

*Bord na Móna
Energy Ltd.*

**Integrated Pollution Control
Licence Application**

ATTACHMENT No. 11

EMISSIONS TO SURFACE WATERS

*Bord na Móna
Energy Ltd.*

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ATTACHMENT No. 11A

*DETAILS OF ALL EMISSIONS TO
SURFACE WATERS*

DERRYGREENAGH GROUP – EXISTING & PROPOSED SILT SEDIMENTATION POND DATA SHEET

Silt pond ID	Emission Pt.	Emission Pt Grid ref	Catchment Area (Hectares)	Pond Capacity (m ³)	Norm. Daily Run-off m ³ /d	Max. Daily Run- off m ³ /d	Receiving Water	Discharge Pt. Grid Ref.	Additional Information
Derryhinch									
DH1	SW1	E255527 N243586	36.2	1632	865.8	28960	Kinnegad River	E256223 N244328	Single
DH2	SW2	E254665 N242287	30.5	1500	729.5	24396.6	Castlejordan	E254519 N241400	Single
DH3	SW3	E255180 N242433	102	2937.6	2439.6	81599.4	Castlejordan	E253445 N241760	Single
DH4	SW4	E252736 N240275	56	2159	1339.4	44796.4	Milltown River	E252669 N242314	Single
Drumman									
DM5	SW5	E252304 N240864	133.5	738	3193	106711.4	Castlejordan	E252504 N240864	Single
DM6	SW6	E252457 N241096	48.5	5240	1160	38766.6	Castlejordan	E252457 N241960	Double Parallel
DM7	SW7	E252497 N241109	48.5	1048	1160	38766.6	Castlejordan	E252497 N241189	Double Parallel
DM8	SW8	E252258 N239811	272	3360	6505.6	217423.2	Castlejordan	E252212 N239864	Single
DM9	SW9	E232994 N238374	18.3	150	437.7	14625.5	Yellow River	E255500 N238150	Single
Derryarkin									
DK10	~	~	62	215	~	~	S.P. DK11	~	Double
DK11	SW10	E250093 N236605	62	215	1482.9	49559.7	Yellow River	E250030 N236200	Double
Ballybeg									
BB12	SW11	E251597 N235318	236	1350	5644.6	188646.6	Yellow River	E251787 N235914	Single
BB13	SW12	E252290 N252290	31.2	18	746.2	24936.8	Yellow River	E251787 N235914	Single
BB14	~	~	300	750	~	~	S.P. BB15,16,17.	~	Single
BB15	~	~	300	1890	~	~	S.P. BB17	~	Double Parallel
BB16	~	~	300	1820	~	~	S.P. BB17	~	Double Parallel
BB17	SW13	E251273 N234373	300	198	7175.3	239805	Yellow River	E252447 N252447	Single
Toar									
TR18	~	~	32	2640	~	~	S.P. TR19	~	Double

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- * Emission point of final effluent discharge from silt pond unit Refer to Drawings 11.1a - 11.1e for locations of various silt pond units
- ** 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 (873mm) over 29 years (1961-1990) for Derrygreenagh rainfall monitoring station (Source: Met Éireann).
- **** 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 (Source: Met Éireann).
- ***** 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

EMISSIONS TO SURFACE WATER

DRAINAGE

By their nature, bogs are large reservoirs of water. In its natural undisturbed 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. The bog is divided between the acrotelm and the catotelm. The acrotelm is the top 10 – 30 cm of living and poorly humified sphagnum mosses. It is periodically aerated and highly permeable. The underlying peat, the catotelm, is more highly humified with increase in depth and has low permeability.

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.

The drainage plan for bogs 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, and as a result the surface water is removed. After a year it is possible to deepen the drains further using a disk ditcher or wheel ditcher 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. Many bogs historically formed in lakes below the present river levels, therefore, pumping is necessary in order to effect drainage. Archimedean screw pumps powered by electric motors were used, lifting the water up to 6 m.. In recent times, the Archimedean screw pump is being replaced by modern submersible pumps.

ENVIRONMENTAL EFFECTS OF DRAINAGE

Reduction in Evapo-Transpiration

Evaporation from intact bogs is higher than that from all other land covers, except in the case of forestry and open water. Annual evaporation from heather and sphagnum covered bogs in Northern Germany has been shown to be 5 – 10% higher than that from neighbouring grassland areas. Evaporation from intact bogs during Winter months is high, while summer evaporation levels are similar to that of drained bogs.

It is estimated that total evaporation from intact, raised bogs, is of the order of 550 mm/annum in NW Germany and the Netherlands (Streefkerk & Casparie, 1992). Evapo-transpiration is expected to be much less from a bare peat bog with drainage effecting a lowering of the water table.

Groundwater flow (combination of lateral flow and downward flow) in an intact bog is confined to the acrotelm (top 30 cm). Below this level, the peat becomes less permeable (values between 10^{-2} and 10^{-4} m d⁻¹) and very little flow is possible with insignificant vertical flow or downward seepage. Keane & Dooge (1975) found that for bog peat, the infiltration rate was highest when moisture content was around field capacity. Infiltration in a worked bog with the acrotelm removed and lower moisture content at the surface would be low.

Removal of Storage

Storage of rainwater near the surface is an important factor in the bog ecosystem. The upper layer consists of almost fresh plant remains and living tissue. Streefkerk & Casparie (1992) estimated the storage coefficient or specific yield (the quotient of a change in soil moisture content to the resulting change in the water level) at 0.8. In the case of a water table of 30 cm below the surface and a storage coefficient of 0.7 it is estimated that the amount of rainfall stored between full saturation and field capacity is as high as 210 mm (Hooijer, 1996).

The acrotelm also has the capacity to shrink and swell with falling and rising water tables (up to 10 cm in intact bogs according to Streefkerk & Casparie (1992)). The swelling occurs in winter and provides additional water storage capacity.

Faster Outlet for Water

As previously outlined, the bog surface is made up of hummocks and hollows. Very little water runs off during dry weather periods. During winter months, the hollows fill with water and are linked providing a route for surface water flow.

Surface run off occurs through this system and only when the soil is completely saturated. It would appear that when this condition is reached, additional run off will be rapid. However, some authors believe that even then, the almost level topography and large storage capacity will delay storm run off (Bej 1967, Verry & Boelter, 1975). Hooijer in his Floodplain Hydrogology 1996, observed that from inspection of historical maps and aerial photographs, streams rarely originate in raised bogs and that bogs seem to be inefficiently linked to the drainage system. This suggests that little rapid streamflow was produced by bogs. Hooijer suggests that part of the run off after temporary storage within the lag zones was discharged to streams through groundwater systems. In Irish conditions where the bogs were often surrounded by permeable eskers, this is a likely scenario.

Rainfall

The above would seem to indicate that the drainage system within the peatlands and the removal of the surface vegetation from the bog has the greatest effect on the quantity of surface water run-off that ultimately discharges to the receiving water body. However, there are other factors.

The primary function of the drainage channels excavated within the bog is to drain and divert rainfall in the form of run off. The overall objective of the bog drainage plan is to reduce the moisture content of the top layer from an initial 95% to 90% thereby doubling the concentration of solids. It has been established that, due to the low permeability of the peats, the drainage ditches have limited effect beyond the first 1.0 m from the side wall of the drain. The first 2 - 3 years of drainage removes any free water from the acrotelm resulting in increased discharge from the bog during this period. The amount of water drained off is estimated at 50 litres per cubic metre.

The drying of milled peat aims to reduce the moisture content from that of 85% at the surface before milling, to 45% moisture content prior to harvesting. This is achieved almost exclusively through evaporation effects.

Therefore, the only factor to be considered is that of rainfall. Hooijer suggests a decline in evaporation from 60% to below 5% during Winter months with a concomitant reduction in the storage coefficient to <0.2 . There are no measurements for evaporation over the winter period but it is reasonable to assume that it is much less than that from an intact bog, therefore, it is likely that more than 80% of rainfall during this period is manifested as run-off. Observations suggest that during the Summer months much of the rainfall is evaporated and also infiltrates through the open textured top layer after milling as minimal run off is generated unless after a period of continuous heavy rainfall. It is reasonable to assume, therefore, that up to 70% of annual rainfall will exit a drained production bog in the form of run off compared with less than 20% from an intact bog.

In addition, the development of outfalls away from the bog has enabled farmland to be drained in the immediate area. While this obviously has a beneficial effect for the landowner, water run off characteristics can be affected.

Hooijer estimates run off from developed bogs at 536 mm/annum which is 90% higher than that from intact bogs. It was found that this land cover type is characterised by 'flashy' hydrographs and consequently a large flood generation capacity. Hooijer found significant long term changes in storm flow regimes and concluded that these resulted from changes in land use. However, he rightly points out that the industrial peatlands do not account for the total. The balance he ascribes to other drainage operations.

The effects of the production bogs can, therefore, be quantified. Accepting Hooijer's figure of 536 mm/annum for run off from developed bogs and assuming an additional run off of 250 mm/ annum for cutaway bogs, this would equate to an additional run off over the catchment caused by an additional 3 – 4 mm of rainfall. As can be seen from flood level records at Portumna, there has been no major change in over 60 years. This is to be expected in such a large catchment. Local flooding may, however, occur in the tributaries which receive the outfalls from the bogs because of the faster run off caused by drainage and removal of vegetation.

EMISSIONS TO SURFACE WATER FROM WORKSHOPS

On-site water emissions from workshop areas can be divided into two categories:

- Domestic Wastewater
- Storm Water (run-off from hardstanding areas, machine washings, petrol/diesel dispensing area)

All on-site wastewater/surface water emissions from individual workshops drain via the on-site surface water drainage systems to the adjacent peatlands surface water drainage network which eventually discharges to the receiving stream/river/lake body.

