ASSESSMENT OF FRESHWATER AQUATIC ECOLOGY FOR EIRGRID EAST WEST INTERCONNECTOR EIS

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1 INTRODUCTION

As part of the investigations for the EIS for the proposed Eirgrid East - West Interconnector *Biosphere Environmental Services* has commissioned *Conservation Services* to carry out a study of freshwater aquatic ecology with the following objectives:

- To assess the present water quality, habitat value, fishery value and general ecological condition of potentially affected surface freshwaters.

- To provide baseline data against which ecological changes can be assessed.

- To assess the potential impact of the proposed development on surface water quality and aquatic flora, fauna, and fish stocks

- To recommend mitigation measures if appropriate

The scope of the aquatic investigation is to assess the biological water quality, fishery value and ecological importance of all streams/rivers which will be intersected by or in close proximity to the proposed cable and 400kV converter station, and to assess salmonid habitat quality for 0.5 km downstream of the potential impact locations. A general assessment of the streams in the context of their downstream catchments is also carried out based on existing available information. An assessment of the potential ecological impact of the proposed development on surface freshwaters is also carried out, and mitigation measures are recommended to minimise such impacts.

The assessment does not include brackish/tidal or saline/marine waters.

The following bodies were invited by letter to provide information/comments for this report:

Central Fisheries Board

Eastern Regional Fisheries Board

Marine Institute

National Parks & Wildlife Service

The field assessment for this report was carried out between 22 May 2008 and 26 May 2008 inclusive and on 17th October 2008.

2 METHODOLOGY

All 21 points at which the proposed development intersects or is in close proximity streams/rivers shown on the 1:50,000 Discovery Series Ordnance Survey maps were assessed (see Maps 1 – 3).

2.1 HABITAT ASSESSMENT

Biological sampling sites were assessed in terms of:

1. Stream width and depth

2. Substrate type, listing substrate fractions in order of dominance, i.e. large rocks, cobble, gravel, sand, mud etc.

3. Flow type, listing percentage of riffle, glide and pool in the sampling area

4. Dominant bankside vegetation, listing the main species overhanging the stream

5. Estimated degree of shade of the sampling site by bankside vegetation.

6. Rating of the site as habitat for salmonid adult, nursery and spawning on a scale of None/ Poor/ Fair/ Good/ Very Good/ Excellent. This rating assesses the physical suitability of the habitat; the presence/absence/density of salmonids at the site will also depend on present and historical water quality and accessibility of the site to fish. A rating of "none" indicates that the ecologist carrying out the assessment regards it as impossible that the stream could support salmonid fish in the relevant life stage. A rating of "None - Poor" indicates that it is regarded as possible but extremely unlikely that the stream could support salmonid fish in the relevant life stage.

A general assessment of salmonid habitat quality was carried out for c.0.5km downstream of each potential impact location. This assessment consisted of walking/wading the stream channel. Salmonid habitat quality was assessed, taking into account the environmental features 1-5 listed above. Based on these observations and more detailed criteria outlined in Section 2.1.1 below, the value of each river section for the different life stages of salmonids was estimated. Locations for identification of habitat sections were recorded as Irish Grid References using a GPS. To illustrate the habitat quality photographs were taken using a digital camera.

2.1.1 CRITERIA USED FOR ASSESSMENT OF SALMONID HABITAT QUALITY

Assessment of the quality of salmonid spawning habitat, nursery habitat and adult habitat is based on personal expertise developed over a period of 13 years of electrofishing and on published information such as the following:

i. Favourable locations for salmon spawning are likely to occur where the gradient of a river is 3% or less (Mills 1989).

ii. Preferred current velocity for spawning is within the range 25–90 cm s^{-1}, with a water depth in the range 17–76 cm (Hendry & Cragg-Hine 1997).

iii. Typical spawning sites are the transitional areas between pool and riffle where flow is accelerating and depth decreasing, where gravel of suitable coarseness is present and interstices are kept clean by up-welling flow (Peterson 1978, Bjorn & Reiser 1991).

iv. Salmon fry and parr occupy shallow, fast-flowing water with a moderately coarse substrate with cover (Symons & Heland 1978, Baglinière & Champigneulle 1986).

v. Deep or slow-moving water, particularly when associated with a sand or silt substrate, does not support resident juvenile salmonids (Wankowski & Thorpe 1979, Baglinière & Champigneulle 1986).

vi. Suitable cover for juveniles includes areas of deep water, surface turbulence, loose substrate, large rocks and other submerged obstructions, undercut banks, overhanging vegetation, woody debris lodged in the channel, and aquatic vegetation (Heggenes 1990; Bjorn & Reiser 1991; Haury *et al*. 1995).

vii. The juxtaposition of habitat types is also important. The proximity of juvenile habitat to spawning gravels may be significant to their utilisation. In addition, adults require holding pools immediately downstream of spawning gravels in which they can congregate prior to spawning. Cover for adult salmon waiting to migrate or spawn can be provided by overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water and surface turbulence (Bjorn & Reiser 1991).

viii. Bjorn & Reiser (1991) suggest that proximity of cover to spawning areas may be a factor in the selection of spawning sites by some salmonid species.

2.2 INVERTEBRATE SAMPLING AND WATER QUALITY ASSESSMENT

Invertebrate assessment was carried out at 20 sampling sites (Site B was not assessed as it had no flowing water at the time of the assessment. A five-minute kick and stone wash sample was taken at each sampling site. Each sample was live sorted for 30 minutes, and macroinvertebrates were stored in 70% alcohol. Invertebrates were identified to the level required for the EPA Q-rating method (Clabby *et al,* 2006) using high-power and low-power binocular microscopes.

Based on the relative abundance of indicator species, a biotic index (Q-rating) was determined for each site in accordance with the biological assessment procedure used by the Environmental Protection Agency (Clabby *et al,* 2006) and more detailed unpublished methodology (McGarrigle, Clabby and Lucey pers. comm.)

2.3 GUIDELINES USED FOR CLASSIFICATION OF IMPORTANCE OF FRESHWATERS

Rating

A **Internationally Important**

Habitats designated as SACs for Annex II species under the EU Habitats Directive. Major Salmon river fisheries. Major salmonid lake fisheries.

B **Nationally or Regionally Important**

Other major salmonid waters and waters with major amenity fishery value. Commercially important coarse fisheries. Waters with important populations of species protected under the Wildlife Act and/or important populations of Annex II species under the EU Habitats Directive. Waters designated or proposed as Natural Heritage Areas by Dúchas.

C **High local value**

Small water bodies with known salmonid populations or with good potential salmonid habitat, or any population of species protected under the Wildlife Act and/or listed Annex II species under the EU Habitats Directive. Large water bodies with some fisheries value.

