Submission No. 2.

Eastern Regional Fisheries Board

Bord Iascaigh Réigiúnach an Oirthir

Fisheries Ireland
Our Natural Heritage

ENVIRONMENTAL PROTECTION AGENCY
17 NOV 2006

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Grainne Oglesby
Office of Licensing & Guidance
Environmental Protection Agency
PO Box 3000
Johnstown Castle Estate
County Wexford

16 November 2006

Re: S4 discharge application by Kerry Foods, Coolatin, Shillelagh to waters at Shillelagh, Co. Wicklow Ref: P0804-01

Dear Ms Oglesby

With reference to the above application we note that the applicant proposes discharging treated effluent to the Derry River. The Slaney River and its tributaries are salmonid waters with good populations of salmon, brown trout and sea trout. The River Slaney is a designated River under the European Communities (Quality of Salmonid Waters) Regulations 1978, the entire main channel River and many tributaries (including the Derry River) are candidate Special Area for Conservation (SAC) under the European Habitats Directive. The Slaney River catchment supports several species listed in Annex II of the Directive including Salmon, River Lamprey, Brook Lamprey, Sea Lamprey, Fresh water Pearl Mussel and Otter. This watercourse is part of the South Eastern River Basin District Management System, a project in support of the catchment based national strategy to implement the Water Framework Directive. One of the objectives of the WFD is to achieve **Good Ecological Status** on all waters by 2015.

The Derry River is the most important salmon spawning / nursery tributary of the Slaney system with a redd count of over 260 in the Winter of 2005-2006 (both upstream and downstream of Shillelagh). The Derry River also holds populations of *Margaritifera margaritifera* (downstream of this discharge), fresh water pearl mussel but these populations are in serious decline as this species requires at least Q5 status for reproduction to occur. It is our understanding that under the Water Framework Directive, in waters with populations of Freshwater Pearl Mussel which are in decline or not reproducing, Good Ecological Status will entail conditions in which these populations of Freshwater Pearl Mussels can successfully reproduce. The NPWS state that a **minimum Q5 status will be required in such waters** and are recommending median ortho-P concs of **0.005mg/l** for such waters. Please note that none of the seven sites on the Derry River surveyed by the EPA in the Interim Report on the Biological Survey of River Quality 2004 achieved the Q5 status as required under the Water Framework Directive, while the Q value reported for the Derry River at Shillelagh Bridge was Q3-4 (slightly polluted).

It is our understanding that a **Q5 value** biological rating will be required on the Derry River through the Shillelagh area, under the Water framework Directive because of the presence of *Margaritifera margaritifera* downstream.

The Board have serious concerns with regard to the assimilative capacity of the Derry River for effluent from this site. We note that in the IPPC Licence Application, they state that

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the applicant uses the figure of 300litres/sec for both the Dry weather flow and the 95 percentile flow at the proposed discharge point. From the EPA's website, the Derry River at Tinahely (with a catchment area of 32km^2) has a DWF of 25l/sec and a 95 percentile flow of 45l/sec, while downstream at Clonegal (with a catchment area of 233km^2) has a DWF of 280l/sec and a 95 percentile flow of 580l/sec. We estimate the catchment area of the Derry River at the proposed discharge point to be approx. 122km^2 and are concerned that figure of 300l/sec may overestimate the Dry Weather Flow and the 95 percentile flow for the receiving water. The Board request that flow measurements / correlations of flows in the Derry River at the proposed discharge point be carried out to allow for the calculation of reliable low / 95 percentile flows for the Derry River at this location.

The Board have reviewed the biological water quality assessment of the proposed receiving water in which the site a short distance upstream of the proposed discharge was reported to be slightly polluted with a Q3-4 rating. The Board have carried out assimilative capacity calculations with regard to the effect of this discharge upon the receiving water using the 95 percentile low flow figure of 300l/sec (**a figure which we believe may overestimate the true figure**) and assuming an ortho – P concentration of 0.03mg/L in the receiving water (relates to Q3-4 as per EPA Report Biological Survey of River Quality 2004) , a discharge rate of 7.5L/sec and an ortho-P conc. of 0.75mg/L in the discharge (assuming that 75% of the total P figure is in the ortho-P form). The ortho-P conc. in the receiving water rose to 0.047mg/L ortho-P which represents a 58.5% increase in ortho-P concentrations in the receiving water, this figure represents a significant increase in background ortho-P levels and is likey to lead to a significant deterioration in the Biological water quality of the Derry River. Given that this watercourse has already been shown to be polluted the Board are concerned that a 58.5% rise in the background ortho-P levels from this proposed discharge will lead to a further deterioration in the receiving water quality and is environmentally unsustainable.

