ditch, peat production, termination of the use of the production area and its aftercare are dealt with as an entity as referred to in the Water Act, Chapter 1, Section 19. The concurrent processing of the various stages is in accordance with accepted legal practice in general and for peat production in particular. The draining and preparation of the peat mining area creates the potential for a peat production area of a given size while implementing the technical solutions for water protection required by the preparation and later activities.

Prohibition to alter and pollute groundwater

Without a permit granted by the Water Rights Court, groundwater may not be used nor may procedures intended for the abstraction of groundwater be instituted if they may hamper water intake at a groundwater plant, cause a significant decline in the yield of an important or other groundwater occurrence suitable for water supply or other deterioration of its exploitability or inconvenience in the household water supply of the real estate of another party. The prohibition to alter groundwater also applies to the extraction of land resources and other measures not referred to in Section 22, if they manifestly lead to the above consequences. The regulations of Section 22 shall be applied to any measure not mentioned in Section 22 of this chapter, but which manifestly may result in the consequences referred to in Section 22.

Chapter 1, Section 19 of the Water Act, which deals with the prohibition to pollute groundwater, states that any material or energy referred to in Chapter 1, Section 19 of the Water Act shall not be placed in or conducted to such a site or handled in such a manner that:

1. in an important or other groundwater area suitable for water intake the groundwater may constitute a threat to health or its quality may otherwise significantly deteriorate;

2. the groundwater on the real estate of another party may constitute a threat to health or become useless for the purpose for which it could otherwise be used; or

3. the measure, by affecting the groundwater quality, may otherwise violate public or private interest.

In the event that the undertaking requires a permit from the Water Rights Court by virtue of the watercourse pollution prohibition, the issues pertinent to the groundwater alteration prohibition are generally processed concurrently.

The groundwater pollution prohibition is unconditional, and the Water Rights Court cannot grant a permit for it.

Advance notification procedure

Under the Water Act, Chapter 21, Section 1, overall supervision of the observance of the Water Act and the regulations and orders issued thereunder shall be carried out by the National Board of Waters and the Environment and the water and environment districts. The municipal environment protection committee serves as the local supervisory authority.

The Decree on Advance Measures in Water Protection (283/62, amended 429/70, 309/79, 499/80 and 816/89) prescribes the duty to report in certain cases. Paragraph 1, Section 3 of the Decree, which came into force on 1 November 1989, prescribes that notification of a commercial peat production area shall be made to the appropriate water and environment district well in advance, at least no later than four months before the beginning of construction. The district shall examine the notification and the appended plan. Notification shall likewise be made if the measures to be undertaken result in a substantial increase in the volume of waste water or other material polluting the water, or if its composition or mode of removal changes significantly. The appropriate water and environment district shall also be notified of the termination of activities.

Harm restricted to a ditch

The need for a permit from the environment protection committee and the obligation to submit advance notification shall be examined taking into account Chapter 1, Sections 1, 2 and 19-23; Chapter 10, Sections 1-6; and Chapter 20, Section 3 of the Water Act; Chapter 2, Section 29 of the Water Decree (282/62, amended 817/89); and Sections 1-3

and 8-8a of the Decree on advance measures (283/62, amended 429/70, 309/79, 499/80 and 816/89) as follows:

A permit of the environment protection committee is necessary for conducting waste water, as referred to in Chapter 10, Section 1 of the Water Act, into a ditch or soil if the procedure may have detrimental effects on the water channel or basin as referred to in the Water Act, Chapter 1, Section 19 VL 10:20) that violate the public or private interest. Irrespective of the effects, a permit of the committee is also necessary for conducting waste water into a ditch or stream located on the property of another party unless the landowner has given his consent thereto VL 10:6).

The environment protection committee may not issue a permit allowing groundwater pollution (VL 1:22) or the pollution of a watercourse (VL 1:19).

Advance notification is needed if the undertaking is obliged to submit advance notification as referred to in the Decree on Advance Measures, Section 3, and if it has not applied for a permit from the environment protection committee or the Water Rights Court. In the cases referred to in Section 1 of the Decree, advance notification shall always be made, except when the waste waters are conducted into the municipal sewerage system as stated in Section 5.

If it is concluded from the advance notification that the operations require a permit from the environment protection committee, the supervisory authority sends the appropriate exhortation. At the same time the authority lets it be known on what conditions he can favour the granting of the permit.

If the peat producer has applied for a permit from the environment protection committee, there is no need for the advance notification but the water and environment district gives its statement to the committee direct (VA 2:29). However, in this case it is necessary to ensure that all relevant data on the activities are obtained before the statement is issued.

Drainage proceedings and provisions

In the preparation of the peat production areas the regulations of the Water Act, Chapter 6, dealing with drainage shall be observed to the appropriate extent. In some cases the provisions of the Water Act, Chapter 7, referring to watercourse regulation may also be applied. If it is necessary to apply for a permit for peat production by virtue of the watercourse pollution prohibition, drainage issues will usually be dealt with at the same time.

The supervisory authority establishes his stand on the permit requirement for the undertaking through the advance notification procedure. Even if the undertaking is not considered at this stage to require a permit from the Water Rights Court, the drainage proceedings often have to be arranged in accordance with the Water Act, Chapter 6, Section 10, or they can be so arranged to avoid future ambiguities in drainage issues. Items referring to water protection in the advance notification plan should be appended to the plan for confirmation in the drainage proceedings. The drainage proceedings may also turn out to be necessary if, in addition to the processing of peat production as a waste

water issue by the Water Rights Court, the drainage issues are ambiguous. This is relevant at least when the peat producer requires other land owners to participate in drainage costs.

B2. GENERAL OBJECTIVES OF WATER PROTECTION

The decision in principle made by the Council of State on 6 October 1988 concerning the objectives of the water protection programme for 1995 defines certain targets, e.g. those for reducing the diffuse load. In the decision, the diffuse load includes peat production.

The decision in principle confirms the above objectives and the measures to be taken to promote and guide water protection. In addition to the water and environment administration, other administration shall also take in to account the objectives of the decision in principle in their activities. The decision in principle is not binding on the Water Rights Courts as decision-making courts of law. Finnish international co-operation in water protection shall also be in harmony with the objectives of this decision in principle. The decision states that:

> "Every effort shall be made to locate new activity loading or changing the environment so as to minimise the harm done to the watercourse. This implies that, before a decision is made, sufficient research shall be undertaken to establish the environmental consequences. The new loading activities are to be provided with the best economically viable technology to keep the load as low as possible".

The decision in principle defines the objectives of water protection in peat production as follows:

> "Appropriate water protection measures shall be implemented in all peat production areas. Sufficient sedimentation basins shall be constructed in peat production areas or other measures initiated to prevent or mitigate harmful consequences. Peat production shall not be established in or extended to catchment areas requiring special protection if it jeopardises the objectives of protection."

In the clause in the decision in principle dealing with nature protection it is stated that a decision of the Council of State shall be prepared for watercourses requiring special protection.

Appended to the decision of the Council of State there is a statement according to which the investment already made in peat production and in peat-fired power plants shall be taken into account.

B3. LOADING AND ITS EFFECT ON SURFACE WATERS AND GROUNDWATERS

The factors affecting loading due to peat production and their potential impact on watercourses should be assessed as comprehensively as possible. In addition to nutrient

and eutrophication issues, other detrimental changes referred to in Chapter 1, Section 19 of the Water Act in its present form shall also be considered. Soluble organic substances, ammonium nitrogen, colour changes, metals and solids should be considered in the load caused by the preparation of and production in the peat mining area and also in the receiving watercourses.