D **Moderate local importance**

Small water bodies with some coarse fisheries value or some potential salmonid habitat. Any stream with an unpolluted Q-value rating.

E **Low value**

Water bodies with no current fisheries value and no significant potential fisheries value. Habitat diversity low and degraded.

(NRA 2006)

2.4 ASSESSMENT OF SIGNIFICANCE OF POTENTIAL IMPACTS

Impacts are defined on the basis of severity of impact on salmonid fish or any rare, protected, or commercially significant species and/or habitats. Assessment of the importance of a potential impact takes into account not only the ecological considerations in the immediate vicinity of the potential impact, but also geographical and wider catchment considerations. If spawning and nursery habitat are limiting factors in short supply in a particular river system, then impacts on them will have an importance out of proportion with their apparent 'face value'.

Because of their amenity, commercial and legal status, salmonid fish (trout and salmon) are given special consideration. If an aspect of a proposed development is judged likely to have a measurable negative effect on salmonid fish populations, it would be classified as a significant potential impact.

The guidelines used for assessing the significance of impacts on flora, fauna and fisheries are as follows. (For details of water-body categories see section 2.3)

A Sites

	Temporary	**Short-term**	**Medium-term**	**Long-term**
Extensive	MAJOR	SEVERE	SEVERE	SEVERE
Localised	MAJOR	MAJOR	SEVERE	SEVERE

B Sites

	Temporary	**Short-term**	**Medium-term**	**Long-term**
Extensive	MAJOR	MAJOR	SEVERE	SEVERE
Localised	MODERATE	MODERATE	MAJOR	MAJOR

C Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	MODERATE	MODERATE	MAJOR	MAJOR
Localised	MINOR	MODERATE	MODERATE	MODERATE

D Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	MINOR	MINOR	MODERATE	MODERATE
Localised	NOT SIGNIFICANT	MINOR	MINOR	MINOR

E Sites

	Temporary	Short-term	Medium-term	Long-term
Extensive	NOT SIGNIFICANT	NOT SIGNIFICANT	MINOR	MINOR
Localised	NOT SIGNIFICANT	NOT SIGNIFICANT	NOT SIGNIFICANT	NOT SIGNIFICANT

(NRA 2006)

In line with the EPA guide lines (EPA 2002) the following terms are defined when quantifying duration:

Temporary: Up to 1 year
Short-term: From 1 to 7 years
Medium-term: 7 to 15 years
Long-term: 15 – 60 years
Permanent: over 60 years.

For the purposes of this report 'localised' impacts on rivers are loosely defined as impacts measurable no more than 250 metres from the impact source. 'Extensive' impacts on rivers are defined as impacts measurable more than 250m from the impact source. Any impact on salmonid spawning habitat or nursery habitat where it is in short supply, would be regarded as an extensive impact as it is likely to have an impact on the salmonid population beyond the immediate vicinity of the impact source.

2.5 LIMITATIONS ENCOUNTERED

No significant limitations were encountered.

3 EXISTING ENVIRONMENT

Proposed cable stream intersections are located on four stream/river systems; the Tolka, the Broadmeadow, the Ballyboghil and the Corduff, and on three small streams entering Rogerstown Estuary.

Local River System & EPA code	Potential Impact Location	Grid Reference
Tolka (09/T/01)	A	N9519 4833
	B	N9568 4731
	C	N9655 4760
	D	N9754 4803
	E	N9860 4902
Broadmeadow (08/B/02)	F	O0006 5030
	G	O0054 5225
	H	O0053 5283
	I	O0064 5378
	J	O0101 5486
Hurley (08/H/01)	K	O0332 5572
Ballyboghil (08/B/01)	L	O0928 5547
	M	O1198 5512
	N	O1228 5470
	O	O1435 5366
	P	O1504 5362
	Q	O1826 5258
Corduff (08/B/03)	R	O1993 5224
Rogerstown Estuary	S	O2175 5241
	T	O2445 5336
	U	O2485 5330

3.1 TOLKA

3.1.1 GENERAL CATCHMENT INFORMATION

The River Tolka rises near Dunshaughlin, in Co. Meath, and flows east via Dunboyne, Clonee, Blanchardstown and Finglas, before entering the sea at Clontarf on the north side of Dublin City.

3.1.1.1 Water Quality

EPA data indicate that the Tolka has suffered from serious pollution problems for at least the last thirty five years. After the 2005 round of biological monitoring EPA stated that "*The Tolka had improved somewhat in the Black Bull area (0300) since 2002 but there was evidence of considerable eutrophication here as also at Loughsallagh Bridge Dunboyne (0600) downstream. The river was again assessed as moderately polluted at Mulhuddart, Abbotstown and Finglas, the latter location additionally affected by oil pollution*." (Clabby *et al* 2006). EPA water quality data for the main channel of the Tolka from 1973 to 2005 are tabulated in Appendix 1.

3.1.1.2 Fishery Value

A survey carried out by Conservation Services in 1994 indicated that despite unsatisfactory water quality, brown trout populations survived in the Tolka in all sections downstream of Mulhuddart. Age distribution of the brown trout, combined with data on stocking provided by the Eastern Regional Fisheries Board, indicated that the population consisted mostly of fish which had been spawned in the river, rather than stocked fish. It therefore seems that, though under severe pressure from pollution, a population of wild brown trout have survived in the Tolka River.

Significant improvements in water quality were recorded in the upper sections of the river after 1996. A survey carried out by Eastern Regional Fisheries Board in 2001 recorded trout as far as 1km upstream of Black Bull (Gretta Hannigan ERFB pers. comm.). The Tolka upstream of Clonee has had water quality suitable for trout survival since 1998. In 2003 good numbers of wild trout were recorded in the section of river from Damastown to Mulhuddart (J. O'Brien ERFB pers. comm.). In September 2007 ERFB recorded 27 adult trout many of wild origin in the main channel upstream of Dunboyne as par of a destocking programme for the M3 scheme also ERFB have recently recorded wild brown trout in many of the tributaries of the Tolka (Gretta Hannigan ERFB pers. comm.).

O'Reilly (2002) states that "*there are seatrout in the lower reaches at Clonliffe and up to the Botanic Gardens, where there are wild trout to 3lb. …. in the 1950s, it regularly produced trout up to 6 lb., and trout of 4 lb. were regularly taken at Ashtown. There are still some wild trout to be found up to Black Bull Bridge on the Trim Road – May 2001 survey. Today, it still holds some wild trout but it is drained and eutrophic and is really a put and take fishery, stocked by the Tolka Angler's Club*."

Trout have survived in the Tolka to the present time, and have the potential to be an important amenity resource for the rapidly developing hinterland of Dublin through which the river flows.