Given the lack of assimilative capacity in the receiving waters for phosphorous and the requirement for Good Ecological Status (at this location Q5 because of the presence of *Margaritifera margaritifera* downstream) the Board ask that a stricter effluent quality standard for Phosphorous be set.

The Board has concerns regarding the sustainability of the discharge from this development because of the lack of assimilative capacity in the Receiving water (slightly polluted conditions recorded in the Derry River upstream of the proposed discharge point. **It should also be noted that Shillelagh WWTP discharges to the Derry River between the proposed discharge point and the EPA Q sampling station**. It is essential that adequate assimilative capacity exists in the receiving watercourse for the effluent from this development and that the sustainability of this discharge is addressed with special reference to the requirements of Good Ecological Status (minimum Q5) under the Water Framework Directive & Phosphorous Regulations at 95 percentile flow rates.

Yours faithfully

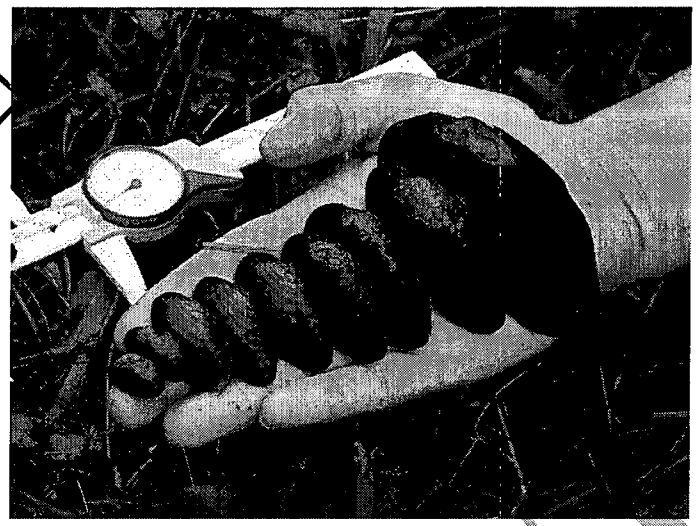
p.p.

Pat Doherty
Acting Chief Executive Officer

HI GRAINNE, I HAVE HIGHLIGHTED THE RELEVANT WATER QUALITY STANDARDS SECTIONS TOWARDS THE BACK OF THE PUBLICATION,

REGARDS,

DONNACHADH BYRNE.



Freshwater Restorability Workshop NI, 2004 (P.Cosgrove).

3.11 Margaritifera margaritifera (Freshwater Pearl Mussel)

NATURA 2000CODE: 1029

NAME OF RESPONDENT(S): **Áine O'Connor**
Tony Waterman
Evelyn Moorkens
Eugene Ross

TYPE OF WATER DEPENDENCY: It is mainly surface water dependent, with some instances may have a Groundwater influence. There is also a high drainage density.

DESCRIPTION OF UNIQUE FEATURES, CONTEXT AND REFERENCE CONDITION: *Margaritifera margaritifera* is large up to 140mm with an oval-shaped heavy black shell often eroded at the umbone (apex). They have strong adductor mussels which close the shells. They also have protractor, retractor and elevator mussels which control the movement of the foot. They are filter feeders associated with Salmonid waters but they require higher water quality than Salomids. Under normal conditions, pearl mussels are buried by up to two-thirds of their length with the siphons exposed to the flowing water above the riverbed. Occasionally, trails can be seen on sandy riverbeds suggesting that mussels can move up to two metres along the riverbed in a relatively short space of time. They have a complex life cycle and can live for up to 100-120 years with the oldest record at approximately 140 years in Irish waters. They are usually dependent on a fish host in particular those younger juveniles of 1-2 years as older fish hosts begin to build up immunity to the *Margaritifera*. In Ireland, native salmon (*Salmo salar*) and trout (*Salmo trutta*) are used. The fish provides the essential step in the mussel' life cycle and adult mussels are an indicator of good clean water. Each mussel can filter up to 50 litres of water per day.

Reference condition: *Margaritifera margaritifera* is found in pristine, well-oxygenated rivers which flow over non-calcareous rock. In contrast the rare form *Margaritifera margaritifera durrovensis*, which is unique to Ireland, is found in calcareous hard water areas.