The solids depositing in streams and rivers may impair the bottom conditions for fish, crayfish and other aquatic fauna. Ditches are often repaired, cleaned and deepened in winter. Such work may intensify the harmful effects because the habitat of fish and crayfish in streams is at its smallest in winter.

During the production stage rainfall may wash solids into the watercourse in summer, which is when the impact on the recreational use of the shores and waters will be most damaging. Every attempt should be made to assess not only rapid, pulsatory changes but also the long-lasting impact of different materials.

The appraisal should take into account the fact that the harmful compounds accumulating in a watercourse protected for birds, fish, vegetation or some other reason may jeopardise the objective of protection.

The hydrological changes in a bog are also significant in terms of loading. After drainage and supplementary measures, the former water resources of the bog enter the downstream watercourse. The reduction in the storage capacity of the bog, and the poor permeability of the most humified production areas in particular, spread the overland flow over large areas. The greatest impact is likely to be caused by the rise in overland flow peaks in summer and autumn. After heavy rainfall, transient flows may exceed 1000 l s^{-1} km^2 in some bogs, and the average daily overland flow rate may be several hundreds of litres a second per square kilometre.

Horticultural peat

Overflows after heavy rainfall are distinctly smaller in horticultural peat bogs (humification H1-H4) than in fuel peat bogs, because water is effectively retained by the peat layer. The load on a watercourse from horticultural peat bogs is also reduced by the large particle size of the suspended solids detached from the peat, which improves the settling rate of the solids.

Effects on groundwater

Peat production established in hollow bogs in areas kept wet by the water discharging from a groundwater occurrence may have the consequence referred to in the prohibition to alter groundwaters. The draining of such a bog usually increases the outflow of groundwater, which in turn lowers the groundwater table and thus reduces the yield of the occurrence. Owing to changes in flow, this phenomenon may result in alteration in water quality at any water intake plant operating in the area. Then part of the water of the occurrence is removed through drainage, and water intake continues at the same rate as

before, poor-quality groundwater, which would not otherwise migrate there, may start to flow to the water intake plant from the margins of the occurrence.

Peat production may also alter groundwater quality when impermeable strata are penetrated at the margins of the groundwater occurrence, resulting in the infiltration of humus-bearing palustral water into the groundwater occurrence. The ditches may also otherwise increase the organic load in groundwater in synclinal esker areas, i.e. in areas that collect water from the environment.

Preparation stage

The preparation of and other associated activities in the peat production area alter the quantity and quality of the runoff water. The alterations are similar to those caused by any drainage. However, it must be taken into account that the draining of a peat production area is distinctly more effective than that of forest ditching. What is more, top soil and nutrient-binding vegetation are removed from the area. Draining is also extended regularly in the course of a production period of 15-20 years. Runoff waters alter because:

- the water reserve in the bog decreases, resulting in an increase in load (dissolved humus, nutrients and metals);
- extraction and working of the field surface loosen material from peat or mineral soil, giving rise to solids load during activities and the subsequent great overland flows;
- the erosion and caving in of channels increase the solids content in waters. Varying in magnitude, this load continues throughout the peat production period. The outlet ditches and isolation ditches are particularly prone to damage from erosion.

Production stage

The wash-out of solids from peat into the watercourse is the most visible part of the load from peat production areas. Peat production also conspicuously increases the amount of soluble humus and nutrients entering the watercourse and the leaching of metals. Abundant wash-out of dissolved nitrogen, ammonium nitrogen in particular, is a characteristic feature of peat production. Peat production may also be of local importance as a phosphorus loader. Investigations conducted to date have shown that mercury is the only heavy metal whose concentrations may have been harmful in certain cases. The acidity of overland flow waters seldom increases although acidity levels may very more widely. Appendix 2 gives an example of the load values of some peat production areas.

Assessment of the load during the production stage should take the following into account:

- heavy rainfall washes out loose peat from the surface of the field, eroding the field and the walls of ditches;

- overland flow is greatest on old, highly humified production fields;
- the intensified decomposition of peat in the production areas results in additional loads of soluble organic substances and nutrients on watercourses;
- peat dust may be transported to watercourses in harmful amounts by air currents, by vertical currents and strong winds in particular;
- peat solids deposited on the bottom of the watercourse decompose slowly, consuming oxygen. The persistent accumulation of solids in watercourse depressions may substantially increase the internal load in oligotrophic and unpolluted watercourses.

Closing-down and after-care

The owner or holder of an area that has been in production is responsible for the after-use of the area and its effect on surface waters and groundwaters. The peat producer must see to it as after-care that, while making the peat production area appropriate for after-use, he takes into account the water protection measures that may still be required by peat production already terminated. One after-use option is to rehabilitate the bog. If necessary the peat producer shall remove any structures that, without maintenance, would prevent normal draining. These include the auxiliary structures of retention pipes and often also the retention pipes themselves, which should be replaced by ditches.

The sedimentation basins and the overland flow fields should be preserved and maintained until considered obsolete.

B4. WATER PROTECTION MEASURES

The starting point of the water protection of a peat production area is to plan the production field so as to minimise its detrimental effects on surface waters and groundwaters.

The alternatives for conducting the runoff waters in new peat production areas should be established at the time the land is acquired, and areas should be reserved for future water protection measures. The orientation of the ditches and the articulation of the production field are an essential element of the comprehensive planning. In old production areas, the water protection structures usually have to be added to the existing network of ditches. Therefore, the load on the ditches can often be affected only to a limited extent.

The runoff waters from the peat production areas should be treated by applying the best available technology appropriate for local conditions. The minimum requirement is usually that the runoff waters should be clarified at the ends of field ditches and in centralised sedimentation basins or that solids should be removed as effectively with some other method.

The work used in the preparation of the bog shall be done in such a manner and at such a time as to prevent loading of the watercourse. Therefore, the draining of the bog shall always start with the building of water protection structures, and excavation should be avoided during flood flow. The water protection measures also include the appropriate use and maintenance of the structures. Water protection measures and other necessary protective actions are dealt with in detail in Appendix 3.

B5. ADVANCE NOTIFICATIONS AND THEIR PROCESSING

According to the Decree on Advance Notification Regarding Water Protection Issues, advance notifications concerning commercial peat production areas shall be submitted to the water and environment district well in advance, and no later than 4 months before drainage works start in the production area. Advance notification is also required for an undertaking through which the volume of waste water or other water-polluting substance increases markedly or its composition or mode of removal changes significantly.

Should voluntary notification not have been made, advance notification should also be made for peat production areas in which the preparation works are underway but peat production has not yet started, and for areas in which production has been suspended for a long time. The need for notification shall then be considered case by case. For example, the advance notification duty does not apply in the event of a production break due to a short-term fluctuation in the market.

Even if no advance notification is made the water and environment authority should be kept well informed about the measures relevant to the development of water protection.

Planning

Notification shall be made using the form approved by the National Board of Water and the Environment. Notifications should be made as soon as possible. Before the advance notification is made, the supervisory authorities and the peat producers should discuss the feasibility of starting or extending production, water protection measures and the surveys needed.