Domestic Wastewater

Sewage (typical sewage constituents: BOD 300 mg/l¹, TSS 200 mg/l¹) emanating from the toilet facilities serving individual works and tea centres receives primary treatment in a septic tank. Final effluent from these treatment units typically discharges to ground.

Storm Water

Surface water run-off from hardstanding areas following a rainfall event is typically channelled via a drain network to the adjacent peatlands drainage system which ultimately discharges to the receiving stream/river/lake body. Machine washings generated due to the cleaning of various tractor, truck, locomotive and bulldozer/excavator units (removal of peat using a power steam wash system which typically takes place when a machine leaves the peatlands) at the wash bay also drain to the adjacent peatlands drainage system. For selected workshops this may be via an interceptor tank and associated gravel soak pit. The primary purpose of the interceptor unit is to facilitate removal of any floatable oil/grease components which may be introduced to the wastewater stream during cleaning events. In addition, an element of settlement for denser solid inputs should be provided for.

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ASSESSMENT OF IMPACT ON RECEIVING SURFACE WATERS

IMPACT OF PEAT EXTRACTION ON RECEIVING WATER QUALITY

Large scale peat extraction can have considerable effects on the quality of receiving water bodies i.e. streams, rivers, lakes. The effects may be categorised as follows:

- Peat Siltation
- Eutrophication Impacts (direct phosphate release from peatlands, UV-mediated phosphorus release from dissolved humic materials)

PEAT SILTATION

Siltation of stream, river and lake substrata with peat silt is perhaps the commonest manifestation of the impact of industrial peat extraction operations. Discharge of peat silt from bog surface water drainage channels permeates the gravel of many river beds. Concern centres on the possible effects of peat silt on the eggs and juvenile stages of salmonids (it should be noted that the majority of drains into which surface water run-off from industrial peatlands discharge do not contain gravel spawning areas). The effect of suspended solids, as opposed to peat silt, upon fisheries is well documented. It has been shown that; brown trout will not cut redds in gravel choked with sediment; cutthroat trout will abandon redds if silt is encountered during digging; salmon and trout eggs buried in gravel can develop satisfactorily only when a current of water is passing through the gravel as opposed to a silted substratum which causes a reduction in intragravel velocity and results in an oxygen deficit to the ova (Central Fisheries Board, 1991; Results of a Preliminary Survey of the Rivers Deel and Owenmore, Co. Mayo, with Particular Reference to Peat Siltation). Localised increases in acidity due to transport of excess amounts of humic and fulvic acids associated with the peat material may also impact on fish egg survival.

Siltation and clogging of stream, river and lake beds may also impact on the floral and faunal communities present in these freshwater systems. Peat siltation is greatest in areas of least water movement (i.e. river margins, lake deeps) resulting in a naturally poorer faunal diversity. It has been historically shown that, in deep, slow-flowing and peat impacted sections of the rivers that aquatic plant production is seriously diminished. This may indicate a reduction in light penetration to submerged plant anatomy resulting from the presence of suspended peat silt particles (peat staining of water) within the water. The presence of a deep and often unstable peat silt substrate on the river bed may present an unstable and unsuitable medium for the colonisation of plants or plant fragments. In shallow and more fast flowing streams/rivers the impact of peat siltation on the resident flora may not be as significant as the silt is regularly flushed and as a result may not have the opportunity to settle on the

stream/river bed (Central Fisheries Board, 1991). Furthermore, in shallow streams/ivers, even under moderately silted conditions, sufficient light for photosynthesis can penetrate through the water column.

Many studies have been done on the effect of peat silt on fisheries. In particular, a study was carried out over a nine year period 1975 – 1983 on the 'Effects of Peat Bog Development on the River Suck Fishery' by the Central Fisheries Board (1988). The study found that downstream of bog outlets, significant silt deposits occurred and there was an imbalance of the aquatic plant community. The report stated that *'the constant discharge of peat silt laden water into the main channel significantly affected light attenuation and in many areas the submerged plant community was totally eliminated from the habitat'*. This has a major effect on the coarse fishery. However, the report also concludes that *'in areas which had been seriously affected by siltation in the past, it was possible to bring about total vegetation recovery in one to two years by maintaining total suspended solids in the discharge water at low levels'*. This is a very important result because it demonstrated that with judicious peat silt management, the damage caused to the floral community can be reversed after a very short period of time to the benefit of the entire ecosystem.

EUTROPHICATION IMPACTS

Wetland areas are considered to be potential sources of nutrients and as such represent a potential contributor to the decline in the water quality of receiving freshwater systems. This nutrient source may be attributed to a direct phosphate loading from the surface water discharge from the peatlands or the phenomenon of UV-mediated phosphate release from humic-iron-phosphate complexes which are formed in peaty waters.

Direct Phosphate Release from Peatlands

There has been a lack of information about the nutrient chemistry of the run-off water discharges from commercial peatlands. Traditionally it has been felt that peatlands are a minor source of nutrients. However, it has been shown that phosphate concentrations can be quite high (concentration range from 20 - 200 $\mu\text{g l}^{-1}$ Total Phosphorous; The Trophic Status of Lough Conn: An Investigation into the Causes of Recent Accelerated Eutrophication - Mayo County Council, 1993) in the discharges from silt settlement units (Central Fisheries Board, 1993; Lough Derg – An Investigation of Eutrophication and Its Causes). This run-off may subsequently cause eutrophication in smaller rivers and streams immediately downstream of surface water discharges from commercial peatlands until they receive significant dilution by low phosphate water.

In the case of the deterioration of the water quality of Lough Derg, the public perception was that the peat silt was a major contributory factor. In 1991, the Lough Derg Working Group commissioned the Environmental Research Unit (now part of the EPA) to undertake a study of the water quality of the lake and to study the effects of the peat. The report, entitled 'Lough Derg – An Investigation of Eutrophication and Its Causes', found that *'the impact of phosphorous from this source (humic substances) on the phosphate budget of the River Shannon and Lough Derg is quite small'*. It was estimated that about 2% of the total phosphate budget of the lake came from peat bog drainage. In any event, the phosphate inputs arising from surface water run-off from commercial peatlands are small in comparison with other phosphate sources, such as municipal sewerage discharges and agricultural run-off, which are still considered the major contributors of nutrients to receiving freshwater systems.

UV-Mediated Phosphorous release from Dissolved Humic Materials

Phosphate bound in Dissolved Humic Material-Iron-Phosphate complexes (phosphate bound to humic substances released within surface water discharges from peatlands) in peaty waters may, on occasion be released by mild UV light of similar strength to that in natural sunlight in a reversible reaction. Three response patterns have been observed in laboratory trials:

- Type 1 Response: Release of phosphate (with an increase of $>1 \mu\text{g P l}^{-1}$)
- Type 2 Response: Decline in phosphate levels on UV irradiation (with a decrease of $>1 \mu\text{g P l}^{-1}$)
- Type 3 Response: Unchanged phosphate levels following UV irradiation

In terms of the impact of this phenomenon on receiving water bodies it appears that the various responses balance each other out. There may be short periods when sunshine causes significant phosphate release during the day thereby allowing algae to absorb additional nutrients not otherwise available. On such occasions this may cause significant additional algal growth which could potentially give rise to algal blooms. On the basis of results from the 13 month sampling period in the Lough Derg study (Central Fisheries Board, 1993) these events are not likely to last for extended periods of time. The overall balance of the three types of response to UV light appears to be weighted in favour of a UV-mediated phosphate loss i.e. phosphate is more likely to be precipitated than released by UV light. Results indicate, therefore, that the overall impact of UV sensitive phosphate release from humic materials on the quality of receiving streams, rivers and lakes is minimal.

Transport of Phosphate from other sources by Humic Materials

A more important role of humic substances within peatland surface water discharges may be as a transporter of phosphate from other sources. In clear water systems where the water has moderate or high conductivity values it is normal to lose phosphate from water through precipitation with available cations such as calcium or magnesium or as a co-precipitate with calcium carbonate. Humic substances (e.g. fulvic acids), however, inhibit normal calcium carbonate precipitation. Therefore, the dissolved humic materials released within water discharges from commercial peatlands may affect the normal precipitation of phosphate. The presence of above background levels of dissolved humic materials may, therefore, contribute indirectly to increased transport of phosphate and increased phosphate levels within the system. In addition, dissolved humic materials can bind phosphate in a relatively bioavailable form for algal growth. The magnitude and type of interaction between dissolved humic materials and phosphates varies with water chemistry (i.e. pH, ionic composition, presence of bivalent cations and type of iron ions present, concentration and quality of dissolved humic materials).

Further study is required in order to quantify these effects. In any event the potential impacts can be reduced by improving management practices aimed at controlling the release of peat silt (and associated dissolved humic materials release) from peatlands.