3.1.1.3 Freshwater ecological value

No rare or protected species were identified in the river by Conservation Services during the present or previous invertebrate surveys. Lampreys, which are listed in Annex II of the Habitats Directive, have been recorded in the Tolka system (Gretta Hannigan ERFB pers. comm.). Crayfish (*Austropotomobius pallipes*), which are protected under the Wildlife Act and listed in Annex II of the Habitats Directive, were not recorded in the present survey. Mapping of crayfish distribution in Reynolds (1998) and Demers *et al* (2005) shows no records for

crayfish in the potentially affected area. The likelihood of crayfish occurring in the potentially affected waters is therefore low.

3.1.2 POTENTIALLY AFFECTED SECTIONS

3.1.2.1 Potential Impact Location A

3.1.2.1.1 Habitat Assessment

Location	N9490 4831 to N9547 4828
Length	c.700m
Description	Potential Impact Location A is on a small tributary of the Tolka. The potentially affected section of stream is 1 - 2m wide consisting mostly of glide over mud with some cobble and gravel with some riffle over muddy cobble (see photos 1 & 2). The stream is heavily shaded by hawthorn, blackthorn, ash and beech except at the lowest c.100m.
Photograph Number	1 & 2
Salmonid Adult Habitat	Poor
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor

3.1.2.1.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	c.225
		Limnephilidae	12
		Chironomidae (ex. *Chironomus sp.*)	45
		Elmidae	1
D	Very Pollution Tolerant	*Helobdella stagnalis*	1
		Glossiphonia sp.	2
		Asellus aquaticus	18
E	Most Pollution Tolerant	None Recorded	

3.1.2.1.3 Fishery Value

A low density of trout may be present in the potentially affected section of stream.

3.1.2.1.4 Freshwater ecological value

Moderate local importance.

3.1.2.2 Potential Impact Location B

3.1.2.2.1 Habitat Assessment

Location	N9468 4731 to N9584 4713
Length	c.400m
Description	Potential Impact Location B is on a small tributary of the Tolka. Most of the potentially affected section of channel had no water at time of assessment (Photos. 3 & 5), stagnant standing water was observed a few locations (Photo. 4). The substrate is mostly mud. The channel is heavily shaded by hawthorn, blackthorn, ash and elder.
Photograph Number	3-5
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	None
Salmonid Spawning Habitat	None
Crayfish Habitat	None

3.1.2.2.2 Invertebrate Water Quality Assessment

Site not suitable for Q-rating assessment.

3.1.2.2.3 Fishery Value

Trout are unlikely to be present in the potentially affected section of stream.

3.1.2.2.4 Freshwater ecological value

Low value.

3.1.2.3 Potential Impact Location C

3.1.2.3.1 Habitat Assessment

Section 1

Location	N9655 4760
Length	Point Location
Description	Potential Impact Location C is on a small tributary of the Tolka. The stream at the proposed crossing point is a muddy pool with some *Callitriche* sp. The pool is a cattle watering location (Photo. 6).
Photograph Number	6
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	None
Salmonid Spawning Habitat	None
Crayfish Habitat	None

Section 2

Location	N9655 4760 to N9678 4749
Length	400m
Description	The stream is mostly poor uniform muddy glide with a few muddy cobble riffles . The stream has moderate cover of Hawthorn.
Photograph Number	7 & 8
Salmonid Adult Habitat	Poor – Fair
Salmonid Nursery Habitat	Fair

Salmonid Spawning Habitat Poor - Fair

Crayfish Habitat Poor - Fair

3.1.2.3.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Glossiphoniidae	2
		Gammarus duebeni	44
		Hydracarina	2
		Baetis rhodani	23
		Ephemerellidae	14
		Limnephilidae	4
		Psychomyiidae	1
		Rhyacophilidae	1
		Chironomidae (ex. *Chironomus sp.*)	6
		Tipulidae	2
		Elmidae	75
D	Very Pollution Tolerant	Sphaeriidae	6
		Asellus aquaticus	1
E	Most Pollution Tolerant	Tubificidae	1
-	Taxa not assigned to Indicator group	Lumbricidae	1
		Ceratopogonidae	1

3.1.2.3.3 Fishery Value

Trout may be present at low density in the potentially affected section of stream.

3.1.2.3.4 Freshwater ecological value

Moderate local importance.

3.1.2.4 Potential Impact Location D

3.1.2.4.1 Habitat Assessment

Section 1	
Location	N9754 4803
Length	Point Location
Description	Potential Impact Location D is on the main channel of the Tolka. The stream immediately upstream of the bridge is muddy glide poached by cattle and with some hawthorn on either side (Photo. 9). Immediately downstream of the bridge the habitat is similar but with heavier cover of hawthorn and sycamore (Photo. 10).
Photograph Number	9 & 10
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	Poor
Salmonid Spawning Habitat	None – Poor
Crayfish Habitat	None
Section 2	
Location	N9754 4803 to N9793 4746
Length	600m
Description	The stream is mostly poor uniform muddy glide with some muddy cobble riffles. Heavily shaded by hawthorn, beech and ash.
Photograph Number	11 - 13
Salmonid Adult Habitat	Fair

Salmonid Nursery Habitat	Fair – Good
Salmonid Spawning Habitat	Fair
Crayfish Habitat	Fair

3.1.2.4.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q2-3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Hydracarina	10
		Limnephilidae	5
		Chironomidae (ex. *Chironomus sp.*)	201
D	Very Pollution Tolerant	*Glossiphonia* sp.	1
		Asellus aquaticus	4
E	Most Pollution Tolerant	Tubificidae	41
		Chironomus sp.	1
-	Taxa not assigned to Indicator group	Ceratopogonidae	37

3.1.2.4.3 Fishery Value

Trout may be present at moderate density in the potentially affected section of stream.

3.1.2.4.4 Freshwater ecological value

Moderate local importance.

3.1.2.5 Potential Impact Location E

3.1.2.5.1 Habitat Assessment

Location	N9860 4902 to N9820 4917
Length	c.450m
Description	Potential Impact Location E is on a small tributary of the Tolka. The stream is a poor muddy glide with heavy shade of hawthorn.
Photograph Number	14 & 15
Salmonid Adult Habitat	Poor
Salmonid Nursery Habitat	Poor
Salmonid Spawning Habitat	None
Crayfish Habitat	None - Poor

3.1.2.5.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q2 indicating seriously polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Chironomidae (ex. *Chironomus sp.*)	19
D	Very Pollution Tolerant	*Helobdella stagnalis*	1
		Asellus aquaticus	520
E	Most Pollution Tolerant	Tubificidae	3

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
-	Taxa not assigned to Indicator group	Lumbriculidae	4

3.1.2.5.3 Fishery Value

Poor habitat quality and seriously polluted conditions combine to make it unlikely that trout are present in the potentially affected section of stream.