The notification shall include the plan for conducting and treating the waste water or other water-polluting substance. The plan shall contain information on the waste water or other waste to be conducted, its amount, the purification method to be used and other measures planned for reducing or preventing water pollution, and, in the event the waste water is conducted to the watercourse, a description of this watercourse and its condition before the undertaking is initiated. Appendix 4 lists in detail the information that shall be included in different cases in the plans appended to the advance notifications for peat production areas. The information needed in each case can best be established by contacting the water and environment district.

For the comprehensive appraisal of the condition and receiving capacity of the watercourse it is of utmost importance that the notification should contain sufficient

information on fishery, groundwaters and nature protection in the area. It is also imperative to describe other peat production in the area or peat production planned for the area by the same producer.

Statements and the decision-making authority

In the event that the planned activities may jeopardise the values of nature protection or fishery, the provincial government and the fishing district shall be informed about the notification, with the possibility of a statement in mind. The water and environment district may at its discretion also request a statement from other authorities, e.g. the environment protection committee of the municipality in which the production plant is located or the regional planning association.

Notifications referring to peat production areas shall as a rule be examined in the water and environment district. Should the effect of peat production extend into the area of another district, the districts shall consider the notification jointly. The notification and the statements of both districts shall be submitted to the National Board of Waters and the Environment for resolution within two months of the date the notification was submitted to the district.

If the preparation of the peat production area has been planned in the water and environment district, the notification shall be transferred to the National Board of Waters and the Environment for processing.

Appraisal of the permit requirement

The water and environment district shall assess whether the planned conducting of waste water from the peat production area referred to in the notification could, either immediately or while continuing, alter the quality of the water or bottom so as to cause pollution. In the event that pollution is anticipated, the water and environment district shall without delay exhort the body that submitted the notification to check and supplement the plan to the extent required or, if necessary, request the body in question to apply for a permit from the environment protection committee as referred to in the Water Act, Chapter 10, Section 3 or from the Water Rights Court as referred to in Section 23. In that case the water and environment district shall be informed about the changes, supplements and other measures which should be made in the implementation plan so that the permit for conducting waste water can be granted in the view of the water and environment district.

As for the alterations to groundwaters, it is necessary to assess whether they would result in consequences such as referred to in the Water Act, Chapter 1, Section 18, which require application for the permit referred to in the Water Act, Chapter 9, Section 7.

In the examination of the permit, special attention shall also be paid to the safeguarding of small watercourses valuable in terms of fishery or nature protection.

Service of notice

The water and environment district shall send the examination report to the National Board of Waters and the Environment, the appropriate environment protection committee, the provincial government, the fishing district and the parties, if any, that have expressed their opinion.

Issues to be considered

While examining the notification, the water environment districts shall pay special attention to issues relevant to the location of peat production areas. In addition to matters of water protection and water usability, the processing of notifications should seek to safeguard the use of water as liquid, the values of nature protection and of the watercourses to be protected in particular, and to avoid adverse effects on fisheries. Groundwater areas important for water supply and other groundwater areas suitable for that purpose should also be protected.

When preparing its comments on peat production and considering the conditions for granting the permit, the water and environment administration shall take into account the decision in principle of the Council of State by virtue of which peat production shall not be implemented or extended in the catchment areas of waters calling for special protection if this would jeopardise the objectives of protection. Likewise, the protection programme being prepared for small watercourses should be taken into account. In the event that the water protection measures in the peat production areas are no improvement on existing ones, the water authority cannot usually recommend that a permit be granted for this type of production area.

Should a major amount of peat production be located in the area of the same watercourse, it is evident that, despite the water protection measures currently applied, the activity would pollute the watercourse. Even a lower rate of peat production might be harmful in areas very valuable for fishing or crayfish catching, and for example in water supply areas.

The regional water protection decisions and plans on the localisation of peat production also guide the decisions of the water and environment districts. The preparations for the comments should take into account the recommendations expressed in the regional water protection and nature economy plans and the plans made by the water and environment districts for the use, maintenance and protection of waters.

B6. EXISTING PEAT PRODUCTION AREAS

The water and environment districts shall see to it that appropriate water protection measures are implemented in all present peat production areas by 1995. The water and environment administration is obliged to do so by the decision in principle of the Council of State on the objectives of water protection for 1995. In practice the objective implies that the water and environment districts shall endeavour to ensure that the appropriate water protection measures have been implemented in all the present peat production areas

by 1995, or that the water protection plan approved by the water and environment district has been put into effect or is being processed by the Water Rights Court.

B7. HOUSEHOLD USE OF PEAT

The water and environment districts shall also require notifications from household peat production areas which, due to their size or location or to the combined effect of several production areas, may have consequences such as referred to in the Water Act, Chapter 1, Section 19. In the event that household use is expanded into a business activity, peat production shall be considered as a commercial enterprise and shall therefore be subject to advance notification.

Household peat production may pollute a ditch. If so, then the producer has to apply for a permit from the environment protection committee.

In regard to the environmental impacts of the household use of peat, special efforts shall be made not to impair the value of small watercourses important for nature protection or fishery.

B8. SURVEILLANCE AND MONITORING

Almost without exception, decisions of the Water Rights Courts concerning peat production areas currently include an obligation to implement load and impact surveillance. The impact surveillance obligation often refers to fisheries as well (VL 10:24a)

Although the Decree on the advance notification procedure does not mention surveillance, the advance notification procedure almost invariably includes surveillance agreed upon by the peat producer and the water and environment authorities, because it is essential to ensure that the undertaking does not cause pollution of surface waters and groundwaters as prohibited by the Water Act. It is therefore recommended that the plan appended to the advance notification should contain information about the manner in which the operational, load and watercourse surveillance should be implemented.

The following presents some issues of current relevance to surveillance of peat production areas.

Operational surveillance

The operational surveillance of peat production areas should be based on operation, maintenance or worksite records. These are updated daily with entries of any event likely to affect the condition of the watercourse.

Information relevant to peat production includes the progress made in draining, preparation and production procedures, and the emptying of sedimentation basins and other maintenance measures. Water levels at the measuring weirs, the dates of water

sampling and information on precipitation, air temperature, evaporation and wind are entered in the operation and maintenance records of the peat production areas. Entries of exceptional events such as heavy rainfall are compulsory.

Load surveillance

If several peat production areas are in operation within the same watercourse area, the acquisition of load data can be centralised and rationalised. Some of the bogs are selected by watercourse area or subarea for intensive surveillance, which permits the calculation of specific load values for the bog or production type in question. The load surveillance of the other bogs in the area can then be less strict or it can be replaced by watercourse surveillance. Every effort should be made to provide the bogs under intensive surveillance with automatic, continuous flow monitoring and water sampling. The surveillance practice can be adjusted from time to time.

Load factors typical of peat production are solids, organic substances consuming oxygen, and plant nutrients. Load surveillance should include determinations of the following parameters: solids, chemical oxygen demand, total N, total P, NH_4-N, Fe, pH, alkalinity, electrical conductivity, colour and temperature.

The following determinations can be made to specify the type of load: ash content of solids, NO_3-N and PO_4-P.

In addition to the annual programme, the information on the load can be adjusted at discretion in fixed years with comprehensive data on the quality of humus, soluble nutrients and metals.

Measurements of flow rate are an integral part of load surveillance. Whenever possible, flow rate should also be measured automatically in other bogs besides those under intensive surveillance.

Since it is important to establish the flow rates of the loading substances, the observations should be timed to record as accurately as possible the load peaks during the vernal flood and heavy rainfall.

Watercourse surveillance

The watercourse surveillance of peat production areas should be based on sufficient data collected beforehand on temporal and regional variations in the condition of the watercourse.