These waters have little calcium and are very low in nutrients. It must have extremely oligotrophic conditions with preferable a **Q5** value for its river status or a GQS value of **A** in the case of Northern Ireland. The Q5 and A values used by the EPA & EHS respectively are the highest categories used by these authorities however in the case of *Margaritifera* a higher standard than this is required if a Q6 existed than it would favour it. The Owenkillew River in NI has a GQS value of A but the populations here are not showing signs of recruitment. This would indicate a higher than pristine value may be required to sustain a recruiting population. The nature of its habitat means that the pearl mussel grows slowly, taking many years to build up its layers of shell. The substrate of the river bed is also of great importance, and determines in which areas within a river the pearl mussels can survive. Clean gravel and sand are essential to a healthy population. A certain amount of boulders may also be required where the adults can hide around. Oxygen has to move freely to the juvenile mussels, which are still buried. If this substrate becomes clogged with silt, oxygen can no longer reach juveniles and can die (Buddensiek *et al.,* 1993).Silt accumulates on the riverbed, or the bed becomes coated in filamentous algae, no juveniles will survive and adults can become stressed, clam their shells shut, and begin to waste away and die. (Moorkens, 1996). As mussel status deteriorates, they may become associated with shaded areas of river under trees (Gittings *et al.,* 1998), but in very clean waters, they are found in high numbers in open, unshaded area (Moorkens, 1996). Ultimately they require Ultra Oligo-trophic rivers that are not subject to any nutrients or siltation.

TYPE OF MORPHOLOGICAL VULNERABILITY: Any physical change to the river will have a huge impact on the species. It is a very sedidentary species, any bed or bank disturbance or sediment movement could have a huge impact. Similarly drainage, channelisation, dredging, deepening and widening all can have a negative impact. *Margaritifera* tend to stick close to the river banks therefore any erosion of the bank will lead to mortality due to caving in of the bank structure. In recent years there has been many changes in catchment management which has lead to a quicker run-off from the landscape this together with afforestation, clear felling, mining and quarrying has led to a variety of sediment loading or sediment release which has a hug impact on *Margaritifera.* (A. O'Connor – *pers.comm.*) All three rivers in Northern Ireland which have *Margaritifera* present have quarrying near the head water and in particular the tributaries. Pollution instances from this activity can lead to mortality. In Swanlinbar mortalities were documented where a pollution incident occurred. Last year a pollution instance in the Ballinderry River also occurred but as yet we are unclear as to the consequences. (Tony Waterman- *pers. comm.*)

TYPE OF CHEMICAL VULNERABILITY: *Margaritifera* is extremely sensitive to chemical changes and extremely vulnerable in all sites found in the NS Share area. The main problem is eutrophication which can lead to them been covered in filamentous algae growth. The Pearl mussel is most vulnerable to human influence at the stage where they leave the host fish and establish in the sediment. This stage will die out completely even if there is even a slight degree of pollution present. The juveniles are also far less tolerant than the adults, and persistent intermediate levels of

eutrophication could prevent long term recruitment, resulting in aged stocks. The level of sediment in the river bed can also affect juvenile growth where low levels may lead to a higher mortality rate in juveniles. The crucial parameters are BOD, calcium and phosphate levels in the water. (Bauer 1988) Most molluscs are affected by toxicity; there is evidence that sheep dip can have an immediate effect on *Margaritifera*. Depending on the time of year, length and severity of the pollution incidence or run-off from sheep dip it may only be a stress situation where there is oxygen depletion or it may lead to toxic death. There is evidence where the mussel has been found in situ as if filtering but it is actually dead. If suspended solids are found in the water column adults can close up and die. (Evelyn Moorkens- *pers. comm.*)

DETAILED DESCRIPTION OF ECOLOGICAL REQUIREMENTS:

a) Floristic composition/species characteristics

The freshwater pearl mussel is typically dioecious, in common with other freshwater bivalves. It matures at 10-15 years, when the length generally exceeds 65mm. In early summer (June to July), the males shed sperm into the water, and it is inhaled by the females. The fertilised eggs develop in a pouch on the gills for several weeks, and are released from July to September as tiny larvae, measuring 60-70mm (0.6-0.7 mm), known as glochidia. These resemble tiny mussels, but their shells are held apart until they encounter a suitable host, when they snap shut on to the host's gill filaments (Young & Williams 1984).

b) Distribution within NS Share area

There has been a considerable decline in species distribution and numbers throughout the NS Share area. Where once they were found throughout the Foyle system and stretching right up to the North East it is now confined to 3 rivers in Northern Ireland.