3.1.2.5.4 Freshwater ecological value

Low value.

3.2 BROADMEADOW RIVER SYSTEM

3.2.1 GENERAL CATCHMENT INFORMATION

The Broadmeadow River rises in the vicinity of Dunshaughlin, Co. Meath and flow via Ratoath and Ashbourne to Malahide Estuary.

3.2.1.1 FISHERY VALUE

O'Reilly (1993) states that "*The Broad Meadow Water, once famous for its magnificent double figure sea-trout is now but a shadow of its former self. The water runs off very fast, as the result of a drainage scheme and the river holds only occasional sea-trout in its lower reaches*." O'Reilly (2002) merely states "*The Broad Meadow Water, once famous for its magnificent seatrout has now been reduced to a ditch by on going drainage work and is not worth fishing*." A fish survey carried out by the Eastern Regional Fisheries Board in 1989 found no salmonid fish in the Broadmeadow, with the exception of two trout recorded in the very lowest section of the river, one of which was described as of fish farm origin. The report mentions that salmon ran to Donaghmore on the Broadmeadow up to the 1920s (report text reproduced in Bonner 1994). However brown trout and salmon were recorded in the lowermost stretches of the Broadmeadow in 2004 (Greta Hannigan ERFB pers. comm.) raising hope of a recovery in the salmonid fish population of the river.

3.2.2 WATER QUALITY

The water quality of the Broadmeadow has been monitored by the Environmental Protection Agency and its predecessors the Environmental Research Unit and An Foras Forbartha since 1971. Water quality in the Broadmeadow system has been poor since this monitoring began, making it

one of the more chronically polluted river catchments in the country. EPA biological monitoring data are presented in Appendix 1.

After the 2005 biological monitoring round EPA concluded that: "*As in all previous surveys sensitive species were not observed at any of the locations surveyed on the Broadmeadow in 2005 indicating significant water quality degradation over its course*." (Clabby *et al* 2006)

3.2.3 FRESHWATER ECOLOGICAL INTEREST

Salmon having apparently died out in the Broadmeadow were again recorded in 2004 (Gretta Hannigan ERFB pers. comm.). Salmon are listed in Annex II of the Habitats Directive. Lampreys, which are listed in Annex II of the Habitats Directive, have been recorded in the Dodder, Liffey and Rye Water (Kurtz & Costello 1998); it is therefore possible that Lamprey species may occur in the Broadmeadow. Crayfish (*Austropotomobius pallipes*), which are protected under the Wildlife Act and listed in Annex II of the Habitats Directive were not recorded in the present survey. Mapping of crayfish distribution in Reynolds (1998) and Demers *et al* (2005) shows no records for crayfish in the potentially affected area. The likelihood of crayfish occurring in the potentially affected waters is therefore low.

3.2.4 POTENTIALLY AFFECTED SECTIONS

3.2.4.1 Potential Impact Location F

3.2.4.1.1 Habitat Assessment

Location	N9994 5029 (culvert under road) to O0058 5007
Length	c.750m
Description	Slow muddy glide with moderate instream growth of *Callitriche* sp. and *Apium nodiflorum*. Moderate bankside cover of ash and hawthorn.
Photograph Number	16 - 20
Salmonid Adult Habitat	Poor – Fair
Salmonid Nursery Habitat	Poor – Fair
Salmonid Spawning Habitat	None

3.2.4.1.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q1-2 indicating seriously polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Dytiscidae	2
		Chironomidae (ex. *Chironomus sp.*)	11
D	Very Pollution Tolerant	*Crangonyx pseudogracilis*	2
		Asellus aquaticus	53

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
E	Most Pollution Tolerant	Tubificidae	120
		Chironomus sp.	52

3.2.4.1.3 Fishery Value

It is unlikely that trout are present in the

3.2.4.1.4 Freshwater ecological value

Moderate local importance.

3.2.4.2 Potential Impact Location G

3.2.4.2.1 Habitat Assessment

Location	O0044 5234 to O0090 5208
Length	c.650
Description	Apart from a short section of good riffle over cobble just downstream of the bridge, the potentially affected section of stream is shallow muddy glide with cobble and gravel. The section is well shaded by hawthorn, ash and bramble.
Photograph Number	21 - 24
Salmonid Adult Habitat	Fair
Salmonid Nursery Habitat	Fair – Good
Salmonid Spawning Habitat	Fair

3.2.4.2.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q2-3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	c.110
		Baetis rhodani	6
		Limnephilidae	1
		Chironomidae (ex. *Chironomus sp.*)	1
		Simuliidae	1

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
D	Very Pollution Tolerant	*Asellus aquaticus*	44
E	Most Pollution Tolerant	Tubificidae	1
-	Taxa not assigned to Indicator group	Porifera	

3.2.4.2.3 Fishery Value

A low density of trout may be present in the potentially affected section of stream.

3.2.4.2.4 Freshwater ecological value

Moderate local importance.

3.2.4.3 Potential Impact Location H

3.2.4.3.1 Habitat Assessment

Location	O0053 5289 to O0111 5283
Length	c.700m
Description	Small stream with uniform shallow muddy glide with some poor mud and gravel riffle. Heavy shade of ash, hawthorn and beech.
Photograph Number	25 - 29
Salmonid Adult Habitat	Poor – None
Salmonid Nursery Habitat	Poor – Fair
Salmonid Spawning Habitat	Poor - Fair

3.2.4.3.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q2-3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	60
		Baetis rhodani	2
		Limnephilidae	6
		Polycentropodidae	3
		Elmidae	9
		Helodidae	1
		Chironomidae (ex. *Chironomus sp.*)	2
		Tipulidae	1

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
D	Very Pollution Tolerant	*Glossiphonia sp.*	2
		Asellus aquaticus	80
E	Most Pollution Tolerant	None recorded	
-	Taxa not assigned to Indicator group	Lumbricidae	1
		Lumbriculidae	2
		Ceratopogonidae	1

3.2.4.3.3 Fishery Value

A low density of trout may be present in the potentially affected section of stream.

3.2.4.3.4 Freshwater ecological value

Moderate local importance.