If the discharge watercourse is a pond or a lake, a bathymetric map bound to levelling should be produced of at least its most critical part before the preparations for peat production get under way. This, combined with detailed photography of the area, will facilitate assessments of siltation and shallowing.

The difference between river courses and lake courses, and the effect this difference will have on the timing of observations, should be taken into account in watercourse surveillance.

The watercourse surveillance programme must be as practicable as possible. The emphasis should be on surveillance of those changes in the condition of the watercourse that best reflect the damage caused by peat production. As well as water quality, the surveillance should cover siltation, eutrophication or slime formation on shores. These more comprehensive surveys could be undertaken at regular intervals, e.g. every three years.

Depending on the magnitude of the damage to be expected, all, or some, of the determinations used for load surveillance should be applied when monitoring the impact of peat production on the watercourse. It is also important to monitor the oxygen content of the watercourse. If mineralised nitrogen is not determined together with total nitrogen, the concentrations of NH_4-N and NO_3-N in the receiving waters should be determined at least from time to time. The same holds for measurements of PO_4 phosphorus. In some cases, turbidity describes the transport of suspended matter to the watercourse better than the abundance of solids.

The eutrophication of the watercourse should be monitored annually with sufficiently frequent determinations of chlorophyll-a. In fixed years, eutrophication should be monitored by determining the amount of periphyton and basic production and by extending the eutrophication mapping into larger areas.

The long-term accumulative effects of peat production can be monitored with studies on bottom sediments and with, for instance, BOD_7 determinations of the bottom sediment.

Groundwater surveillance

If necessary, the impact of the preparation of and production in the peat mining area on the groundwater, such as on the level of the water table, the amount and flow of groundwater and possibly also on groundwater quality, should be monitored.

Fishery surveillance

Surveillance of fisheries implemented in a manner approved by the fishery authorities may be included in the watercourse impact surveillance. If in the course of the examination of the advance notification it is found necessary to implement fishery surveillance, the matter should be negotiated with the fishery district and the peat producer.

In terms of the assessment of the condition of the watercourse, fishery surveillance could include determinations of mercury levels in fish and studies on off-tastes.

Monitoring and the supervision of the implementation of the procedures

In the event that water protection measures are not implemented as intended by the water and environment administration, and/or the undertaking causes or the surveillance reveals or it becomes otherwise evident that consequences will ensue as referred to in the Water Act, Chapter 1, Sections 15, 18, 19 or 22, the peat producer is expected to remedy the shortcomings or to intensify the water protection measures and/or to apply for a Water Rights Court permit to conduct the waste waters or carry out another procedure causing the above consequences.

APPENDIX 11

Water Quality in Ireland
1995 - 1997

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SUMMARY

1. A review of the position on water quality in the State in the period 1995-1997 is presented. The review is based on data arising from surveys carried out on over 13000 km of river and stream channel, 120 lakes and 23 estuarine and coastal waters. In addition, and for the first time in national reports, information is given on the quality of the waters of the main canals and of representative groundwaters. The bulk of the survey work in the period was undertaken by the EPA and the local authorities, complemented by the work of a number of other bodies, in particular the Central Fisheries Board.

RIVERS AND STREAMS

2. Some 13,100 km of river and stream channel were surveyed in the period 1995 to 1997 and on the basis of the biological survey primarily this baseline is classified as follows:

Class A	8,754	km	67%
Class B	2,376	"	18%
Class C	1,832	"	14%
Class D	122	"	1%

As might be expected, the more densely populated and intensively farmed regions of the country are worst affected by all levels of pollution. The Donegal-Sligo area (North-Western 'b' Region) is least affected by pollution (87% in Class A) while the Eastern Region, with just 45 per cent in this Class, is much more extensively polluted: here some 27 per cent of surveyed channel is classed as moderately polluted (Class C) and 3 per cent as seriously polluted (Class D). The incidence of serious pollution is generally relatively low in the other areas of the country, ranging from 0.5 to 1 per cent of surveyed channel in most regions with the notable exceptions of the Southern and the North-Western 'a' (Cavan-Monaghan) Regions where it was not recorded in the current cycle. Moderate pollution (usually characterised by marked organic and severe eutrophication effects) is relatively widespread in both the Mid-Western and North-Western 'a' Regions where some 22 per cent of channel is affected. Slight pollution (mainly seen as eutrophication) is most widespread in the South-Eastern Region where some 29 per cent of channel is affected and it is also relatively very widespread in the Eastern (24.5%) and Shannon (22.6%) regions. In terms of the proportion of channel in Class A the regions may be ranked as follows:-

1st	NW 'b' (Donegal-Sligo)	87%
2nd	Southern	86%
3rd	Western	80%
4th	Mid-Western	62%
5th	NW 'a' (Cavan-Monaghan)	60%
6th	Shannon	59%
7th	South-Eastern	52%
8th	Eastern	45%

3. Long-term (since 1971) and recent (since 1994) trends are analysed and both analyses show :-

a) a distinct trend of continually increasing slight and moderate pollution and
b) a recent reversal of the trend of decreasing serious pollution which had been gradually falling off over the years.

The upward trend in the extent of slight and moderate pollution is attributed mainly to eutrophication by organic (animal manure) and artificial fertilisers and to a lesser extent by point source (i.e. sewage) discharges. The recent slight increase in the extent of seriously polluted channel is attributed mainly to suspected sewage discharges and to a lesser degree to suspected agricultural activities.

4. Most instances of slight and moderate pollution, (43% and 42% respectively), may be attributed to agriculture and the bulk of the remainder to sewage (18% and 20%) or to 'Other' causes (21% and 18%). Siltation and other effects, due primarily to soil erosion from overgrazing by sheep and to bog and forestry development, is responsible for much of the slight and moderate pollution recorded in the west of Ireland. Sixty-four instances of serious pollution were identified in the reporting period. Of these, 28 instances were due to suspected sewage discharges, 15 to agriculture, 14 to industry, four to other/unknown sources, two to a combination of sewage and industrial discharges and one to a combination of suspected agriculture and sewage.

5. The most notable instance of serious pollution is undoubtedly the Avoca river which has been grossly polluted over a considerable distance by toxic mining spoil

leachate for more than a century. With the exceptions of this river and the Boyne, Dalgan, Feale, Liffey and Nore, most instances of serious pollution are in smaller rivers and streams. The serious pollution of the Feale, Liffey and Nore rivers is confined to a short stretches along the rivers' sides below Abbeyfeale, Straffan and Thomastown respectively but the upper reaches of the Boyne and Dalgan rivers are much more extensively affected. Most serious pollution originates at point sources and is, therefore, readily amenable to elimination a) by the provision of adequate waste treatment facilities where these are lacking; b) by improved management of existing sewage and industrial waste treatment facilities or c) by large, 'industrial' farmers in particular adopting a much more responsible approach in waste disposal and in the location and maintenance of animal manure slurry installations.

6. An abatement of serious pollution was recorded at some 19 locations in 13 rivers and streams in the current survey period: these are documented in Chapter Two of the Report. The most striking improvements were in the Camlin below Longford and the Blackwater (Kells) above Bailieboro. In all but two instances recovery was partial - the locations remain moderately polluted - but a complete recovery was recorded in the Ballaghdoo (Kilcar, Co. Donegal) and the Corbally Stream (Enniscorthy area).