SAC's designated for *Margaritifera* within the NS Share.

SAC Site Code	SAC Site Name	Rivers (including tributaries) containing *Margaritifera*	River Systems designated for *Margaritifera*
IE0000197	West of Ardara/Mass Road	Owenea	Owenea
IE002047	Cloghernagore Bog & Glenveagh National Park SAC	Owencarrow	Owencarrow
IE0002176	Leannan River SAC	Leannan	Leannan
IE0002047	Cloghernagore Bog & Glenveagh national Park SAC	Glaskeelan	Glaskeelan
IE0000163	Lough Eske & Ardnamona Wood SAC	Eske	Eske
IE0000140	Fawnboy Bog/Lough Nacung SAC	Clady	Clady
UK0030233	Owenkillew River		Owenkillew
UK0030116	Cladagh (Swanlinbar) River		Cladagh (Swanlinbar) River
UK0030296	Upper Ballinderry River		Upper Balinderry

Table 1. Recent Population estimates for important mussel rivers in Northern Ireland (densities range from <1m-2 to 40m-2).		
River	**County**	**Minimum recent population estimates**
Swanlinbar river	Co. Fermanagh	3.500
Owenkillew river	Co. Tyrone	10.000
Ballinderry river	Co. Tyrone	<1000
Other rivers		<1000

c) Landscape situation and topography

The landscape situation can be very variable. It is more concerned with stability and a natural flow, structure, temperature etc. Generally it is found in the less steep portion of the river where it is short and spatty. This however has not been a natural progression it is due to changes in catchment practices and management. They favour mostly western rivers and any mountain streams. The gradient could affect mussel distribution indirectly by determining the stability of the substrata. Purser (1985) demonstrated that an intermediate gradient range of 0.8-3 m km $^{-1}$ was preferred. In both Northern Ireland and the NS Share section of the ROI they are found in the mid-lower stretches characterised by the raunculus river types they are associated with the trophic status of this river type. Upstream of a population is as important as where the population is found downstream.

d) Substratum

The characteristics of riverbed substrata are of critical importance for freshwater pearl mussel populations. The typical substrate preference is small sand patches stabilised amongst large stones or boulders in fast-flowing streams and rivers. Such boulder-sheltered mussel beds may be critical for recruitment after heavy floods (Vannote & Minshall 1982). Riffle areas with mixtures of rocks, cobbles and sand are important habitats in low gradient sections, providing a well-oxygenated silt-free environment. Juveniles are mostly associated with such riffles, and require fine sediment within which to shelter. Both adults and juveniles should be found together in the same area. Juveniles should be found throughout the range.

e) Supply mechanism if appropriate

Not applicable

f) Water regime: optimal

Optimum depth and velocity in Scottish rivers were found by Hastie *et al.* (2000a) to be 0.3-0.4 m deep and 0.25-0.75 m s^{-1}.No absolute figures are available for a minimum suitable flow velocity. Until such factors have been quantified by further research, a precautionary approach should be followed. (Skinner *et al*, 2003). These are typical values, but it must be remembered that these will vary depending on area, presence or absence of boulders, riffles together with the degree of naturalness. It must be noted that these figures are in relation to the adults only and no figures are available for the juveniles however once the juvenile is within the sediment it may not have as much of a significance. Again the degree of naturalness is the most important factor.

g) Water regime: Sub-optimal or damaging

Slight hydrological changes may result in serious degradation of habitat due to the very specific sediment requirements of juveniles (Bauer 1988, Buddensiek *et al.* 1993). They do not like very dry conditions. Where the velocity is altered as is the case where trees are felled, there is no water take up, drains flood leading to flash floods and an increased velocity. In this higher velocity they can't cope due to transportation to unsuitable areas which may be exposed, badly managed or unstable. All large scale installations of hydro schemes or dams should be avoided on *Margaritifera* rivers as they may lead to flash floods and an increased velocity.

h) Nutrients & Hydrochemistry:

(i) Soil pH

Not applicable

(ii) Water pH

pH of 7.5 or less according to Bauer (1988) and the Life report. This will depend on the natural conditions. A base line should have been taking back in the 50/60's in order to see what the natural conditions were.

(iii) Water conductivity

An overall low conductivity is best. Bauer has quoted <70 µs/cm in his 1988 report while Oliver has a value of <100 µs/cm in his 2000 report. According to the Life report on the ecology of the Freshwater Pearl Mussel conductivity must not exceed 100 µS cm^{-1} although higher values of 120 µS cm^{-1} may be natural on limestone-influenced stretches.