3.2.4.4 Potential Impact Location I

3.2.4.4.1 Habitat Assessment

Location	O0064 5378 to O0132 5367
Length	c.700m
Description	Mostly riffle over cobble gravel and sand well shaded by ash and hawthorn.
Photograph Number	30 - 34
Salmonid Adult Habitat	Fair
Salmonid Nursery Habitat	Good
Salmonid Spawning Habitat	Fair - Good

3.2.4.4.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	c.100
		Baetis rhodani	9
		Limnephilidae	10
		Elmidae	1
		Chironomidae (ex. *Chironomus sp.*)	1
		Simuliidae	22
		Tipulidae	3
D	Very Pollution Tolerant	*Glossiphonia sp.*	
		Asellus aquaticus	13

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
E	Most Pollution Tolerant	None recorded	
-	Taxa not assigned to Indicator group	Lumbricidae	6
		Muscidae	2

3.2.4.4.3 Fishery Value

A low density of trout may be present in the potentially affected section of stream.

3.2.4.4.4 Freshwater ecological value

Moderate local importance.

3.2.4.5 Potential Impact Location J

3.2.4.5.1 Habitat Assessment

Location	O0101 5486 to O0147 5448
Length	c.700m
Description	Mostly shallow riffle and glide over muddy cobble, gravel and sand. Well shaded with ash and hawthorn.
Photograph Number	35 - 38
Salmonid Adult Habitat	Poor
Salmonid Nursery Habitat	Fair – Good
Salmonid Spawning Habitat	Fair

3.2.4.5.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q2-3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	Sericostomatidae	1
C	Moderately Pollution Tolerant	*Gammarus duebeni*	61
		Baetis rhodani	1
		Polycentropodidae	1
		Chironomidae (ex. *Chironomus sp.*)	2
		Tipulidae	3
D	Very Pollution Tolerant	*Glossiphonia sp.*	2
		Asellus aquaticus	c.100

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
E	Most Pollution Tolerant	Tubificidae	18
-	Taxa not assigned to Indicator group	Lumbricidae	5
		Lumbriculidae	5

3.2.4.5.3 Fishery Value

A low density of trout may be present in the potentially affected section of stream.

3.2.4.5.4 Freshwater ecological value

Moderate local importance.

3.3 HURLEY AND NANNY RIVER SYSTEM

3.3.1 GENERAL CATCHMENT INFORMATION

The River Hurley rises north west of Ashbourne and flows north to join the Nanny River about 3km upstream of Duleek. The River Nanny rises west of Kentstown and flows east through Duleek and Julianstown to enter the sea at Laytown.

3.3.1.1 Fishery Value

The Nanny, of which the River Hurley and the Kentstown Branch of the Nanny are tributaries, is listed as a sea trout fishery by Whelan (1989). O'Reilly (2002) states that "*it gets a small run of sea-trout up to the pool at the back of the mill at Julianstown and the rest of the fishing is for brown trout averaging 12oz, of which a fair number are wild trout. The river is also stocked and more than half the trout taken every year are these stocked trout. The trout fishing extends up to Balrath Bridge on the Nanny and to Dean's Bridge on its tributary, the Hurley Rive, where there are trout to a pound.* "

A survey carried out by Conservation Services in 1997 in the Hurley River downstream of Rathfeigh, recorded good salmonid habitat quality and good densities of juvenile trout.

3.3.1.2 Water Quality

Clabby *et al* (2006) reporting on the 2005 round of EPA biological water quality monitoring stated: "*Following a marked improvement in the lower reaches conditions were mostly satisfactory in the Hurley at the time of this survey but heavy siltation depressed ecological diversity at Painestown (0200) where the river was assessed as slightly polluted*."

EPA monitoring results for the Hurley are tabulated in Appendix 1.

3.3.1.3 Freshwater ecological interest

Lamprey which are listed in Annex II of the Habitats Directive have been recorded in the Nanny/Hurley system (Kurz & Costello 1999).

Crayfish (*Austropotomobius pallipes*), are protected under the Wildlife Act and listed in Annex II of the Habitats Directive. Mapping of crayfish distribution in Demers *et al* (2005) shows no records for crayfish in the potentially affected area. The likelihood of crayfish occurring in the system is therefore low.

Salmon which are listed in Annex II of the Habitats Directive were not recorded in a fish survey of sections of the Nanny & Hurley rivers in 1997.

3.3.2 POTENTIALLY AFFECTED SECTIONS

3.3.2.1 Potential Impact Location K

3.3.2.1.1 Habitat Assessment

Location	O0332 5572 to O0279 5610
Length	c.650m
Description	Stream c.5m wide, slow deep uniform glide over mud. Heavy shade of ash and hawthorn.
Photograph Number	39 & 40
Salmonid Adult Habitat	Poor

Salmonid Nursery Habitat None - Poor

Salmonid Spawning Habitat None

3.3.2.1.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at the site merit a Q-rating of Q2 indicating seriously polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None recorded	
C	Moderately Pollution Tolerant	Chironomidae (ex. *Chironomus sp.*)	3
D	Very Pollution Tolerant	*Pisidium sp.*	c.1000
		Sialidae	1
E	Most Pollution Tolerant	Tubificidae	4
		Chironomus sp.	54

3.3.2.1.3 Fishery Value

A low density of trout may be present in the potentially affected section of stream.

3.3.2.1.4 Freshwater ecological value

Moderate local importance.

3.4 BALLYBOGHIL RIVER

3.4.1 GENERAL CATCHMENT INFORMATION

The headwater tributaries of the Ballyboghil River rise in the area between Ashbourne and Garristown Co. Meath and joins the Corduff River just upstream of Rogerstown Estuary.

3.4.1.1 FISHERY VALUE

A fish survey of the Ballyboghil River was carried out by the Eastern Regional Fisheries Board in 1994 (Eastern Regional Fisheries Board 1994). No trout were found; only stickleback, stone loach, minnow and flounder were recorded. More recent survey work carried out by Eastern Regional Fisheries Board has recorded sea trout in the lower stretches of the river and brown trout further upstream at grid ref. O153 535 (Greta Hannigan ERFB pers. comm.)

3.4.1.2 WATER QUALITY

EPA water quality data for the Ballyboghil Stream in 2005 indicated a Q-value of Q3 at site 1900 (bridge south of Trallie Lodge) and Q3 at site 2200 (bridge in Ballyboghil). EPA concluded that "*The complete absence of sensitive species indicated considerable ecological disruption at both locations surveyed on the Ballyboghil River in May 2005. Agriculture suspected*." (Clabby *et al* 2006)

3.4.1.3 FRESHWATER ECOLOGICAL INTEREST

Lamprey species which are listed in Annex II of the Habitats Directive 92/43/EEC were not recorded by the Eastern Regional Fisheries Board in its 1994 of the river, it is nevertheless possible that lampreys could occur in the

Ballyboghil system. Crayfish (*Austropotomobius pallipes*), which are protected under the Wildlife Act and listed in Annex II of the Habitats Directive were not recorded in the present survey. Mapping of crayfish distribution in Reynolds (1998) and Demers *et al* (2005) shows no records for crayfish in the potentially affected area. The likelihood of crayfish occurring in the potentially affected waters is therefore low.