7. Small increases are reported in the numbers of locations being seriously polluted by agriculture (+2) and industry (+3) but a very substantial increase has occurred in the number of locations being seriously polluted by sewage (+29): the most likely cause of this is outdated or overloaded sewage treatment facilities. All of these locations are documented in Chapter Two of the Report.

8. Data for the rivers designated under the EU Freshwater Directive are reviewed. There were 342 individual exceedances of the limits set in the Directive in the period; the most commonly encountered concerned dissolved oxygen, copper, nitrite and BOD. The exceedances of the dissolved oxygen limit represented 30 per cent of all exceedances and appear to have increased since the last period. This may reflect increasing eutrophication of the river system. This analysis does not necessarily reflect non-compliance with the Directive which is assessed on yearly sets of data and also allows for a small percentage of exceedances in the case of each parameter.

9. The number of fish kills reported by the Marine Institute in the 1995-1997 period shows a substantial increase over the previous period. Agriculture is identified as the greatest single cause, accounting for 52 of the 173 kills in the recent period. Industry is quoted as causing 20 kills, sewage 13 and 'civil works plus waterworks' 15. However, the greatest number of kills, is attributed to non-specific causes viz. enrichment, deoxygenation and unknown causes which together account for 73 kills in the three-year period. As it seems reasonable to assume that most if not all enrichment and deoxygenation is likely to be of anthropogenic origin, the Marine Institute's figures under these headings as well as their 'Unknown' category have been proportionally re-distributed here to the most obvious primary sources (agriculture, sewage and industry). On the basis of this exercise it seems likely that in the period under review, agriculture might have been responsible for some 97 fish-kills, industry for 37 and sewage for 24.

10. An analysis is given of the continuing performance of selected sewage treatment plants which were upgraded in the early 1980s. The sewage works in question are at Carrickmacross, Cashel, Castlebar, Mountmellick, Mullingar, Portlaoise, Thurles and Tipperary. With the notable exception of Castlebar none of the rivers and streams in question has yet recovered to a fully satisfactory condition; most continue to be over-enriched, either by un-intercepted waste inputs or by the continuing excessive phosphorus loading which, with the exception of Mullingar, the treatment plants were not designed to remove. This is compounded by episodes of poor plant performance in most cases. As pointed out in the previous Review, all rivers in receipt of secondarily treated wastes are liable to become eutrophic or hypertrophic as phosphorus is not sufficiently removed by this level of treatment. Any further recovery in the above stretches is unlikely in the absence of phosphorus removal.

11. The data for oxidised nitrogen levels in the rivers in the period are assessed. This parameter approximates to nitrate nitrogen as nitrite, the other component of oxidised nitrogen in freshwaters, is usually present at

much lower concentrations than nitrate. Again, concentrations were generally well below the limit (11 mg/l N) set by the EU Directive on the quality of raw waters being taken into treatment plants. However, median levels in the south-east rivers showed a further small increase and the incidence of individual samples with concentrations over 5 mg/l N was greatest in this area and the eastern area. This pattern is likely to reflect land use in the two areas.

12. Available information on the occurrence of potentially toxic substances in rivers is presented. These substances are not routinely measured and the amount of data is limited. In general, the incidence of contamination is low and mostly concerns metals derived from mining activity. A discussion of endocrine disrupting chemicals (oestrogen mimicking substances) is given, based on a recent review of the topic commissioned by the EPA. These substances are thought to induce feminisation of fish in rivers. To date there are no reported incidences of the phenomenon in Irish rivers.

13. Data are presented on the total phosphorus and oxidised nitrogen loads carried by the larger Irish rivers into their estuaries. These are included in measurements made by the EPA as the Irish contribution to the Comprehensive Study on Riverine Inputs being carried out under the OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic. In general the greatest loads are carried by the larger rivers but normalising these loads to catchment area shows that unit area export rates vary considerably.

14. The quality of the waters of the main canals is described, based on the reports of surveys carried out by the Central Fisheries Board on behalf of Dúchas, the Heritage Service. Since the canals are more or less static waters, the application of the lake assessment procedure is more appropriate than that used for rivers. Overall, the quality of the canals is assessed as good and generally of a mesotrophic status. A generally similar position holds for the feeder streams.

LAKES

15. Of the 120 lakes examined in the review period 97 (81%) have been assigned a trophic status (oligotrophic or mesotrophic) consistent with unenriched, satisfactory water quality conditions and a low probability of pollution. The water quality of the remaining 23 (19 %) lakes examined points to less than satisfactory conditions and the likelihood of significant impairment of beneficial use. Of these lakes, 18 exhibited algal growths indicative of a moderately to highly eutrophic status and five were classified in the hypertrophic category indicating a very high level of pollution.

16. The surface area of the 120 lakes examined amounted to 889 km^2 representing approximately 60 per cent of the lake surface area of the country. Lakes accounting for 582.5 km^2 (65.5%) were in the unenriched oligotrophic/mesotrophic categories. A further 283 km^2 (31.8 %) were classified as eutrophic and 24 km^2 (2.7 %) were assigned to the hypertrophic category.

17. The areas in Ireland with the greatest number of lakes are the counties along the western seaboard, particularly Galway, Mayo and Donegal, and the north-midlands counties of Cavan and Monaghan. Elsewhere in the country lakes are relatively scarce. Of the 76 lakes examined in the west of Ireland, 70 were in the unenriched oligotrophic or mesotrophic categories while the remaining six were eutrophic. In the midlands counties, 32 lakes were investigated of which 21 (66%) were in a satisfactory condition while 11 lakes showed evidence of varying degrees of pollution. The five hypertrophic or seriously polluted lakes in the country are located in this region. Of the 12 lakes examined in the remaining areas of the country six were in the oligotrophic or mesotrophic categories and six were eutrophic.

18. The majority of the 120 lakes examined (62, 52%), have surface areas of less than 1 km^2 (100 ha). Of the lakes in this size category, 79 per cent, were classified in the oligotrophic or mesotrophic. The great majority (91%) of the lakes in the 1.0-7.5 km^2 size category were also classified in this category. Of the 24 lakes with surface areas greater than 7.5 km^2, 16 (70%) were in the oligotrophic or mesotrophic categories, while the remaining seven exhibited varying degrees of enrichment.

19. The unsatisfactory water quality conditions in the 23 lakes classified as being enriched are due to excessive inputs of

38. Where there was a high iron concentration in a sample, there was generally a high manganese concentration although this was not exclusively the case. High iron and manganese concentrations recorded do not have a health implication although they may cause problems in treatment of the raw waters and possibly for consumers due to staining of clothes when used in washing.

39. While bacteriological examination was not undertaken on all samples, a significant number of sources had high total and faecal coliform (>10/100 ml) counts. This emphasises the need for disinfection of drinking water supplies taken from groundwaters.

40. Analyses of 135 samples from nine counties (Clare, Donegal, Galway, Leitrim, Limerick, Louth, Mayo, Roscommon and Sligo) were undertaken by the EPA for a selection of pesticides as well as trihalomethanes (THMs) and volatile organic compounds (VOCs) during the period. All the results were found to be either below the level of detection or within the limits specified in the Drinking Water Regulations.

PHOSPHORUS STANDARDS REGULATIONS

41. Since the quality assessments for rivers and lakes set out in this review constitute the basis for the implementation of the recently adopted Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus), Regulations, 1998, a detailed discussion of the implications is presented.