SILT TREATMENT UNITS (SILT/SEDIMENTATION PONDS)

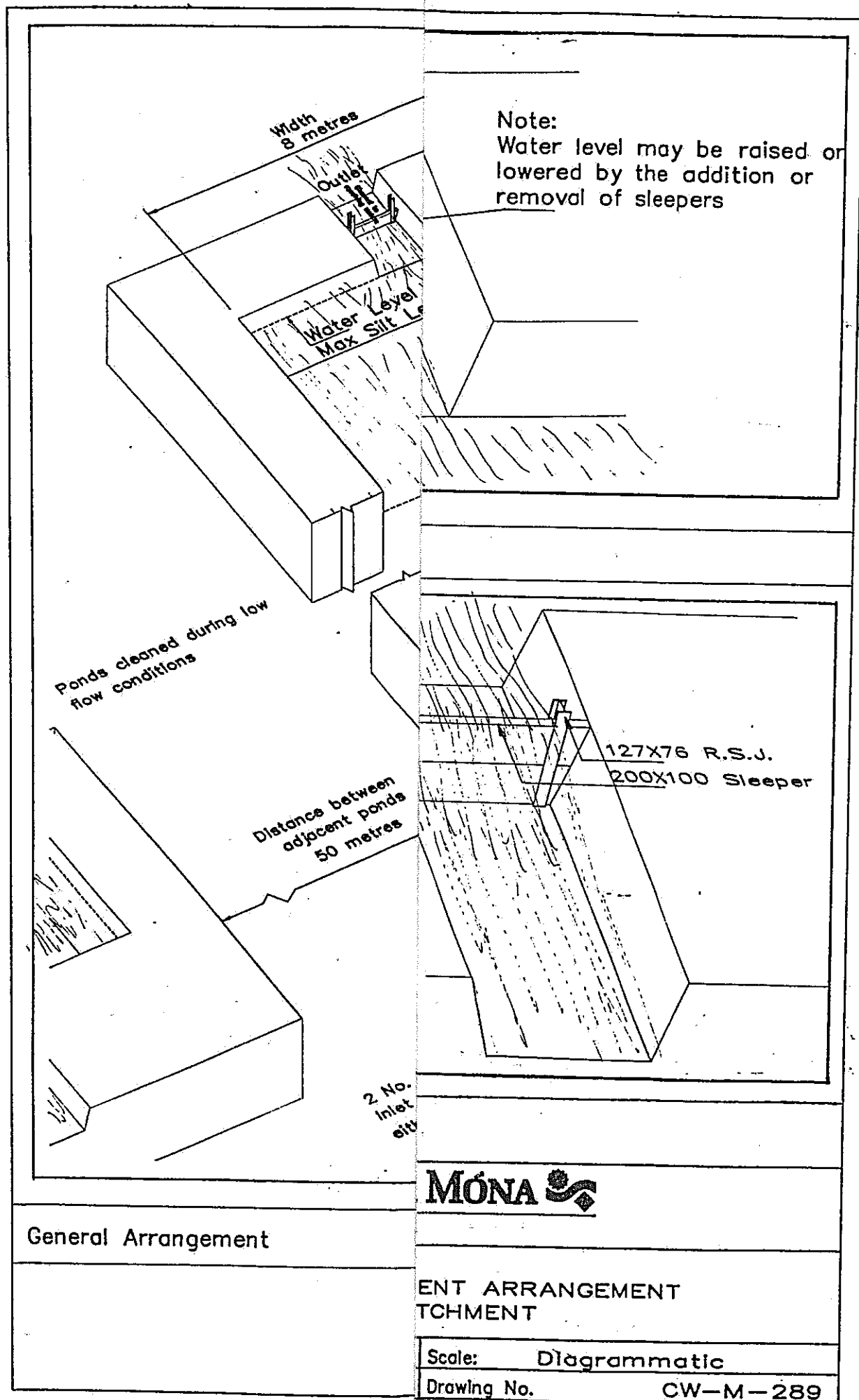
Probably the most significant environmental effect arising from milled peat production operations is that of the discharge of suspended solids (peat particles) to freshwater systems (streams, rivers, lakes) via peatland surface water drainage channels. When Bord na Móna switched from sod peat production to milled peat production procedures in the 1950's, it took some time to recognise the seriousness of the problems associated with high levels of suspended solids in drainage waters from milled peat operations i.e. previously accustomed to relatively minor suspended solids concentrations within the drainage ditches associated with sod peat production.

The milled peat production process involves milling or cutting the surface of the bog to a depth of 10 – 15 mm. The peat is spread over the surface and air dried assisted by harrowing. When dry (approximately 45% moisture content), the peat is formed into ridges at the centre of the field and harvested into stockpiles where it is stored until required. The surface water drainage system is an open arrangement with drains every

15 metres, 1.2m top width, 40 cm bottom width and 1.2 m deep. The depth is maintained at 1.2 m by ditching each year. The ditched spoil is spread over the adjacent field. These field drains feed into piped outfalls (usually 60 cm or 90 cm diameter concrete pipes) and these channel the water to external outfalls into the receiving river body. This is normally a gravity flow system but frequently pumping is necessary for low lying peatlands.

During heavy rain, fine peat particles may be washed into the drainage water becoming suspended (drainage water from the bog may also contain peat particles originating from air borne dust). Without treatment, the suspended peat solids will settle out at areas of least water movement (i.e. stream/river bends, stream/river confluence points, cattle drinking slips and eventually in lakes). A study of Lough Derg carried out in the mid 1970's identified deposits of peat silt at various locations in Upper Lough Derg just south of Portumna.

Treatment of the drainage water from industrial peatlands is achieved by the installation of silt settlement/sedimentation ponds (Figure 11.1). Peat silt particles have a low specific gravity, 1.02 – 1.04, consequently accumulation and settling will only occur under quiescent conditions. It has been found that the flow rate must be $<0.15 \text{ m s}^{-1}$, as at faster flowrates the settled peat may become re-suspended. The silt ponds, therefore, are designed to reduce the flow rate of drainage waters to $<0.15 \text{ m s}^{-1}$, thereby allowing the peat particles within the surface water run-off to settle. Storage for settled silt is provided within the pond unit below the invert of the outfall. A minimum residence time of 6 hours is desirable for silt settlement. Storage to a depth of 1.5 m below the invert is provided for within the silt pond, giving 12 m^3 silt storage capacity per metre run of pond (minimum pond width of 8 m). The amount of sludge generated is estimated at 48 m^3 per hectare per annum, so if the pond is desludged twice a year, the requirement is 2 m length of pond for every hectare of peatlands in production. In order to estimate the quantities of silt within the run off from the bogs, Bord na Móna conducted a daily sampling and analysis programme at a number of different locations over a full calendar year (Harkins Internal Bord na Móna Report 1990). In addition, rainfall records were analysed and bog operations at the various times recorded. The study found that for each net acre of production bog, 50 m^3 of sludge was typically discharged. The silt sedimentation ponds were subsequently designed to cater for the settling of this amount of silt providing enough storage based on the pond undergoing desludging twice per annum. A second pond in parallel or a bypass drain is typically excavated adjacent to a silt pond unit to facilitate desludging of the pond when it reaches silt storage capacity i.e. water run-off from the



peatlands is diverted from the silt pond unit to a bypass/pond in parallel in order to prevent discharge of peat silt during desludging (pond outlet is also dammed). Variations of this design are used, depending on the physical conditions at each site (i.e. ponds in series, ponds in parallel, baffle within pond, L-shaped pond).

The Harkins study identified critical periods during which the surface water run off from the peatlands contained the greatest concentrations of peat suspended solids:

- during ditching of drains
- following periods of heavy rainfall during the production season (Summer time) when the bog surface is covered with milled peat.

Results indicated that silt settlement ponds, when properly maintained, are effective in reducing the level of suspended solids within peatlands surface water run-off to $<30 \text{ mg l}^{-1}$ for 80% of the time and $<100 \text{ mg l}^{-1}$ for 98% of the time. The main difficulty encountered with the sedimentation pond system is the provision of regular and effective de-sludging. Because of the width (minimum width 8 m) of the silt pond treatment units long reach excavators are required for effective silt removal from the pond. Originally, draglines were used for the desludging of ponds. The draglines were slow and cumbersome and gave rise to significant turbulence within the pond during cleaning operations resulting in significant discharges of silt from the pond during desludging. Various pumping systems were evaluated as an alternative system for pond desludging with limited success. In 1990, a Priestman-built combined rope/hydraulic excavator (developed for maintenance of canals) with a 15 m reach replaced the draglines for silt pond cleaning operations. The excavation bucket (0.8 m^3) is delivered by hydraulics and retrieved by steel hawser. A moving ballast forms part of the jib which gives the machine balance and distributes the load evenly over the tracks. Since their introduction these machines have proved highly successful and efficient for sedimentation pond de-sludging.

SILT CONTROL RESEARCH

Research into silt control of surface water run-off discharges from industrial peatlands is ongoing. Effective control of silt discharges from sedimentation ponds during periods of heavy rainfall is extremely difficult. Use of weirs (e.g. a flow proportional weir through which the flow rate of the silt pond inflow is kept constant, as the influent run-off water is allowed to back-up upstream within the peatland drains, while the effluent discharges at a known constant rate) at the sedimentation pond outfall, is currently at the early stages of evaluation. Such a weir system would facilitate settlement of suspended peat particles within the peatlands drainage channels thereby reducing the downstream clean up requirement (of drains and silt ponds) following a storm event.

It has been noted that where pumped drainage is installed, control of silt discharges from the sedimentation ponds is easier. An option currently under review is that if the sedimentation pond is at a higher level, the influent run-off water may be pumped to the pond and the effluent discharged over a weir at levels that can be controlled.

IMPROVEMENT PROGRAMME

A programme of improvement towards achieving higher standards for emissions from silt pond treatment units is under preparation. The proposals for modification of the silt pond treatment system/operational procedures to bring emissions to within tighter levels include:

Modification of Treatment System

- Ensure that properly designed silt sedimentation ponds are constructed on all outfalls
- Install weirs on all silt pond treatment units
- Raise weirs during heavy rain if peat stock is not affected

Change in Operational Procedures

- Ensure silt ponds are properly maintained as per the maintenance/cleaning programme (biannual cleaning)
- Ditch drains in suitable weather
- Take precautions to prevent silt run off while piping outfalls

- Clean outfalls starting upstream
- Block outlets from field drains during stockpile loading
- Ditch dry peat from drain before unblocking
- Ensure that harrows, millers, ridgers do not drag loose peat into drains
- Have outer harrow spoons directed away from drain.

It is considered that the environmental impacts resulting from surface water emissions from the silt settlement ponds will be greatly reduced once the proposed improvements programme is implemented.