3.4.2 POTENTIALLY AFFECTED SECTIONS

3.4.2.1 Potential Impact Location L

3.4.2.1.1 Habitat Assessment

Location	O0928 5546 to O0981 5514
Length	c.550m
Description	Cobble and mud glide and some riffle. Heavy shade of hawthorn and bramble.
Photograph Number	41 & 42
Salmonid Adult Habitat	Poor
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor

3.4.2.1.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site L merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	37
		Hydracarina	4
		Limnephilidae	3
		Polycentropodidae	1
		Chironomidae (ex. *Chironomus sp.*)	27
		Simuliidae	1
		Tipulidae	26
		Dytiscidae	1
		Helodidae	1
D	Very Pollution Tolerant	*Glossiphonia* sp.	1
		Asellus aquaticus	8
E	Most Pollution Tolerant	Tubificidae	2
-	Taxa not assigned to Indicator group	Lumbricidae	1

3.4.2.1.3 Fishery Value

The potentially affected section of stream could have a small population of brown trout.

3.4.2.1.4 Freshwater ecological value

Moderate local value

3.4.2.2 Potential Impact Location M

3.4.2.2.1 Habitat Assessment

Section 1

Location	O1198 5502 (Proposed crossing point d/s bridge)
Length	Point location
Description	Muddy Glide; heavy shade of hawthorn and bramble
Salmonid Adult Habitat	Fair
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Fair

Section 2

Location	O1198 5502 to O1225 5490
Length	c.250m
Description	Mostly riffle over cobble with some muddy glide. Heavy cover of alder, elder and hawthorn
Photograph Number	43 & 44
Salmonid Adult Habitat	Fair
Salmonid Nursery Habitat	Good – Very Good
Salmonid Spawning Habitat	Fair

Section 3

Location	O1225 5490 to O1278 5458
Length	c.500m
Description	Diverse meandering stream with good cobble and gravel riffle, pools and glide. Significant siltation throughout section particularly downstream of effluent at O1268 5468. Good bank cover of alder and hawthorn.
Photograph Number	45 & 46
Salmonid Adult Habitat	Fair – Good
Salmonid Nursery Habitat	Good
Salmonid Spawning Habitat	Fair - Good

3.4.2.2.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site M merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	26
		Baetis rhodani	22
		Glossosomatidae	12
		Hydropsychidae	26
		Limnephilidae	3
		Chironomidae (ex. *Chironomus sp.*)	3
		Tipulidae	10
		Elmidae	60
D	Very Pollution Tolerant	*Asellus aquaticus*	6
E	Most Pollution Tolerant	Tubificidae	1

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
-	Taxa not assigned to Indicator group	Lumbriculidae	3
		Lumbricidae	1
		Nematomorpha	1

3.4.2.2.3 Fishery Value

On the basis of Q3 water quality and god salmonid habitat quality it must be presumed that the potentially affected section of stream has a good population of brown trout.

3.4.2.2.4 Freshwater ecological value

High Local Value.

3.4.2.3 Potential Impact Location N

3.4.2.3.1 Habitat Assessment

Section 1

Location	O1228 5470 to O1246 5472 (confluence with Ballyboghil Stream)
Length	c.250m
Description	The proposed crossing point is on a small tributary of the Ballyboghil Stream. The stream is a mixture of riffle and glide on muddy cobble and gravel. Much of the stream is heavily shaded with hawthorn and bramble.
Photograph Number	47-49
Salmonid Adult Habitat	Poor – Fair
Salmonid Nursery Habitat	Good
Salmonid Spawning Habitat	Fair

Section 2

Location	Ballyboghil Stream O1246 5472 to O1278 5458
Length	c.300m
Description	Diverse meandering stream with good cobble and gravel riffle, pools and glide. Significant siltation throughout section particularly downstream of effluent at O1268 5468. Good bank cover of alder and hawthorn.
Photograph Number	45 & 46
Salmonid Adult Habitat	Fair – Good
Salmonid Nursery Habitat	Good

Salmonid Spawning Habitat Fair - Good

3.4.2.3.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site N merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	c.90
		Baetis rhodani	16
		Chironomidae (ex. *Chironomus sp.*)	6
		Simuliidae	c.190
		Tipulidae	1
D	Very Pollution Tolerant	*Physa fontinalis*	1
		Asellus aquaticus	6
E	Most Pollution Tolerant	Tubificidae	2
-	Taxa not assigned to Indicator group	Lumbriculidae	2
		Lumbricidae	1
		Naididae	1

3.4.2.3.3 Fishery Value

On the basis of Q3 water quality and god salmonid habitat quality it must be presumed that the potentially affected section of stream has a good population of brown trout. A juvenile brown trout was recorded in the invertebrate sampling at the proposed crossing point.

3.4.2.3.4 Freshwater ecological value

High Local Value.

3.4.2.4 Potential Impact Location O

3.4.2.4.1 Habitat Assessment

Location	O1435 5366 to O1483 5365
Length	c.500m
Description	Mixture of short riffles on gravel and cobble and longer muddy gravel glides all heavily silted. Good cover of alder, hawthorn and ash.
Photograph Number	50-52
Salmonid Adult Habitat	Fair – Good
Salmonid Nursery Habitat	Fair – Good
Salmonid Spawning Habitat	Fair – Good

3.4.2.4.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site O merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Tricladida	1
		Gammarus duebeni	14
		Hydracarina	c.55
		Baetis rhodani	25
		Ephemerellidae	3
		Hydropsychidae	2
		Chironomidae (ex. *Chironomus sp.*)	3
		Simuliidae	11

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
		Tipulidae	2
D	Very Pollution Tolerant	*Asellus aquaticus*	4
E	Most Pollution Tolerant	Tubificidae	2
-	Taxa not assigned to Indicator group	Enchytraeidae	1
		Lumbricidae	1
		Lumbriculidae	3

3.4.2.4.3 Fishery Value

On the basis of Q3 water quality and fair – good salmonid habitat, it must be assumed that the potentially affected section of stream has a good population of brown trout.

3.4.2.4.4 Freshwater ecological value

High Local value.