42. In the case of rivers, the Regulations require improvements by 2007 at those sites where the biological quality rating (Q) was less than Q4 in 1995-1997. This improvement may have either a set biological rating or an annual median phosphate concentration as a target. The correspondence between the Q rating and phosphate concentration is based on a statistically significant relationship between the two parameters which has been demonstrated by the EPA. The numbers of sites in each county which will need improvement under the Regulations is set out as well as those presently satisfactory locations at which conditions must be maintained.

43. Specified improvements by 2007 are also required for lakes classified as eutrophic or hypertrophic in 1995-1997. Again, this improvement may be made in relation to the biological condition (trophic status as defined by chlorophyll concentration) or to the concentration of phosphorus, in this case the annual mean concentration of total phosphorus. The correspondence between the biological criterion and the phosphorus concentration in this case is derived from an OECD classification scheme used as the basis of the EPA's national scheme. Of the 120 lakes for which assessments are presented in this review, 23 are classified as eutrophic or hypertrophic and will require improvement by 2007. Lakes assessed as mesotrophic or oligotrophic in 1995-1997 must be maintained in those categories.

44. Achievement of the targets for the currently unsatisfactory lakes and river stretches will generally require the adoption of management plans to determine the measures needed to reduce phosphorus inputs. A number of such plans have already been undertaken or are currently in preparation. Control of phosphorus from sewage treatment plants and other point sources does not present major technological challenges but non-point sources control will be more problematical. It is suggested that investigations need to be undertaken to identify the "hot spots" in the catchment in order to ensure that controls on such sources are implemented in the most efficacious manner. This approach is best operated within the ambit of a multi-sectoral management group and a number of indicators are suggested whereby such groups can assess progress.

CONCLUSIONS

45. The overall condition of Irish waters remains satisfactory and compares favourably with the position in other European countries. This is mainly a reflection of a relatively low population density and still moderately developed agricultural and industrial sectors. The further decline in the quality of the river system indicates, however, that the present level of water pollution control is not adequate.

CHAPTER TWO

THE WATER QUALITY OF RIVERS AND STREAMS

INTRODUCTION

2.1 This chapter gives an overview of water quality in a representative baseline comprising 1072 of the country's rivers and streams surveyed in the period 1995-1997. Long-term and recent water quality trends on a national, regional and local basis are identified by comparison with baselines established in 1971 and in the periods 1987-1990 and 1991-1994. Full details of the information available for the rivers and streams surveyed in 1995-1997 are available in electronic format on computer disc. This sets out for each location surveyed the biotic indices (Q values) arising from surveys carried out since 1971, together with a summary of the physico-chemical data.

2.2 As discussed in Appendix I, water quality is optimally assessed by a combination of biological and chemical methods but the national position in this and in previous reviews is largely based on the biological surveys as many rivers and streams, particularly those in more remote areas, are either not surveyed chemically or the frequency of such surveys is inadequate. However, an assessment is presented below of the quality of the designated salmonid rivers based on the data for those physico-chemical parameters for which standards are set in the relevant Regulations. Specific analyses of the data available on nitrate and phosphate levels in the period are also presented.

2.3 Appendix II sets out by Hydrometric Area (see 2.11 below) the number of rivers and locations biologically surveyed, the year of the most recent survey and the number of locations in each of the four biologically-based Quality Classes (see Appendix I and 2.6 below). Accompanying the report is a colour coded River Quality Map which depicts the biological quality at each of the 3117 locations surveyed. Rivers and streams which were not surveyed for reasons of inaccessibility, drought, stagnation or drainage operations in progress, are shown without an identification code on the accompanying River Quality Map.

2.4 The scope of the biological surveys has been substantially increased since the original national survey carried out by An Foras Forbartha in 1971, the original channel length of 2,900 km expanding to 7,000 km by 1986, to 12,700 km by 1990 and to 13,200 km by 1994. This baseline (13,200 km) includes all of the readily accessible rivers and streams depicted on the Ordnance Survey map entitled 'Rivers and their Catchments Basins' and it takes three* years to survey. As the survey extends over several years it is important to note that the overview presented in these reports cannot represent the most recent position for all rivers. However, recent chemical information will be available for many of the seriously polluted river reaches.

2.5 Routine water quality monitoring programmes are of most value in assessing the effects of more or less continuous inputs of waste but short-term pollution events may well escape detection, particularly by routine chemical surveys which generally rely on relatively infrequent grab samples. However, the biological effects of such once-off events are usually detectable for some considerable time afterwards, so that the biological surveys are likely to detect them in many instances. Again, however, because of the current frequency of assessment (three yearly), the biological survey is not expected to adequately reflect all such transient events.

WATER QUALITY ASSESSMENT

2.6 The Biological river quality classification system is set out and discussed in detail in Appendix I and is summarised hereunder:-

'Q' Value	Community Diversity	Water Quality	Condition*
Q5	High	Good	Satisfactory
Q4	Reduced	Fair	Satisfactory
Q3	Much reduced	Doubtful	Unsatisfactory
Q2	Low	Poor	Unsatisfactory
Q1	Very low	Bad	Unsatisfactory

* 'Condition' refers to the likelihood of interference with beneficial or potential beneficial uses.

* It should be noted that the survey, which had been carried out over a four year period, has been modified in recent years to allow a three-yearly coverage. This entailed reducing the number of sampling points by 1000 to the current 3200; these have been chosen so as to ensure that the coverage of the 13,200 km baseline remains representative.

The intermediate indices Q1-2, 2-3, 3-4 and 4-5 are also used to denote transitional conditions. The scheme mainly reflects the effects of biodegradable organic wastes (i.e. deoxygenation and eutrophication) but toxic effects are also readily discernible and where such effects are suspected or apparent the suffix '0' is added to the biotic index (e.g. Q1/0, 2/0 or 3/0). In order to simplify this scheme the biotic indices are related to four Water Quality Classes viz., Unpolluted, Slightly Polluted, Moderately Polluted and Seriously Polluted as follows:-

Biotic Index	Quality Status	Quality Class
Q5, 4-5, 4	Unpolluted	Class A
Q3-4	Slightly Polluted	Class B
Q3, 2-3	Moderately Polluted	Class C
Q2, 1-2, 1	Seriously Polluted	Class D

2.7 Class A waters are those in which problems relating to existing or potential uses are unlikely to arise; they are, therefore, regarded as being in a 'satisfactory' condition. Classes B, C and D are to a lesser or greater extent 'unsatisfactory' in this regard. For example, the main characteristic of Classes B and C waters is eutrophication which may interfere with the amenity, abstraction or fisheries uses of such waters. Eutrophication is typically found in the recovery zones below seriously or moderately organically polluted reaches or it may arise as a consequence of the run-off of nutrients from agricultural or forestry land. Waters assessed as Q3-4 (slightly polluted - Class B) are essentially transitional between the satisfactory Class A and the unsatisfactory Classes C and D. It is considered prudent, however, that these slightly polluted waters should also be classified as unsatisfactory in the analyses set out in this report because of the potential risk to wild game fish populations of nocturnal dissolved oxygen (DO) depletion which may occur in such waters, particularly in times of low flow and elevated temperature. In Class D waters excessive organic loading leads to deoxygenation and may produce 'sewage fungus' growths; as a consequence, most beneficial uses may be severely curtailed or eliminated. Appendix Table I.1 sets out some of the principal characteristics of the four water quality classes and the relationship between these and the biotic indices (Q1 to Q5).