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*AN ENVIRONMENTAL ASSESSMENT OF THE
QUALITY OF SURFACE WATER EMISSIONS
EMANATING FROM A SELECTION OF SILT
SEDIMENTATION PONDS WITHIN THE
DERRYGREENAGH GROUP IN COMPLIANCE WITH
THE REQUIREMENTS OF AN INTEGRATED
POLLUTION CONTROL LICENCE APPLICATION.*

DRAFT

REPORT NO:

K960-SW5 (Derrygreenagh Group)

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Appendix 1: ENVIRONMENTAL PROTECTION AGENCY BIOLOGICAL DATA

1.0 INTRODUCTION

In compliance with the requirements of their Integrated Pollution Control Licence Application, the Derrygreenagh Group, Bord na Móna Energy Limited, c/o Derrygreenagh Works, Rochfordbridge, Mullingar, Co. Westmeath; are required to assess the nature of surface water drainage emissions from the Derrygreenagh Group. This study focuses specifically on that of surface water emissions from silt sedimentation ponds, in addition to predicting the environmental impacts of these discharges on receiving surface water bodies (streams/rivers/lakes).

Bord na Móna Environmental Limited were commissioned to perform the sampling and analysis. A selection of silt settlement ponds within the Derrygreenagh Group were subsequently sampled by a Bord na Móna Environmental Consultant on 22/4/1999. Emission to surface water samples were returned to the laboratory for subsequent analysis.

This report details the surface water sampling which took place including the sampling and analytical methods used. In addition, an interpretation of the results obtained is included.

2.0 METHODOLOGY

2.1 Sampling Locations

In order to give a representative indication of the quality of the surface water discharges from the silt sedimentation ponds, a total of 8 stations throughout the Derrygreenagh Group were sampled. The surface water sampling locations are described in Table 2.1 and illustrated in Drawings 11.1a - 11.1e of the Drawings Folder of the IPC Licence Application. The silt sedimentation ponds selected for sampling are those that will be serving bog catchment areas under active production during the impending harvesting-season. It should be noted that the results generated in this particular study will yield, what are considered, 'baseline' results as neither ditching (normally occurs from September - March) nor harvesting (normally occurs from June - September) processes (critical periods during which the surface water run off from industrial peatlands typically contain the greatest concentrations of peat suspended solids) were taking place during the sampling events of the 22/4/1999.

TABLE 2.1: LOCATION OF SURFACE WATER SAMPLING POINTS		
Sample Point Reference ID	Location	Justification
SW-1	DH1 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to the river Boyne (via Kinnegad river)
SW-4	DH4 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to the river Boyne (via Milltown river and Castlejordan river)
SW-5	DM5 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to the river Boyne (via Castlejordan river)
SW-13	BB17 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to the river Boyne (via Yellow river)
SW-14	TR19 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to the river Boyne (via Yellow river)
SW-30	BN36 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to the river Boyne (via Deel river)
SW-32	CN39 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to river Boyne (via Stonyford river)
SW-44	KD51 - outlet	To assess the quality of the surface water discharge from a silt sedimentation pond which ultimately discharges to the river Boyne (via Kinnegad river)

2.2 Surface Water Sampling

Grab samples of surface water were collected directly to 1 litre polypropylene containers. All sampling was in strict accordance with recognised standard procedures. All samples were returned to the laboratory, and stored at 4°C.

2.3 Control Chain Of Custody

As part of the Quality System in place in Bord na Móna, Environmental Limited, measures* are taken to ensure controlled chain of custody. An outline of the chain of custody is given overleaf.

2.4 Flow Measurements

Where possible an assessment of the flow throughput from the silt sedimentation pond outlets was undertaken using a Flo-Mate™ portable flowmeter (Marsh-McBirney Inc.). The flow meter utilises a solid-state electromagnetic sensor whereby the principle of operation is based on Faraday's law which states that an electrically conductive liquid passing through a magnetic field produces a voltage. The voltage amplitude is linear and is proportional to the water velocity flowing around the sensor. This flowmeter allows flow velocity readings to be taken at discrete points within a water body to an accuracy of 10^{-3} m s^{-1} . Flow velocities were taken across the profile of the pond outfall at 0.3 m intervals and at four depth levels. The area of the pond outfall at each of these 0.3 m sections was calculated and the flow rate ($\text{m}^3 \text{ s}^{-1}$) determined at each cross-sectional location. The average flow rate within the pond outfall ($\text{m}^3 \text{ s}^{-1}$) was thus calculated. Each reading was taken in triplicate and the flow rate calculated at two different locations within the pond outfall, thus allowing a percentage error value to be calculated.

BORD NA MÓNA
BORD NA MÓNA ENVIRONMENTAL LIMITED

CONTROLLED CHAIN OF CUSTODY

SITE

Sampling and packaging of all samples were carried out by Bord na Móna Technical Team:
Dr. E. Molyneaux

TRANSPORT

Transport Document Form



Transport to laboratory by Bord na Móna Technical Team.

Sample Reception Form



LABORATORY

Receiving of samples at Bord na Móna Environmental Limited Laboratory complex by:
Dr. J. Reilly, Laboratory Manager
(Secure laboratory complex access to authorised personnel only)



Storage of all samples for 1 month period after report issue.



Supervised Disposal

2.5 Analysis

All surface water samples returned to the laboratory were stored at 4°C. Subsequent analysis of all samples was carried out in strict accordance with recognised standard methods as detailed in Table 2.2 below:

TABLE 2.2: CHEMICAL ANALYSIS OF SAMPLES		
Parameter	Limit of Detection/Range	Method
pH	0.1 - 14 pH units	G/05
BOD ₅	2 - 5000 mg l ⁻¹	G/04
COD	10 - 1500 mg l ⁻¹	G/03
Conductivity	0.1 - 1999 µS cm ⁻¹	G/06
Anions & Cations	<0.1 mg l ⁻¹	IC based on ASTM D 4327
Total Suspended Solids	5 mg l ⁻¹	APHA 2540 D

- ASTM - American Society for Testing and Materials, Annual Book of ASTM Standards 1997.
 APHA - American Public Health Association, Standard Methods For the Examination of Waters and Waste Waters, 19th Edition, 1995.
 G/ - ILAB Accredited Method, Bord na Móna Environmental & Analytical Services Standard Operating Procedures Manual

2.6 Quality Control

The Environmental Limited Laboratory complex have been awarded ILAB accreditation by the ILAB secretariat. A stringent six point quality control approach is at present implemented in the laboratories.

- (i) Controlled chain of custody.
- (ii) Operator competence - all analysts must be suitably qualified to carry out required analysis.
- (iii) Certified Reference Materials (CRM). The accuracy of a series of determinations is checked against known standards.
- (iv) Duplicate - 10% duplication is normal.
- (v) Quality Control Charts.
- (vi) Inter Laboratory Testing - The Environmental Limited Laboratories are members of the WASP Interproficiency Testing Scheme and the W.R.C. Aquacheck Scheme. The Laboratory also participates in the Environmental Protection Agency's Intercalibration Programme and is listed on the Agency's Draft Register of Quality Approved Testing Laboratories for 1998/99.

3.0 RESULTS

The results of the emissions to surface water (from silt sedimentation ponds) investigation within the Derrygreenagh Group are presented in Tables 3.1 and 3.2.

Table 3.1: Results of Volumetric Flow Measurements taken at Silt Sedimentation Pond Discharge Outlets

Table 3.2: Results of Chemical Analysis of Emission to Surface Water Samples

TABLE 3.1: RESULTS OF VOLUMETRIC FLOW MEASUREMENTS TAKEN AT SILT SEDIMENTATION POND DISCHARGE OUTLETS

Parameter	Sample Point Reference ID							
	SW-1	SW-4	SW-5	SW-13	SW-14	SW-30	SW-32	SW-44
Average Flow (m s ⁻¹)	1.200	1.263	0.820	0.509	1.246	0.443	0.150	0.207
Average Depth (m)	0.04	0.10	0.202	0.096	0.170	0.013	0.063	0.250
Width (m)	0.40	0.44	0.50	1.10	0.52	0.15	1.00	0.22
Volumetric Flow Rate (m ³ s ⁻¹)	0.019	0.056	0.083	0.054	0.110	0.001	0.009	0.011

TABLE 3.2: RESULTS OF CHEMICAL ANALYSIS OF EMISSION TO SURFACE WATER SAMPLES

Parameter	Sample Point Reference ID							
	SW-1	SW-4	SW-5	SW-13	SW-14	SW-30	SW-32	SW-44
pH (pH units)	7.8	7.9	8.0	8.6	7.7	7.8	7.4	5.1
Conductivity (µS cm ⁻¹)	343	518	611	450	543	218	162	640
COD (mg l ⁻¹)	97	50	50	69	46	77	88	110
BOD ₅ (mg l ⁻¹)	<2	<2	<2	<2	<2	3	2	2
TSS (mg l ⁻¹)	29	13	6	16	6	8	6	14
Ammoniacal-N (mg l ⁻¹)	1.3	2.9	1.0	2.0	1.0	0.3	0.5	1.4
Nitrate-N (mg l ⁻¹)	1.5	2.0	2.1	1.9	1.2	0.2	1.0	1.6
Orthophosphate (mg l ⁻¹)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

4.0 DISCUSSION

4.1 Volumetric Flow Assessments of Emissions to Surface Water

All sampling and flow measurements were preceded by a wet weather period. At the flow rates measured (Table 3.1) for each silt sedimentation pond discharge the quality of the effluent discharge associated with particular silt ponds is as presented in Tables 3.2 and 3.3. The impact of flow on the quality of the surface water discharges from individual silt sedimentation ponds will be assessed during future monitoring events.