3.4.2.5 Potential Impact Location P

3.4.2.5.1 Habitat Assessment

Section 1

Location	Proposed crossing point between Ballyboghil Weir and O1504 5362
Length	c.100m
Description	Muddy gravel glide. Bankside birch, ash and beech.
Photograph Number	53 & 54
Salmonid Adult Habitat	Fair – Good
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor – Fair

Section 2

Location	O1504 5362 to O1576 5327
Length	c.800m
Description	Good sequence of riffle on silted cobble and gravel and heavily silted glide. Good cover of ash, hawthorn and alder. 0.5m high weir at O1537 5327 (photo. 64) likely to constitute partial obstacle to upstream fish movement.
Photograph Number	55 - 57
Salmonid Adult Habitat	Fair – Good
Salmonid Nursery Habitat	Fair – Good
Salmonid Spawning Habitat	Fair

3.4.2.5.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site P merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Potamopyrgus antipodarum*	1
		Gammarus duebeni	3
		Hydracarina	c.40
		Baetis rhodani	12
		Ephemerellidae	3
		Hydropsychidae	1
		Chironomidae (ex. *Chironomus sp.*)	15
		Simuliidae	1
		Tipulidae	13
D	Very Pollution Tolerant	*Asellus aquaticus*	2
E	Most Pollution Tolerant	Tubificidae	1
-	Taxa not assigned to Indicator group	Lumbriculidae	1
		Lumbricidae	2
		Nematomorpha	1

3.4.2.5.3 Fishery Value

On the basis of Q3 water quality and fair – good salmonid habitat, it must be assumed that the potentially affected section of stream has a good population of brown trout.

3.4.2.5.4 Freshwater ecological value

High Local value.

3.4.2.6 Potential Impact Location Q

3.4.2.6.1 Habitat Assessment

Section 1 – Potential Impact Location

Location	O1802 5275 to O1826 5258
Length	c.300m
Description	Mostly poor muddy glide with very little muddy gravel riffle. Two sections of large pipe culvert. Good shade of ash, elder and hawthorn.
Photograph Number	58 & 59
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	Poor – Fair
Salmonid Spawning Habitat	Poor – Fair

Section 2

Location	O1826 5258 to O1832 5216 (confluence with Ballyboghil River)
Length	c.400m
Description	Small stream with mostly muddy glide and some poor gravel riffles. Good shade of hawthorn.
Photograph Number	60 - 62
Salmonid Adult Habitat	Poor – None
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor - Fair

Section 3 – Ballyboghil River

Location	O1832 5216 (confluence with Ballyboghil River) to O1830 5206
Length	c.100m
Description	Mixture of muddy glide and gravel riffle. Moderate cover of ash and hawthorn.
Photograph Number	63 & 64
Salmonid Adult Habitat	Fair
Salmonid Nursery Habitat	Good
Salmonid Spawning Habitat	Good

3.4.2.6.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site Q merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Gammarus duebeni*	c.460
		Baetis rhodani	27
		Chironomidae (ex. *Chironomus sp.*)	1
		Tipulidae	16
D	Very Pollution Tolerant	*Asellus aquaticus*	1
E	Most Pollution Tolerant	Tubificidae	1
-	Taxa not assigned to Indicator group	Lumbriculidae	3
		Lumbricidae	10

3.4.2.6.3 Fishery Value

The habitat and water quality renders this small stream suitable for supporting a small population of juvenile brown trout, and the potentially affected section of the Ballyboghil River suitable for supporting a good population of brown trout.

3.4.2.6.4 Freshwater ecological value

The potentially affected small stream is classified as of moderate local value. The potentially affected section of the Ballyboghil River is classified as of high local value.

3.5 CORDUFF RIVER

3.5.1 GENERAL CATCHMENT INFORMATION

The headwater tributaries of the Corduff River rise in the area between Naul Co. Meath and Ballyboghil Co. Dublin. The River flows to Rogerstown Estuary.

3.5.1.1 Fishery Value

The Eastern Regional Fisheries Board carried out a fish survey of the Corduff stream in 1994. In addition to stickleback, stone loach and minnow, the survey located "*good numbers of brown trout in the lower reaches of the Corduff. We also encountered a sea trout of 39.2 cm*" (Eastern Regional Fisheries Board 1994). Fish scale analysis was carried out by Dr Martin O'Grady of the Central Fisheries Board who stated "*Of the thirty three sets of scales which could be read a total of 29 fish appear to be resident fish, their scale patterns suggest that they had not left this stream since birth. All of these fish were either 1+ or 2+ years old individuals. The growth rate of these trout is good, by Irish standards, and probably reflects the enriched nature of the stream. A small number of fish including the three largest individuals in the sample would appear to be migratory individuals which could either be slob trout or true sea trout. Three of these fish appear to have gone to sea initially as 2+ year old individuals. One fish, with "B scale growth" appears to have a "transient slob phase" before going to sea. It is possible that many of the younger resident fish are potential sea trout or slob trout pre-smolts. It is likely that the juvenile stock in the stream is being maintained largely by the spawning efforts of migratory individuals.*" (O'Grady 1995) Surveys carried out approx. 5 years ago by the Eastern Regional Fisheries Board recorded sea trout up to Corduff Bridge and brown trout further upstream at grid ref. O187 541 (Greta Hannigan ERFB pers. comm.)

A survey carried out by Eastern Regional Fisheries Board in 2007 recorded the presence of juvenile salmon in the Corduff River downstream of Corduff ‘Bridge in 2007.

3.5.1.2 Water Quality

EPA monitoring in 2005 at site 08/B/03/1600 (Corduff Bridge) recorded a Q-rating of Q3 indicating moderately polluted conditions (Clabby *et al* 2006). EPA concluded that “*an unbalanced and very restricted fauna indicated significant water quality impairment at Corduff Bridge in mid May 2005. Agriculture suspected*.”

3.5.1.3 Freshwater ecological interest

Lamprey species have not been recorded in previous surveys of the Corduff River by Conservation Services and the Eastern Regional Fisheries Board; it is nevertheless possible that lampreys could occur in the Corduff system.

Crayfish (*Austropotomobius pallipes*), are protected under the Wildlife Act and listed in Annex II of the Habitats Directive. Mapping of crayfish distribution in Reynolds (1998) and Demers *et al* (2005) shows no records for crayfish in the potentially affected area. Crayfish have not been recorded either in the present survey or during widespread sampling of the Ballough/Corduff system as part of the Fingal Landfill EIS in 2005. The likelihood of crayfish occurring in the system is therefore low.

Salmon were recently recorded for the first time in the Corduff River. Salmon are listed in Annex II of the Habitats Directive 92/43/EEC.