SAMPLING PROCEDURE

2.8 The freshwater reaches of rivers and streams are surveyed from an upper 'survey limit' to their confluences with other rivers or to their tidal limit. The survey limit is a point in the headwaters above which biological sampling is inappropriate, usually because of lack of flow. Sampling sites are typically located at 5 km intervals with extra stations to reflect better the effects of point discharges or of other known or potential pollution sources. In order to determine the channel lengths in the various water quality classes it has been necessary to interpolate conditions between the individual sampling points: this procedure has been carried out in a systematic and standardised fashion having regard to typical or expected recovery patterns in rivers affected by waste discharges. River lengths quoted in the text refer to the surveyed, freshwater reaches, exclusive of lakes.

SURVEY RESULTS: MAIN FINDINGS

River Quality: National Status

2.9 The water quality of the 13,084 kilometres of channel surveyed in the period 1995-1997 is classified, on the basis of the biological survey, as under:-

Class A	8754 kilometres	67%
Class B	2376 "	18%
Class C	1832 "	14%
Class D	122 "	1%

These results indicate that the bulk (67%) of surveyed rivers/stream channel length is in a satisfactory quality condition but a considerable length is affected by slight or moderate pollution; some 18 per cent (2376 km) is classed as slightly polluted/eutrophic, a further 14 per cent (1832 km) is being moderately polluted and 1 per cent (122 km) is currently subject to a serious degree of pollution.

2.10 An analysis based on the ***numbers of sampling locations*** surveyed is given below:-

Class A	1873 locations	60%
Class B	580 "	19%
Class C	601 "	19%
Class D	65 "	2%

River Quality: Regional Situation

2.11 A regional analysis of river quality is presented in Table 2.1 which shows, for each of the eight Water Resource Regions, the surveyed channel length apportioned to the four Biological Water Quality Classes. This Table shows the North-Western 'b' Region (Donegal-Sligo) to have the highest proportion of unpolluted river channel

Trends Generally

2.17 Changes in both the long-term (2900 km) and recent (13,200 km) baselines indicate :-

a) a distinct trend of continually increasing slight and moderate pollution and
b) a recent reversal of the trend of decreasing serious pollution which had been gradually falling off over the years.

The upward trend in the extent of slight and moderate pollution is attributed mainly to eutrophication by organic (animal manure) and artificial fertilisers and to a lesser extent by point source (i.e. sewage) discharges (see below). The recent increase in the extent of seriously polluted channel is attributed mainly to suspected sewage discharges and to a lesser degree to suspected industrial and agricultural activities.

POLLUTION CAUSES

General Considerations

2.18 While the causes of the observed pollution have not been specifically proven, it is quite clear in most cases what they are likely to be. The term 'suspected' is used in order to indicate the circumstantial nature of the analysis carried out in this report. The suspected causes of all observed pollution are summarised in Fig 2.3 which shows the number of polluted locations grouped by the four main suspected causes, agriculture, sewage, industry and other/unknown as well as combinations of the four main causes. The heading 'Agriculture' includes the various adverse effects of overgrazing by unsustainable populations of sheep in the more remote areas of the west in particular as well as the more usual organic pollution and eutrophication caused by diffuse and point sources of agricultural wastes. The heading 'Sewage' includes waterworks effluent, septic tank effluent and diffuse urban inputs as well as sewage works discharges. 'Industry' includes bog and forestry development and mining as well as point source industrial discharges. The heading 'Other' includes pollution due to uncertain or unknown causes and also the enriching effects on rivers and streams of organic wash-out from eutrophic lakes.

Overall Situation

2.19 Most instances of slight and moderate pollution (i.e., 43% of Class B and 42% of Class C locations) are apparently due to agriculture and the bulk of the remainder is attributed to sewage (18% of B and 20% of C locations) or to 'Other' causes (21% of B and 18% of C locations). Siltation and other effects, due primarily to soil erosion resulting from overgrazing by sheep but also to bog and forestry development programmes, are responsible for much of the slight and moderate pollution recorded in the west of Ireland. Most seriously polluted locations (44% of Class D) are in this condition as a result of suspected sewage discharges and the bulk of the remaining instances of serious pollution appear to be due to agriculture (23%) or industry (22%) in roughly equal proportions (Fig. 2.3)

Seriously Polluted Stretches

2.20 A total of 65 locations were seriously polluted in the period under review: 25 cases were already on record, five of these since 1971, six since the late seventies/early eighties, 12 since the late eighties/early nineties and two since the previous (1991-1994) period (Table 2.3) but there were 40 'new' instances (Table 2.4) i.e., locations which were not seriously polluted in the previous (1991-1994) period. Twenty seven of the 'new' instances were at locations which had been moderately polluted, four had been just slightly polluted, four had been unpolluted and a further five had not been surveyed in the previous period. As regards the likely causes of serious pollution and in terms of the approximate lengths of channel affected by the major pollution sources the situation is as follows: of the total of 122.5 km of seriously polluted channel it is estimated that some 40 per cent (49.5 km) is due to sewage, 24 percent (29.5 km) to industry, 22 per cent (27 km) to agriculture and the remainder 14 per cent (16.5 km) to other/unknown causes.

2.21 With the exceptions of the reaches on the Avoca, Boyne, Dalgan, Feale, Liffey and Nore rivers, most of this pollution has been recorded in smaller rivers and streams. The serious pollution of the Feale, Liffey and Nore rivers is confined to short stretches along one side of the channel only below, respectively, Abbeyfeale, Straffan and Thomastown but the Boyne (a 'new' instance) and Dalgan (since 1979) were much more extensively affected. The most outstanding case of serious pollution remains that in the Avoca river which has been grossly polluted by toxic mining wastes since the mid 1800s. Most of the serious pollution originates at point sources and is, therefore, readily amenable to elimination:

a) by the provision of adequate sewage treatment facilities where these are lacking,
b) by industry adopting more effective waste minimisation and waste treatment measures and
c) by farmers adopting a responsible approach in the location and maintenance of farm waste storage installations and in the disposal of manure slurry and other high strength wastes. This is particularly important where very large

TABLE 2.4

New instances of serious pollution. List of seriously polluted (Class D) river locations recorded in the period 1995 - 1997 showing channel length, location, former quality status (if previously surveyed) and suspected causes of the observed pollution :- A Agriculture, S Sewage, I Industry, O Other / Unknown. Descriptions of river survey locations taken from OS 1 inch Maps. Total length : 62.5 km