4.2 Chemical Analysis of Emissions to Surface Water Samples

The location of the various silt sedimentation pond discharge sampling stations are described in Table 2.1 and outlined in Drawings 11.1a - 11.1e of the Drawings Folder of the IPC Licence Application. The results of the chemical analysis of the emissions to surface water samples are presented in Table 3.2.

4.2.1 SW-1 (Silt Sedimentation Pond DH1)

In general, the water quality at the SW-1 sampling location is good with low levels of organics (BOD, COD), nutrients ($\text{NO}_3\text{-N}$, $\text{PO}_4\text{-P}$) and normal pH/conductivity values detected. Elevated levels of $\text{NH}_3\text{-N}$ were detected (1.3 mg l^{-1}). The Total Suspended Solids level recorded at the point of final discharge from this sampling station is slightly elevated (29 mg l^{-1}). On site inspection of the pond during the sampling event showed evidence of silt build up within the settlement pond. This may be attributable to ditching operations that took place on the associated peatlands catchment during September to November 1998. Despite the fact that the pond was desludged during 1998 ditching operations, a large silt element has settled once again within the pond. It is recommended that clean up and removal of the silt within this pond is carried out as part of the silt pond maintenance and desludging programme within the Derrygreenagh Group in order to maintain or improve upon the TSS discharge from this pond during the impending production season.

4.2.2 SW-4 (Silt Sedimentation Pond DH4) & SW-13 (Silt Sedimentation Pond BB17)

In general, the water quality at the SW-4 and SW-13 sampling locations is good with low/background levels of organics (BOD, COD), nutrients ($\text{NO}_3\text{-N}$, $\text{PO}_4\text{-P}$) and normal pH/conductivity values detected. Elevated levels of $\text{NH}_3\text{-N}$ ($2.0 - 2.9 \text{ mg l}^{-1}$) were detected at both sampling stations. The source of this contaminant is currently unknown but will be fully evaluated in future assessments. The Total Suspended Solids level recorded at the point of final discharge from these sampling stations is relatively low ($13 - 16 \text{ mg l}^{-1}$). On site inspection of the ponds during the sampling events showed evidence of minor silt build up within the settlement ponds. This may be attributable to ditching operations that took place on the associated peatland catchments during September to November 1998.

4.2.3 SW-5 (Silt Sedimentation Pond DM5), SW-14 (Silt Sedimentation Pond TR19), SW-30 (Silt Sedimentation Pond BN36) & SW-32 (Silt Sedimentation Pond CN39)

In general, the water quality at the SW-5, SW-14, SW-30 and SW-32 sampling locations is good with background levels of organics (BOD, COD), nutrients ($\text{NH}_3\text{-N}$, $\text{NO}_3\text{-N}$, $\text{PO}_4\text{-P}$) and normal pH/conductivity values detected. Slightly elevated levels of $\text{NO}_3\text{-N}$ (2.1 mg l^{-1}) were detected at SW-5. The Total Suspended Solids level recorded at the point of final discharge from these sampling stations is low (range $6 - 8 \text{ mg l}^{-1}$). On site inspection of the ponds during the sampling events showed no evidence of silt build up within the settlement ponds.

4.2.4 SW-44 (Silt Sedimentation Pond KD51)

The surface water emission (SW-44) from the KD51 silt sedimentation pond is generally of good chemical quality, however, the COD level recorded (110 mg l^{-1}) was elevated which may indicate the presence of organic acids originating from the surrounding peatlands. The acidic pH (5.1 pH units) would appear to confirm this assertion. Results of nutrient ($\text{NO}_3\text{-N}$, $\text{PO}_4\text{-P}$) analysis showed that the levels were generally low (elevated levels of $\text{NH}_3\text{-N}$ were detected - 1.4 mg l^{-1}). The Total Suspended Solids level recorded at the point of final discharge from this sampling station is low (14 mg l^{-1}). On site inspection of the pond during the sampling event showed evidence of slight silt build up at the inlet point of the settlement pond.

4.3 Environmental Impacts

The silt sedimentation ponds selected for sampling for this study are those that will be serving and receiving run-off water from bog catchment areas under active production during the harvesting season. It should be noted that the results generated in this study are considered to represent baseline results as neither ditching (normally occurs September - March) nor harvesting (normally occurs June - September) processes were taking place during the sampling events of the 22/4/1999. It is proposed to carry out further sampling of the same silt sedimentation pond sampling stations during full production and/or the ditching season in order to ascertain the impacts of these processes (critical periods during which the surface water run off from industrial peatlands typically contain the greatest concentrations of peat suspended solids) may have on the quality of surface water discharges from the Derrygreenagh Group of silt sedimentation ponds. The impact that these discharges may subsequently have on the surface waters into which they ultimately drain can then be fully evaluated.

According to the River Boyne Water Quality Management Plan of 1997: *'there is evidence of peat siltation in the upper section of the main channel and its important tributaries. This can give rise to increased colour and possibly eutrophication arising from the humic complexes associated with peat silt'*. In addition, *'peat siltation is a factor in the increased colour of river waters including the Boyne, Yellow, Kinnegad, Blackwater (Longwood), Stonyford and Clady rivers. Dredging work has indicated peat silt deposition at Leinster bridge (sampling station 7/B/04/0500) on the Boyne main channel'*.

Emissions SW-1 and SW-44 from the DH1 and KD51 silt sedimentation ponds ultimately discharge to the Kinnegad river. Results from published data have demonstrated historical variations in water quality along the upper and lower reaches of this river (Appendix 1). Inputs of surface water run-off (which may contain elevated levels of peat silt) from commercial peatland catchment areas to the river have been historically highlighted as a potential contributing factor to this decrease in biological water quality.

4.3.1 Comment

Elevated levels of $\text{NH}_3\text{-N}$ were detected at a number of silt pond discharges. The source of this contaminant is currently unknown, however, preliminary cross referencing with published data suggests that large quantities of nitrogen can be obtained from particular humus soils/peats via hydrolysis reactions of organic compounds. Furthermore, drained peatlands have been found to contain higher concentrations of ammonia-nitrogen than that obtained for undisturbed peatlands run-off. Given that it is likely that nutrient contamination ($\text{NH}_3\text{-N}$, $\text{NO}_3\text{-N}$, $\text{PO}_4\text{-P}$) would receive considerable dilution prior to and after entering the main river units, thereby preventing any downstream elevation of total phosphorus and total nitrogen concentrations, the environmental impacts of same are considered minimal. It is considered that the most significant environmental effect arising from large scale industrial milled peat production operations is that of the discharge of suspended solids (peat particles) to freshwater systems via peatland surface water drainage channels resulting in the siltation of stream, river and lake substrata with peat silt. Careful treatment of drainage water will reduce suspended solids levels. As a result a programme of improvement towards achieving higher standards for emissions from silt sedimentation ponds within the Derrygreenagh Group is under preparation. The following proposals for modification of the silt pond treatment system/operational procedures to bring emissions to within tighter levels include:

- *Modification of Treatment System*

- Ensure that properly designed silt control ponds are constructed on all outfalls
- Install weirs on all silt ponds
- Raise weirs during heavy rain if stock is not affected

- *Change in Operational Procedures*

- Ensure silt sedimentation ponds are properly maintained as per the silt pond maintenance and desludging programme (biannual cleaning)
- Ditch drains in suitable weather (dry weather conditions)
- Take precautions to prevent silt run off while piping outfalls
- Clean outfalls starting upstream
- Block outlets from field drains during stockpile loading
- Ditch dry peat from drain before unblocking
- Ensure that harrows, millers, ridgers do not drag loose peat into drains
- Have outer harrow spoons directed away from drain.

It is considered that the environmental impacts resulting from surface water emissions from the silt pond units within the Derrygreenagh Group will be greatly reduced once the proposed improvements programme is implemented, thereby ensuring compliance with the objectives and policies of the River Boyne Water Quality Management Plan of 1997.

APPENDIX 1

ENVIRONMENTAL PROTECTION AGENCY BIOLOGICAL DATA



INTERIM REPORT
ON
**THE BIOLOGICAL SURVEY
OF RIVER QUALITY**

RESULTS OF THE
1997
INVESTIGATIONS

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River and Code : **BLACKWATER (LONGWOOD)** 07/B/02
 Tributary of : Boyne OS Catchment No: 159
 OS Grid Ref : N 712 503 Date(s) Surveyed : 8, 9 September 1997

Sampling Stations No. Location	Biological Quality Ratings (Q Values)					
	1976	1981	1985	1990	1994	1997
0050 Br nr Derrycrib	-	-	-	2	3	-
0060 Br S of Hortland	-	-	-	-	-	4
0070 Br N of Hortland	-	-	-	3	4	-
0100 Br at Johnstown	4	3-4	3-4	3-4	4	4
0200 Blackwater Br	-	4	3-4	3-4	3-4	3-4
0400 Br NE of Longwood	4-5	4	3-4	3-4	3-4	3-4
0600 Br u/s Boyne R confl	4	5	4	4-5	4	3-

Assessment: Both locations surveyed in the slow-flowing area upstream of Johnstown (0060, 0100) were assessed as satisfactory but the three points examined below this village were in a distinctly eutrophic condition (Q3-4) in early September 1997. DO was reduced to 63% saturation at Blackwater Bridge (0200) where faunal anomalies indicated factors other than eutrophication.

River and Code : **BOYCETOWN** 07/B/03
 Tributary of : Boyne OS Catchment No: 159
 OS Grid Ref : N 833 564 Date(s) Surveyed : 28 August 1997

Sampling Stations No. Location	Biological Quality Ratings (Q Values)					
	1976	1981	1985	1990	1994	1997
0200 Br N of Martinstown	-	3	3	3-4	3-4	3
0300 Scurlockstown Br	4	3-4	4	4	3-4	3

Assessment: The absence of sensitive species and the generally unbalanced faunal structure indicated that the Boycetown was in an unsatisfactory condition, particularly in the Martinstown area (0200) where DO was reduced to 65% saturation in late August 1997. Very heavy marl deposits reduced faunal numbers and diversity at Scurlockstown Bridge (0300) and, notwithstanding the presence of several trout, the abundant algal growths in a relatively shaded area indicated considerable eutrophication at this point.