(iv) Substrate fertility

Not applicable

i) Management strategy

Eliminate all nutrient losses and return to pristine conditions. Catchment level management is needed which address forestry, farming, mining, quarrying and all agriculture, sewage treatment and afforestation. Interim guidelines for forestry are needed in the ROI and more stringent ones are needed in NI to help them along before the Water Framework Directive Program of Measures. Farming and septic tank pressures also need to be addressed in relation to *Margaritifera.* These rivers need to be returned to a "no tolerance" or outside input of nutrients or siltation. They cannot be managed based on values for pollution incidences; they need no input what so ever.

j) Vulnerability

It is extremely vulnerable to siltation & eutrophication with the major cause of decline being deterioration of water quality. Any changes to phosphate, nitrate and conductivity are likely will have a significant negative effect on the population. At its worst now none of the sites are in favourable conservation status. There are only 6 or 7 sites which have juveniles ,<15 years old, present in the ROI sites, while in NI there is a minimum to very little numbers. It is an aging population which is susceptible to illegal pearl fishing, cattle poaching of the river banks together with any other direct damage from farming, quarrying, forestry and mining.

k) Restorability

There have been many attempts to restore population with one in the process in Ballinderry. Its aim is to establish a simple extensive large-scale culture facility. The objective of this programme is as follows:

- **To mimic a stretch of River under experimental conditions**
- **To infect juvenile fish with glochidial *M. margaritifera***
- **To release infected fish into experimental system**
- **To monitor: glochidial growth and survival on salmonids settlement and growth of juvenile *M.margaritifera***

Another successful attempt is in Germany where numbers of *Margaritifera* had dropped to 1700 at the time that restoration measures were complete. Adequate recruitment may be indicated by 20% of the population being less than 20 years old together with 10% needed less than 5 years of age. Transplantation of mussels from river to river is relatively unsuccessful, with mortalities of over 50% in the first three years, compared to short-term survival rates of 90% from a translocation exercise within the same river system (Valovirta 1998). **Life in UK Rivers** and Aberdeen University are currently investigation techniques for captive breeding of the species as a means of reinforcing recruitment within catchments. This project has yielded 6 year old mussels in 2006.

l) Limitations of requirements and gaps in knowledge

Currently substantial reference data is missing for *Margaritifera*. It is a very hard species to survey due to the nature of the rivers being dark combined with the species dark shell. Within the NPWS there is a substantial electronic database held but a next progressive step with these would be to import into a GIS. Within EHS they have mapped the species to individual level. There is insufficient knowledge on their requirements for reproduction particularly in relation to juvenile survival. (Tony Watermann – *pers. comm.*).

CONSERVATION REQUIREMENTS:

1. To find the reference conditions and assign conservation requirements based on them.
2. To return the rivers to reference condition with no siltation or nutrient loss.
3. An interim solution to the declining populations may be to remove the current species from the rivers, place in artificial surroundings with pristine water conditions, promote recruitment and following the achievement of Good Ecological Status in our rivers return the populations to their original location.

Re-introduction programme would require:

- Adhering to IUCN Guidelines for Re-introducing Species
- Detailed knowledge of genetic diversity of existing populations to avoid inbreeding depression or vulnerability to environmental stochasticity
- Knowledge of best reintroduction protocol

RELEVANT REFERENCES

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http://www.english-nature.org.uk/lifeinukrivers/publications/mussel.pdf
http://www.npws.ie/en/PublicationsLiterature/IrishWildlifeManuals/

Information from the Freshwater pearl mussel restoration workshop held in Belfast from the 16th-17th of November 2004.

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Table of Annex V WFD Water Quality and Quantity Elements for the species *Margaritifera margaritifera* – Freshwater Pearl Mussel