River Name	EPA Code	Length km	Location	Former Quality Class	Most Recent Survey	Suspected Cause
Banoge	11B02	1.0	Bridge at E side of Gorey	C ('93)	1995	S
Boyne	07B04	2.0	Kinnafad Bridge	C ('94)	1997	S
Bride (Lee)	19B04	*	Bridge at Crookstown (RHS)	C ('94)	1997	S
Broadmeadow	08B02	2.0	Milltown Bridge	C ('94)	1996	S
Donagh	40D01	1.0	Corvish Bridge	C ('93)	1996	S
Eyrecourt Stream	25E01	4.0	Bridge NNE of Fearmore	C ('93)	1996	S
Feale	23F01	*	0.2 km d/s Abbeyfeale Br	A ('91)	1996	S
Glory	15G01	1.0	Bridge N of Kilmaganny	C ('91)	1995	S
Hind	26H01	2.0	Bridge E of Ballymartin	C ('92)	1996	S
Kilcolgan	29K01	5.0	Killilan Bridge	A ('94)	1997	S
Liffey	09L01	*	Straffan Turnings Lower (LHS)	-	1995	S
Lough Naminoo Stream	34L04	1.5	Br d/s Castlebar Rd Br, Balla	B ('93)	1995	S
Moate Stream	25M05	4.0	d/s Moate (Two Locations)	C ('93)	1996	S
Proules	06P01	0.5	d/s L. Naglack	C ('94)	1997	S
Rhine	26R04	1.5	Bridge N of Cartron	C ('92)	1996	S
Rock (Birr)	25R02	2.0	Aughnagann Ford	A ('93)	1996	S
Triogue	14T01	6.5	d/s Portlaoise (Two Locations)	C ('93)	1997	S
Yellow (Knock)	34Y02	1.0	120m d/s Bridge SW of Eden	B ('93)	1995	S
Sewage : Total		**35.0 km**				
		56.0 %				
Ahavarraga Stream	24A02	1.5	Bridge W of Mundellihy	C ('93)	1996	A
Ballindine	30B03	3.0	Ballindine Bridge	C ('94)	1996	A
Ballyboghil	08B01	3.0	Bridge S of Trallie lodge	-	1996	A
Ballylongford	24B03	2.0	Bridge SW of Shrone	C ('94)	1996	A
Ballynagrenia Stream	25B16	1.5	Bridge S of Rosemount	C ('93)	1996	A
Broadmeadow	08B02	1.0	Cookstown Bridge	C ('89)	1996	A
Bunoke	24B06	1.5	Bridge S of Glenquin House	C ('94)	1996	A
Cappanacloghy	15C06	2.0	Bridge E of Clooncullen	C ('91)	1995	A
Dromore	36D02	*	Bridge NE of Corryloan (LHS)	-	1997	A
Lee (Tralee)	23L01	*	Ahnambraher Br (RHS)	C ('91)	1996	A
Pinkeen	09P02	0.5	Br SE of Powerstown House	-	1996	A
Tolka	09T01	2.5	Bridge at Black Bull	C ('94)	1996	A
Agriculture : Total		**18.5 km**				
		29.6 %				
Aighe	38A03	1.0	Lower Reaches (Two Points)	A ('94)	1997	I
Figile	14F01	1.0	Cushaling Bridge	B ('93)	1997	I
Greese	14G04	1.0	Bridge NW of Crosskeys	C ('93)	1997	I
Tully Stream	14T02	2.0	0.5 km d/s Br near Tully House	C ('93)	1997	I
Total due to suspected Industry		**5.0 km**				
		8.0 %				
Aughboy (Courtown)	11A02	2.0	Br NE of Middletown House	C ('93)	1995	O
Devlin's	07D02	1.5	Bridge S of Grange Crossroads	B ('94)	1997	O
Tullaghobegley	38T01	0.5	Ford 1.5 km d/s L. Altan	C ('94)	1997	O
Total due to Other/Unknown causes		**4.0 km**				
		6.4 %				

* = Less than 500m

CHAPTER SEVEN

DISCUSSION AND CONCLUSIONS

7.1 Relatively low population density and still moderately developed agricultural and industrial activities are factors which would be expected to prevent large scale damage to the quality of the water resources of the State. It is not surprising, therefore, that the position on water quality in Ireland generally compares very favourably with that in other European countries (EEA, 1994; 1998). The widespread occurrence of the salmon and trout in Irish freshwaters is a further indication of the generally good situation.

7.2 In view of the foregoing, it is disappointing that this review has shown an increase in the extent of pollution in the inland waters of the State compared with the previous period of review (1991-1994), continuing a trend which has been noted over the last two decades. This indicates that the current level of water pollution control is not sufficient to maintain the generally satisfactory position. Although much of the deterioration in quality is of a minor order, it is of concern in view of the high quality conditions needed to sustain the salmonid fish populations which particularly characterise Irish rivers and lakes The dependence of much of the public water supply on surface waters is a further concern in this regard.

7.3 The main problem affecting inland surface waters, as noted on previous occasions, is eutrophication and this is attributed to enrichment of rivers and lakes with phosphates, mainly arising in sewage and agricultural wastes. The incidence of serious organic pollution seems to have diminished in recent years, paralleling a general trend in Europe which is due to more widespread use of secondary treatment for sewage and other wastes. However, it is noted that there has been a slight increase in the extent of serious pollution in the rivers in the current period, and that this is attributed mainly to sewage. This is the first reversal of a trend towards a reduction in the incidence of such pollution which has been on record since the late 1970s. There are indications that overloading of sewage treatment capacity is responsible for some at least of this change.

7.4 In contrast to the inland waters, the position in estuarine and coastal waters is generally satisfactory, despite some localised problems due to untreated and poorly dispersed wastes. The main focus of the surveys carried out in the period was the detection of eutrophication tendencies. Clear indications of such tendencies were observed in only a few cases, e.g. in inner Cork Harbour and in the Broadmeadow estuary in Co. Dublin while the elevated growth of algae recorded in other cases, e.g. the Suir-Nore-Barrow Estuary, may be, in part at least, a natural phenomenon. While estuarine waters are in receipt of the State's larger discharges of nutrients from point and diffuse sources, factors such as turbidity and rapid flushing by tidal movement may act to minimise the impact of the nutrient loads on algal growth.

7.5 It is also notable in these brackish and saline waters that the monitoring for the presence of potentially toxic pollutants shows generally low levels of contamination. This is particularly reassuring in view of the fact that the bulk of the aquatic organisms harvested for human consumption come from such waters.

7.6 The pollution potential in the estuaries and coastal waters should be further reduced in the next few years as the upgrading and building of sewage treatment plants proceed, in compliance with the requirements of the EU Urban Wastewater Treatment Directive. In many of the coastal towns this will mean a change from none to full secondary treatment of sewage, with favourable implications in particular for nearby shellfish and bathing waters due to large scale reductions in the discharge of potentially harmful micro-organisms.

7.7 The information presented in Chapter Five for groundwaters suggests that, in the main, these are of high quality and should not present difficulties where they are needed as a source of public supply. However, it is also clear that localised contamination occurs. Of most concern in this respect is the presence of faecal coliforms in some samples, suggesting contamination with sewage or livestock manures. Such contamination indicates the necessity for disinfection of all waters drawn from groundwaters as a precautionary measure. It is noted that monitoring of water in supply also shows that faecal coliform contamination occurs in a relatively high proportion of samples taken from private schemes (EPA, 1999). The observations on groundwaters in the 1995-1997 period, reported in Chapter Five, suggest that some at least of this

APPENDIX 12

Teagasc
AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

JOHNSTOWN CASTLE
RESEARCH AND DEVELOPMENT CENTRE
WEXFORD TEL 053-42888 FAX 053-42004
FAX LAB/RESEARCH 053-42213

ANALYTICAL REPORT

Client: Mr Jim Gaynor, Gaynor Corr & Associates

Material: 4 soil samples

Reference: No 1 - 4
Lab Set U999, Code 593 - 596

Results

NOS	% Dry matter	% Organic Matter	% Neutralizing Value
1	57.8	33.1	23.6
2	59.8	27.5	29.4
3	55.6	37.0	36.1
4	72.9	21.8	43.5

Comment:

1. Results are quoted on dried sample
2. Organic matter is measured by ashing at 550°C
3. Neutralizing value is a measurement of carbonates. For example, good quality limestone (calcium carbonate) has an neutralizing value of 100%.

Signed: Jean Kayne Date: 19/11/96