River and Code : **BOYNE**

07/B/04

Tributary of : Sea - Drogheda Harbour

OS Catchment No: 159

OS Grid Ref : O 091 751 Date(s) Surveyed : 27 Aug; 1,8,10,12,28,29 Sept. & 6 Oct. 1997

Station Nos.	Biological Quality Ratings (Q Values)										
	1971	1973	1974	1975	1977	1979	1981	1986	1990	1994	1997
0100	4-5	-	-	-	-	-	3-4	4	4	-	3
0200	2-3	3-4	-	3-4	3	4	4	4	3	4	2-3
0300	2-3	2-3	-	2	1-2	2-3	4	4	-	3	2
0400	4-5	3	-	-	4-5	4	4	4	4	4	3
0600	4-5	-	4	-	4	4	4	4-5	4	4	3-4
0800	4-5	-	3	-	-	4	4-5	4-5	4	4	3-4
0900	5	-	3-4	-	-	4-5	5	5	4	4	4
1000	5	-	4	-	-	4	5	5	3-4	3-4	4
1200	-	-	4-5	-	-	-	4	4-5	3-4	3-4	4
1400	-	-	4	-	-	3-4	3-4	4	3-4	3-4	3
1500	5	-	4-5	-	-	4-5	5	4	3-4	3-4	3-4
1600	-	-	-	-	-	-	4	4-5	3-4	3-4	3-4
1700	5	-	4	-	-	3-4	4	4-5	3-4	-	-
1800	-	-	-	-	-	4	4-5	4-5	3-4	3-4	3-4
1900	4	4	-	4	3-4	3	3-4	4	2-3	3	2-3
2010	-	-	-	-	-	-	-	4	3-4	3-4	3
2100	4-5	4-5	-	4	4	4	4-5	4	4	3-4	3
2150	-	-	-	-	-	-	-	-	4-5	3-4	3-4
2200	5	4-5	-	3-4	4	4	4	4	-	-	3-4

Sampling Station

No. Location

0100 River Br

0200 Boyne Br

0300 Kinnafad Br

0400 Ballyboggan Br

0600 Ashfield Br

0800 Inchamore Br

0900 Scarriff Br

1000 Derrinydaly Br

1200 West Br Trim

1400 u/s Knightsbrook R confl

Sampling Station

No. Location

1500 Bective Br

1600 Ballinter Br

1700 Kilcarn Old Bridge

1800 Railway Br Navan

1900 2km d/s Navan (LHS)

2010 d/s Broadboyne Br (RHS)

2100 Slane Br

2150 Ford S of Broc Ho

2200 Oldbridge

Assessment:

As the above Biotic Indices show there has been a major deterioration in the upper Boyne since 1994. This is borne out by the DO levels which were reduced to 26, 18, 64 and 67 percent of saturation at Stations 0200, 0300, 0400 and 0600 respectively in late August and early September 1997. By contrast minor improvements were apparent in the reach immediately upstream of Trim (1000 to 1200) where conditions were assessed as satisfactory but below the town (1400) a deterioration to moderately polluted conditions was recorded. Conditions from Bective to Navan (1500 to 1800) were similar to those recorded in 1994 (slightly polluted/eutrophic) but further deteriorations were recorded below Navan (1900), at Broadboyne (2010) and at Slane (2100) where more marked pollution effects had become apparent. The lowermost reaches (2150, 2200) were unchanged and appeared to be in a considerably enriched condition.

River and Code	: CASTLEJORDAN	07/C/04
Tributary of	: Yellow (Castlejordan)	OS Catchment No: 159
OS Grid Ref	: N 592 378	Date(s) Surveyed : 26, 27 August 1997

Sampling Stations No. Location	Biological Quality Ratings (Q Values)					
	1976	1981	1985	1990	1994	1997
0060 SE of Rahinine	-	-	-	3-4	2-3	2-3
0100 Baltinoran Br	-	4-5	3-4	4	3-4	3-4
0190 Castlejordan Br	-	-	-	4	3-4	3-4
0200 0.5km d/s Castlejordan Br	4-5	4	3-4	-	-	-

Assessment: The Castlejordan River was once again moderately polluted below Rochfortbridge (0060) and slightly polluted over the remainder of its course when surveyed in late August 1997.

River and Code	: CHAPEL LAKE STREAM	07/C/05
Tributary of	: Blackwater (Kells)	OS Catchment No: 159
OS Grid Ref	: N 614 945	Date(s) Surveyed : 23 September 1997

Sampling Station No. Location	Biological Quality Ratings (Q Values)		
	1990	1994	1997
0400 Br nr Drummoosclin	-	-	4
0700 Br u/s Blackwater R confl	3	4	4

Assessment: As in 1994, this small tributary of the upper Blackwater was in a satisfactory condition when surveyed in late September 1997.

River and Code : **DEEL (RAHARNEY)**

07/D/01

Tributary of : Boyne

OS Catchment No: 159

OS Grid Ref : N 695 496

Date(s) Surveyed : 8, 10 September 1997

Sampling Stations		Biological Quality Ratings (Q Values)							
No.	Location	1971	1976	1978	1982	1985	1990	1994	1997
<i>Lough Lene Branch</i>									
0040	Br u/s Lough Adeel	-	-	-	-	-	4-5	4	3-4
<i>Main Channel</i>									
0070	Br W of Mabestown	-	-	-	-	-	4	4	4-5
0090	E Br u/s Lough Analla	-	-	-	-	-	3	3-4	4
0200	Cummer Br	5	4-5	4-5	4	4-5	4-5	3-4	3-4
0300	Raharney Br	-	5	4-5	4-5	4-5	4	3-4	3-4
0400	Inan Br	5	4	4-5	4-5	5	3-4	3-4	3-4
0600	Br u/s Boyne R confl	5	4	4	4-5	4-5	4-5	4	3-4

Assessment: The virtual absence of sensitive mayfly species, which were formerly present, indicate that the Lough Adeel Branch (0040) of the Deel river was being slightly polluted when surveyed in September 1997. The uppermost reaches of the Main Channel (0070, 0090) were in a satisfactory condition but for most of its course the indications were of a less than satisfactory quality standard.

River and Code : **DEVLIN'S**

07/D/02

Tributary of : Mattock

OS Catchment No: 159

OS Grid Ref : O 001 763

Date(s) Surveyed : 6 October 1997

Sampling Stations		Biological Quality Ratings (Q Values)					
No.	Location	1976	1981	1985	1990	1994	1997
0140	Br S of Grange X-Rds	-	-	-	-	3-4	2/0
0200	Devlin's Br	4-5	4-5	3/0	4	-	-
0300	Ford u/s Mattock R confl	-	4	4	-	3-4	3

Assessment: The Devlin's River was in an unsatisfactory condition at the two points surveyed in early October 1997. Serious pollution by oil was apparent at the upper location while in the lower reaches very heavy siltation, excessive algal crops and a restricted macroinvertebrate fauna indicated some considerable ecological disruption.

River and Code : **KINNEGAD**

07/K/01

Tributary of : Boyne

OS Catchment No: 159

OS Grid Ref : N 678 446

Date(s) Surveyed : 26 August 1997

Sampling Stations

Biological Quality Ratings (Q Values)

No.	Location	1976	1978	1981	1983	1985	1990	1994	1997
0060	Br SE of Cloonfad Ho	-	-	-	-	-	3-4	2-3	3
0100	Ballivor Rd Br Kinnegad	1-2	1	3	3	3	1	3-4	3-4
0300	Clonard Br	2	1	4-5	3-4	3	3-4	3-4	3

Assessment: The deep, sluggish and silty upper (0060) and lower (0300) reaches of the Kinnegad river were almost totally overgrown with emergent water weed and were devoid of sensitive species in late August 1997. Such excessive weed growths were likely to lead to unstable DO regimes and because of these factors conditions were assessed as unsatisfactory in those areas. The reach immediately below Kinnegad (0100) was in a distinctly eutrophic condition at that time. Conditions have deteriorated in the lower reaches since 1994.

River and Code : **KNIGHTSBROOK**

07/K/02

Tributary of : Boyne

OS Catchment No: 159

OS Grid Ref : N 829 564

Date(s) Surveyed : 28 August 1997

Sampling Stations

Biological Quality Ratings (Q Values)

No.	Location	1976	1981	1985	1990	1994	1997
0100	Moynalvy Br	-	3-4	3	-	3	-
0300	Dangan Br	-	3-4	3	3	3	3
0360	Br nr Summerstown Ho	-	-	-	-	3-4	3-4
0500	Br u/s Boyne R confl	4	4	4	3-4	4	4

Assessment: As in most previous surveys, the Knightsbrook river was significantly polluted in the Summerhill area (0300) in late August 1997. It then recovered over the remainder of its course to join the Boyne in a satisfactory condition. The unsatisfactory conditions observed are apparently due to a combination of tip-head leachate, which affects a tributary, the Clonmeath river, and also to heavy usage by watering cattle.

River and Code	: MILLTOWNPASS	07/M/04
Tributary of	: Castlejordan	OS Catchment No: 159
OS Grid Ref	: N 530 420	Date(s) Surveyed : 26 August 1997

Sampling Stations	Biological Quality Ratings (Q Values)		
No. Location	1990	1994	1997
0400 Br in Milltownpass	3-4	3-4	3

Assessment: Abundant weed, turbid water and an impoverished, unbalanced macroinvertebrate fauna indicated considerable ecological upset at Milltownpass in late August 1997. Conditions have worsened here since 1994.