Rivers	Quality Element	Parameter ranges if applicable to Juveniles	Parameter ranges if applicable to adults
Biological quality elements:	Composition and abundance of aquatic flora	Nil	Nil
	Composition and abundance of benthic invertebrate fauna.	Very few are found with *Margaritifera* due to the associate waters being Ultra-Oligotrophic	Very few are found with *Margaritifera* due to the associate waters being Ultra-Oligotrophic
	Composition, abundance and age structure of Fish Fauna	Density of 1-2 year old salmonids should be sufficient to allow for juvenile infestation however it is not a case of the more fish the better.	
Hydromorphological:			
Hydrological regime	Quantity & dynamics of water flow	As long as its kept natural	As long as its kept natural
	Connection to groundwater bodies	Not considered to be an issue due to its non reliance on nutrients.	Not considered to be an issue due to its non reliance on nutrients.
River continuity	River depth and width variation	It needs a good variation in depth & width	It needs a good variation in depth & width
Morphological condition	River depth and width variation	No removal of boulders, gravel, cobbles or bedrock	No removal of boulders, gravel, cobbles or bedrock
	Structure and substrate of the river bed	Naturalness to be retained or restored	Naturalness to be retained or restored
	Structure of the riparian zone	Needs to be stable, no poaching from cattle and sheep which can lead to siltation which has a very negative effect.	Needs to be stable, no poaching from cattle and sheep which can lead to siltation which has a very negative effect.
General Physico-chemical requirements: Transparency, Thermal conditions, Oxygenation conditions, Salinity, Acidification status, Nutrient Conditions			
	Calcium	A baseline Ca level of each river should first be taken & maintained as the only Ca input would be a once off event such as from liming.	<10 mg/l Ca CO_3 (Oliver 2000), 2 mg/l (Bauer 1988). **Minimum level to be applied**
	Transparency	This is a very important factor as it measures the amount of suspended solids in	This is a very important factor as it measures the amount of suspended

		the water. If insufficient transparency the mussels will not open and fail to filter.	solids in the water. If insufficient transparency the mussels will not open and fail to filter.
	Temperature	5-19^{0}C	5-19^{0}C
	Dissolved oxygen		>9 mg/l (Moorkens 2000). **Minimum level to be applied**
	Salinity	Only estuarine salinity, no evidence of reproduction in saline influenced estuaries.	Only estuarine salinity, no evidence of reproduction in saline influenced estuaries.
	Electrical conductivity	No artificial changes in conductivity (79-90 µs/cm	<100 µs/cm (Oliver 2000), <70 µs/cm (Bauer 1988), <200 µs/cm (Moorkens (included *Durrovensis*) 2000), <100 µs/cm (Life Report 2000) **Minimum level to be applied**
	pH	Depends on what they are naturally found on.	6.5-7.2 (Oliver 2000) , 7.5 or less (Life Report 2000), <7.1 - >6.3) (Moorkens 2000) **Minimum level to be applied**
	Alkalinity		
	Ortho-Phosphate	0.005(Moorkens Impress) **Note:** Oliver & Bauers values are double the EPA Q5 values	<0.03 mg/l (Oliver 2000), <0.03 mg/l (Bauer, 1988), 0.005(Moorkens 2006 In press) <0.03 mg/l (Life Report 2000) **Minimum level to be applied.**
	Total phosphorus	N/A	
	Soluble reactive phosphorus	N/A	
	Total nitrogen	N/A	
	Oxidised Nitrogen	0.125 mg/l (Moorkens In press)	<1.0 mg/l (Oliver 2000), <0.5 mg/l (Bauer 1988), 0.125 mg/l (Moorkens In press), 1.0 mg/l (Life Report 2000) **Minimum level to be applied**
	Ammonium	0.01 mg/l	0.01mg/l
	Suspended solids	The quantity is not as significant as the % of time.	The quantity is not as significant as the % of time.
	Turbidity	The quantity is not as significant as the % of time.	The quantity is not as significant as the % of time.
	Total organic carbon (TOC)	Negligible	Negligible

	Biochemical oxygen demand (BOD)	Juvenile mussels live interstitially, but no monitoring of substrate oxygen levels is currently undertaken. **Negligible**	<1.3 mg/l (Oliver 2000), 1.4 mg/l (Bauer 1988), <3 mg/l (Moorkens 2000) **Minimum level to be applied**
	Chemical oxygen demand (COD)		
Specific pollutants	Pollution by all priority substances identified as being discharged into the body of water	Anything with Copper is highly toxic together with Cu, Cadmium, Zinc, Nickel	Anything with Copper is highly toxic together with Cu, Cadmium, Zinc, Nickel
	Pollution by other substances identified as being discharged in significant quantities into the body of water.		Indirect effect from Pyrethroid sheep or any of the sheep dips on Salmonid fish.

Note: All values provided in the above table by Oliver and Bauer are a median/mean not a minimum or maximum. Values provided by Moorkens 2000 were maxima. Those from Moorkens which are in press or post 2000 are medians