River and Code	: MOYNALTY	07/M/03
Tributary of	: Blackwater (Kells)	OS Catchment No: 159
OS Grid Ref	: N 787 742	Date(s) Surveyed : 24, 25 September 1997

Sampling Stations	Biological Quality Ratings (Q Values)							
No. Location	1971	1978	1980	1984	1986	1990	1994	1997
<i>Main Channel</i>								
0050 Br nr Lurganbane	-	-	-	-	-	4	4	3
0070 Clogagh Br	-	-	-	-	-	3	3	3-4
0090 Skearke Br	-	-	-	-	-	-	3	4
0100 Rathbourne's Br	-	5	3-4	4	3-4	3	-	-
0300 Br d/s Rosehill Br	-	4	3-4	3-4	3-4	3-4	3-4	3
0600 Moynalty Br	-	4-5	3-4	-	3-4	3-4	4	3-4
0800 Carlanstown Br	-	-	4	-	4	4	4	3-4
0900 Fyanstown Br	5	3-4	4	-	4	-	4	4
<i>Mullagh Branch</i>								
0400 Br u/s Main Ch confl	-	3	3-4	3-4	3	3	3	3

Assessment: Only two of the eight locations surveyed in 1997 were satisfactory; this compares with four in 1994 and reflects increasing slight and moderate pollution/eutrophication. The disappearance of sensitive species indicated a considerable deterioration in the Lurganbane area (0050) but, as the slight and significant improvements recorded at the next two stations (0070, 0090) show, this was a localised event. Conditions indicating moderate pollution were also recorded immediately above the Mullagh Branch and in this branch itself (0300, 0400); this situation represents a deterioration in the Main Channel but no change in the branch. The lowermost reaches (0900) continue to be satisfactory.

River and Code : **STONYFORD**

07/S/02

Tributary of : Boyne

OS Catchment No: 159

OS Grid Ref : N 737 531

Date(s) Surveyed : 11, 12 September 1997

Sampling Stations		Biological Quality Ratings (Q Values)					
No.	Location	1976	1981	1985	1990	1994	1997
<i>East Branch</i>							
0015	Br N of Boherard	-	-	-	-	4-5	3
0030	Snipe's Br	-	-	-	4	3-4	3
<i>West Branch</i>							
0045	Br NW of Geehanstown	-	-	-	-	4-5	3-4
0055	Curlingford Br	-	-	-	4	4-5	3-4
<i>Main Channel</i>							
0070	Br SW of Clonmaskill	-	-	-	3-4	3-4	3-4
0080	Lisclogher Br	-	-	-	3-4	4	3-4
0090	Br u/s Rathkenna Br	-	-	-	3-4	4	4
0300	Shanco Br	-	4	4	4	4	4
0400	Stonyford Br	4-5	4	4	3-4	4	4

Assessment: There has been a marked deterioration in both branches of the Stonyford river and a further decline in the upper Main Channel since 1994. The East Branch was assessed as moderately polluted at both locations surveyed while the West Branch and the upper half of the Main Channel were slightly polluted/eutrophic in September 1997. Agriculture suspected. The reach downstream of Delvin (0080) had been recently dredged and this plus suspected sewage effects are the likely causes of the deterioration observed at this location.

River and Code : **YELLOW (BLACKWATER)**

07/Y/01

Tributary of : Blackwater (Kells)

OS Catchment No: 159

OS Grid Ref : N 834 710

Date(s) Surveyed : 26 September 1997

Sampling Stations		Biological Quality Ratings (Q Values)			
No.	Location	1971	1990	1994	1997
1100	Br u/s Blackwater R confl	4-5	4	3-4	3

Assessment: The steady decline of the Yellow River continued in 1997 when the location surveyed was assessed as moderately polluted. Industrial discharges/leachate suspected.

River and Code	: YELLOW (CASTLEJORDAN)	07/Y/02
Tributary of	: Boyne	OS Catchment No: 159
OS Grid Ref	: N 612 372	Date(s) Surveyed : 27 August 1997

Sampling Stations No.	Location	Biological Quality Ratings (Q Values)					
		1976	1981	1985	1990	1994	1997
0060	Nr Derryarkin	-	-	-	-	4	4
0100	Garr Br	-	3-4	4	3-4	4	3-4
0300	Clongall Br	4-5	4-5	4	4	4	4

Assessment: The Castlejordan River was in a mostly satisfactory condition when surveyed in late August 1997. A big increase in weed growth and the virtual disappearance of sensitive mayfly species indicated some considerable enrichment at Garr Bridge (0100) where the DO was reduced to 62% of saturation at the time of this survey.

BORD NA MÓNA

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*AN ENVIRONMENTAL ASSESSMENT OF THE
QUALITY OF WATER EMISSIONS EMANATING
FROM PRE-SELECTED LOCATIONS IN
COMPLIANCE WITH THE REQUIREMENTS OF
BORD NA MÓNA'S INTEGRATED POLLUTION
CONTROL LICENCE APPLICATION*

DRAFT

REPORT NO:

K960-SW2-2

ATTENTION:

Mr. Paul Riordan
Bord na Móna Energy Limited
Boora Group
c/o Boora Works
Leabeg
Tullamore
Co. Offaly

Mr. Finn Campbell
Bord na Móna Energy Limited
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PREPARED BY:

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DATE:

20 May 1999

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DERRYGREENAGH WORKS

1.0 INTRODUCTION

In compliance with the requirements of their Integrated Pollution Control Licence Application, Bord na Móna are required to assess the nature of emissions to surface water from various works within the company. Due to the similarity of activities that take place at individual works it was proposed to choose two works, namely Boora Works (Boora Group) and Derrygreenagh works (Derrygreenagh Group) which are deemed representative of emissions to surface water that are generated at other works sites within Bord na Móna as a basis for a preliminary assessment. This study focuses specifically on that of emissions to surface water (surface water drainage and wastewater emissions) from Boora and Derrygreenagh works, in addition to predicting the environmental impacts of these discharges on receiving surface water bodies (streams/rivers/lakes).

Bord na Móna Environmental Limited were commissioned to perform the sampling and analysis. The Boora and Derrygreenagh works sites were subsequently visited by a Bord na Móna Environmental Consultant on 7/4/1999 and 20/4/1999, respectively. Emission to surface water samples were returned to the laboratory for subsequent analysis.

This report details the emissions to surface water sampling which took place including the sampling and analytical methods used. In addition, an interpretation of the results obtained is included.

2.0 METHODOLOGY

2.1 Sampling Locations

The locations of the emissions to surface water (Boora Works - SWE-1, SWE-2, SWE-3, SWE-4; Derrygreenagh Works - SWE-1, SWE-2) sampling stations are accurately marked on Appendix 1 (taken from Drawing 11.2 of the Drawing's Folder of the Boora Group IPC Licence Application) and Appendix 2 (taken from Drawing 11.2 of the Drawing's Folder of the Derrygreenagh Group IPC Licence Application), respectively. The various emissions to surface water sampling locations are described as follows:

SWE-1 - Boora Works: For Boora works sewage receives primary treatment within a settlement tank and secondary treatment within a **Puraflo™** biofiltration system. Final effluent drains to the adjacent peatlands drainage network. The point of sample extraction for emission to surface water emission point SWE-1 was at the outlet point from the **Puraflo™** biofiltration system prior to discharge to the surface water drain.

SWE-2 - Boora Works: Surface water run-off from hardstanding areas following a rainfall event is typically channelled via a drain network to the adjacent peatlands drainage system. The point of sample extraction for emission to surface water emission point SWE-2 was at point of entry of run-off water from the workshop yard area to the drain manhole prior to discharge to the surface water drain (sample extracted after period of heavy rainfall).

SWE-3 - Boora Works: For Boora works any accidental diesel/petrol spills that may occur within the car/tractor diesel and petrol fuelling area during a fuelling event, and surface water run-off from this hardstanding area following a rainfall event are channelled via an interceptor tank to the adjacent peatlands drainage ditches. The point of sample extraction for emission to surface water emission point SWE-3 was at the outlet point from the interceptor tank prior to discharge to the surface water drain (sample extracted after period of heavy rainfall).

SWE-4 - Boora Works: Machine washings generated due to the cleaning of various tractor, truck, locomotive and bulldozer/excavator units at the wash bay drain to the adjacent peatlands drainage system via an interceptor tank. The point of sample extraction for emission to surface water emission point SWE-4 was at the outlet point from the interceptor tank prior to discharge to the surface water drain (sample extracted during a machine washdown event).

SWE-1 - Derrygreenagh Works: Surface water run-off from hardstanding areas following a rainfall event is typically channelled via a drain network to the adjacent peatlands drainage system. The point of sample extraction for emission to surface water emission point SWE-1 was at point of entry of run-off water from the workshop yard area to the drain manhole prior to discharge to the surface water drain (sample extracted after period of heavy rainfall).

SWE-2 - Derrygreenagh Works: Machine washings generated due to the cleaning of various tractor, truck, locomotive and bulldozer/excavator units at the wash bay drain to the adjacent peatlands drainage system via an interceptor tank. The point of sample extraction for emission to surface water emission point SWE-2 was at the outlet point from the interceptor tank prior to discharge to the surface water drain (sample extracted during a machine washdown event).

2.2 Sampling

Grab samples of emissions to surface water were extracted in accordance with standard procedures. All samples were returned to the laboratory, and stored at 4°C.

2.3 Control Chain Of Custody

As part of the Quality System in place in Bord na Móna, Environmental Limited, measures are taken to ensure controlled chain of custody. An outline of the chain of custody is given overleaf.

2.4 Analysis

All samples returned to the laboratory were stored at 4°C. Subsequent analysis of all samples was carried out in strict accordance with recognised standard methods as detailed in Table 2.1 below:

TABLE 2.1: CHEMICAL ANALYSIS OF SAMPLES		
Parameter	Limit of Detection/Range	Method
pH	0.1 - 14 pH units	G/05
BOD ₅	2 - 5000 mg l ⁻¹	G/04
COD	10 - 1500 mg l ⁻¹	G/03
Conductivity	0.1 - 1999 µS cm ⁻¹	G/06
Oils, Fats & Greases	1 mg l ⁻¹	APHA 5520 B
Total Suspended Solids	5 mg l ⁻¹	APHA 2540 D

- APHA - American Public Health Association, Standard Methods For the Examination of Waters and Waste Waters, 19th Edition, 1995.
- G/ - ILAB Accredited Method, Bord na Móna Environmental & Analytical Services Standard Operating Procedures Manual

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CONTROLLED CHAIN OF CUSTODY

SITE

Sampling and packaging of all samples were carried out by Bord na Móna Technical Team:
Dr. E. Molyneux

TRANSPORT

Transport Document Form

Transport to laboratory by Bord na Móna Technical Team.

Sample Reception Form

LABORATORY

Receiving of samples at Bord na Móna Environmental Limited Laboratory complex by:
Dr. J. Reilly, Laboratory Manager
(Secure laboratory complex access to authorised personnel only)

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Storage of all samples for 1 month period after report issue.

↓

Supervised Disposal

2.5 Quality Control

The Environmental Limited Laboratory complex have been awarded ILAB accreditation by the ILAB secretariat. A stringent six point quality control approach is at present implemented in the laboratories.

- (i) Controlled chain of custody.
- (ii) Operator competence - all analysts must be suitably qualified to carry out required analysis.
- (iii) Certified Reference Materials (CRM). The accuracy of a series of determinations is checked against known standards.
- (iv) Duplicate - 10% duplication is normal.
- (v) Quality Control Charts.
- (vi) Inter Laboratory Testing - The Environmental Limited Laboratories are members of the WASP Interproficiency Testing Scheme and the W.R.C. Aquacheck Scheme.
The Laboratory also participates in the Environmental Protection Agency's Intercalibration Programme and is listed on the Agency's Draft Register of Quality Approved Testing Laboratories for 1998/99.

3.0 RESULTS

The results of the emissions to surface water investigation for Boora works and Derrygreenagh works are presented in Table 3.1.

Table 3.1: Results of Chemical Analysis of Boora Works and Derrygreenagh Works Emission to Surface Water Samples

TABLE 3.1: RESULTS OF CHEMICAL ANALYSIS OF BOORA WORKS AND DERRYGREENAGH WORKS EMISSION TO SURFACE WATER SAMPLES						
	Boora Works				Derrygreenagh Works	
Parameter	SWE-1	SWE-2	SWE-3	SWE-4	SWE-1	SWE-2
pH (pH units)	8.0	7.6	7.6	7.7	8.0	7.8
BOD ₅ (mg l ⁻¹)	<10	8	4	25	5	<2
COD (mg l ⁻¹)	84	270	29	243	120	44
TSS (mg l ⁻¹)	62	492	18	155	281	10
Oils, Fats & Greases (mg l ⁻¹)	-	-	25	21	-	34

4.0 DISCUSSION

4.1 Chemical Analysis of Emissions to Surface Water Samples

The location of the various emissions to surface water sampling stations are outlined in Appendix 1 (Boora Works - SWE-1, SWE-2, SWE-3, SWE-4) and Appendix 2 (Derrygreenagh Works - SWE-1, SWE-2). The results of the chemical analysis of the emissions to surface water samples from Boora and Derrygreenagh works are presented in Table 3.1.

4.1.1 Boora Works

- (i) SWE-1 - Boora Works: For Boora works sewage receives primary treatment within a settlement tank. On leaving the settlement tank the partially treated effluent enters the sites collection sump containing a submersible pump. A float control mechanism triggers the pump to evenly distribute the effluent onto a **Puraflo**TM biofiltration system for secondary treatment. Final effluent drains to the adjacent peatlands drainage network. Results of chemical analysis for SWE-1 (point of sample extraction was at the outlet point from the **Puraflo**TM biofiltration system prior to discharge to the surface water drain) show an elevated TSS level (62 mg l⁻¹) for this wastewater discharge. The slightly elevated COD level (84 mg l⁻¹) and corresponding low BOD (<10 mg l⁻¹) indicates the possible presence of relatively inert organic material (may be peaty solids from peat biofilter). It is noted that the **Puraflo**TM biofiltration system is due to undergo routine annual service maintenance. Once complete the treatment efficiency of the biofiltration system should revert to design specifications (i.e. final effluent quality: BOD <10 mg l⁻¹, TSS <10 mg l⁻¹) and the environmental impacts of such an effluent on the receiving surface waters (Boora river) will be minimal.
- (ii) SWE-2 - Boora Works: Surface water run-off from hardstanding areas following a rainfall event is typically channelled via a drain network to the adjacent peatlands drainage system. Results of chemical analysis for SWE-2 (sample extracted after period of heavy rainfall; point of sample extraction was at point of entry of run-off water from the workshop yard area to the surface water drain manhole prior to discharge to the drain) indicate a significantly elevated level of suspended solids (492 mg l⁻¹) for this surface water run-off sample. This is directly associated with peat residues/dust that accumulate in the general yard area. An improvement in the house keeping of the area is required in order to prevent such a build-up of solids within the yard areas.

- (iii) SWE-3 - Boora Works: For Boora works any accidental diesel/petrol spills that may occur within the car/tractor diesel and petrol fuelling area during a fuelling event, and surface water run-off from this hardstanding area following a rainfall event are channelled via an interceptor tank to the adjacent peatlands drainage ditches. Results of chemical analysis for SWE-3 (sample extracted after period of heavy rainfall; point of sample extraction was at the outlet point from the interceptor tank prior to discharge to the surface water drain) indicate that the final effluent discharging from the interceptor tank is generally of good chemical quality (BOD 4 mg l⁻¹, COD 29 mg l⁻¹; TSS 18 mg l⁻¹; OFG 25 mg l⁻¹). The practice of good operational procedures by personnel within this area results in little or no diesel/petrol spillage's occurring during the fuelling of road transport vehicles (cars, vans and trucks).
- (iv) SWE-4 - Boora Works: Machine washings generated due to the cleaning of various tractor, truck, locomotive and bulldozer/excavator units (removal of peat using a power steam wash system which typically takes place when a machine leaves the peatlands) at the wash bay drain to the adjacent peatlands drainage system via an interceptor tank. The primary purpose of the interceptor unit is to facilitate removal of any floatable oil/grease components which may be introduced to the wastewater stream during cleaning events. In addition, an element of settlement for denser solid inputs should be provided for. Results of chemical analysis for SWE-4 (sample extracted during a machine washdown event; point of sample extraction was at the outlet point from the interceptor tank prior to discharge to the surface water drain) indicate that the final effluent discharging from the interceptor tank is generally of poor chemical quality (BOD 25 mg l⁻¹, COD 243 mg l⁻¹; TSS 155 mg l⁻¹). On site inspection of the interceptor tank during the sampling event showed evidence of significant build up of peat solids within the tank. Clean up and removal of the settled peat/solids should ensure an improvement of the treatment efficiency of the interceptor tank unit and a return to compliance for the TSS discharge from this tank.

4.1.2 Derrygreenagh Works

- (i) SWE-1 - Derrygreenagh Works: Surface water run-off from hardstanding areas following a rainfall event is typically channelled via a drain network to the adjacent peatlands drainage system. Results of analysis for SWE-1 (sample extracted after period of heavy rainfall; point of sample extraction was at point of entry of run-off water from the workshop yard area to the drain manhole prior to discharge to the surface water drain) indicate a significantly elevated level of suspended solids (281 mg l⁻¹) for this surface water run-off sample. This is directly associated with peat residues/dust that accumulate in the general yard area. An improvement in the house keeping of the area is required in order to prevent such a build-up of solids within the yard areas.

- (ii) SWE-2 - Derrygreenagh Works: Machine washings generated due to the cleaning of various tractor, truck, locomotive and bulldozer/excavator units (removal of peat using a power steam wash system which typically takes place when a machine leaves the peatlands) at the wash bay drain to the adjacent peatlands drainage system via an interceptor tank. Results of chemical analysis for SWE-2 (sample extracted during a machine washdown event; point of sample extraction was at the outlet point from the interceptor tank prior to discharge to the surface water drain) indicate that the final effluent discharging from the interceptor tank is generally of good chemical quality (BOD <2 mg l⁻¹, COD 44 mg l⁻¹; TSS 10 mg l⁻¹; OFG 34 mg l⁻¹).

4.2 Environmental Impacts

Given that it is likely that the contamination detected in a selection of the emission to surface water streams (surface water run-off and wastewater discharges) from individual works would receive considerable dilution prior to and after entering the main river unit into which these discharges ultimately drain (Boora river for Boora Works; Castlejordan river for Derrygreenagh Works), the environmental impacts of same are considered negligible. It is considered that in the overall context of emissions to surface water originating from activities within Bord na Móna that the environmental impacts associated with emissions to surface water originating from individual works on the receiving environment are minimal (i.e. discharge of suspended solids within peatland surface water run-off via drainage channels and silt sedimentation ponds to freshwater systems is considered the most significant environmental effect arising from large scale industrial milled peat production operations). However, it is noted that a programme of improvement towards achieving higher standards for environmental emissions, inclusive of emissions to surface water from all associated activities, is currently under preparation by Bord na Móna. It is considered that the environmental impacts resulting from all emissions to surface water originating from individual works within the company will be greatly reduced once the proposed improvements programme is fully implemented.

APPENDIX 1

LOCATION OF EMISSION TO SURFACE WATER SAMPLING POINTS AT BOORA WORKS