3.5.2 POTENTIALLY AFFECTED SECTION

3.5.2.1 Potential Impact Location R

3.5.2.1.1 Habitat Assessment

Section 1 – Upstream of road

Location	O1985 5223
Length	Point Location
Description	Slow muddy glide, c.10m wide and c. 30 – 40 cm deep. Heavily shaded by sycamore.
Photograph Number	65
Salmonid Adult Habitat	Fair – Good
Salmonid Nursery Habitat	Poor
Salmonid Spawning Habitat	Poor – None

Section 2

Location	Just downstream of bridge
Length	Point Location
Description	Pool >1m deep and c. 10m wide. Moderate shade of sycamore and hawthorn.
Photograph Number	66
Salmonid Adult Habitat	Good
Salmonid Nursery Habitat	Poor
Salmonid Spawning Habitat	Poor

Section 3

Location	Pool downstream of bridge to O2014 5188
Length	c.500m
Description	Good mixture of riffle on gravel and cobble, glide over muddy cobble and pool to >0.5m deep. Heavy cover of filamentous algae in less shaded sections (photo. 79). Good cover of willow, ash, sycamore and hawthorn.
Photograph Number	67 - 71
Salmonid Adult Habitat	Good
Salmonid Nursery Habitat	Good
Salmonid Spawning Habitat	Good

3.5.2.1.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site R merit a Q-rating of Q3 indicating moderately polluted conditions.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	Heptageniidae (small specimen)	1
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	*Piscicola geometra*	1
		Valvata sp.	1
		Gammarus duebeni	1
		Baetis rhodani	94
		Ephemerellidae	4
		Hydropsychidae	3
		Chironomidae (ex. *Chironomus sp.*)	133
		Simuliidae	c.110
		Tipulidae	2
D	Very Pollution Tolerant	Erpobdellidae	1

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
E	Most Pollution Tolerant	None Recorded	
-	Taxa not assigned to Indicator group	Lumbricidae	1
		Ceratopogonidae	2

3.5.2.1.3 Fishery Value

Habitat and water quality render the potentially affected section of river suitable for a good population of brown trout, both adult and juvenile. Juvenile salmon have recently been recorded in the potentially affected section of river (G. Hannigan ERFB pers comm.) The presence of salmon in this river renders it of particular importance given the intensive agricultural, commercial and residential usage of the catchment.

3.5.2.1.4 Freshwater ecological value

High local importance. The presence of salmon renders this section of river as important at a county level.

3.6 SMALL STREAMS FLOWING TO ROGERSTOWN ESTUARY

3.6.1 GENERAL CATCHMENT INFORMATION

Three streams flowing to the north side of Rogerstown estuary will be potentially affected by the proposed development. As these streams are not named on the O.S. 1:50,000 map they are named for the purposes of this report the Balleally West Stream, the Whitestown Stream and the Rush West Stream.

1. The Balleally West Stream rises on the south west side of Lusk and flows for c.3km to the estuary.

2. The Whitestown Stream is formed by the confluence of two streams which drain the area to the north of Lusk and flow c.8km to their confluence close to the R128 road from where the stream flows c.0.75km to the estuary.

3. The Rush West Stream drains the area immediately west of Rush from where it flows c.2km to the estuary.

3.6.2 POTENTIALLY AFFECTED SECTIONS

3.6.2.1 Potential Impact Location S – Balleally West Stream

3.6.2.1.1 Habitat Assessment

Section 1 – Immediately Upstream of road

Location	O2164 5247
Length	Point Location
Description	Upstream 'Banks' and stream bottom formed of gabion rock baskets. Well developed *Rorippa and Phalaris* on east side of channel. Bankside ash.
Photograph Number	72
Salmonid Adult Habitat	Poor
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor

Section 2 - Immediately downstream of road culvert

Location	Immediately downstream of road culvert
Length	Point Location
Description	Gabion basket sided channel with muddy bottom and dense *Rorippa and Phalaris.*
Photograph Number	73
Salmonid Adult Habitat	None – Poor
Salmonid Nursery Habitat	Poor
Salmonid Spawning Habitat	None

Section 3

Location	Immediately downstream of road culvert to O2175 5241
Length	c.100m
Description	Muddy channel with some muddy cobble and gravel riffle, but mostly poor muddy glide. Good cover of sycamore on south side.
Photograph Number	74
Salmonid Adult Habitat	Poor - Fair
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor - Fair

Section 4

Location	O2175 5241 to O2170 5230
Length	c.150m
Description	Muddy glide.
Photograph Number	75 & 76
Salmonid Adult Habitat	Poor - Fair
Salmonid Nursery Habitat	Fair
Salmonid Spawning Habitat	Poor - Fair

3.6.2.1.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site S merit a tentative Q-rating of Q2

indicating seriously polluted conditions. As the site may be subject to saline influence in high tide conditions, the Q-rating is tentative.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Tricladida	1
		Hydracarina	1
		Gammarus duebeni	1
		Chironomidae (ex. *Chironomus sp.*)	83
D	Very Pollution Tolerant	*Glossiphonia cp.*	1
		Erpobdellidae	1
E	Most Pollution Tolerant	Tubificidae	30
		Chironomus sp.	7
-	Taxa not assigned to Indicator group	Enchytraeidae	1
		Lumbriculidae	6
		Lumbricidae	6
		Naididae	2

3.6.2.1.3 Fishery Value

The habitat quality of the potentially affected stream is adequate to support a small population of brown trout; however the seriously polluted condition of the stream renders it unlikely that trout were present in this section of stream at the time of the survey. Fish could recolonise the potentially affected section if water quality improves.

3.6.2.1.4 Freshwater ecological value

Moderate local value. This section of stream is immediately upstream of Rogerstown Estuary cSAC. Estuarine assessment does not fall within the remit of this report.

3.6.2.2 Potential Impact Location T – Whitestown Stream

The invertebrates at the proposed crossing point tabulated below indicate brackish estuarine conditions. Tidal conditions are evident in the potentially affected channel (photos 77 & 78). This potential impact location therefore does not fall within the remit of this report.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Chironomidae (ex. *Chironomus sp.*)	2
D	Very Pollution Tolerant	None Recorded	
E	Most Pollution Tolerant	Tubificidae	5
-	Taxa not assigned to Indicator group	Enchytraeidae	223
		Naididae	87

3.6.2.3 Potential Impact Location U – Rush West Stream

3.6.2.3.1 Habitat Assessment

Location	O2485 5330 (proposed crossing point)
Length	c.50m
Description	Poor uniform glide over deep mud. Dense growth of filamentous algae.
Photograph Number	79 & 80
Salmonid Adult Habitat	None
Salmonid Nursery Habitat	Poor
Salmonid Spawning Habitat	None

The stream enters a culvert at the proposed crossing point. Aerial photographs indicate that the stream is culverted for the rest of its course to the estuary.

3.6.2.3.2 Invertebrate Water Quality Assessment

Habitat assessment for the sampling site is contained in Appendix 2. The following taxa which were recorded at Site U merit a Q-rating of Q2/0 indicating seriously polluted conditions with an additional toxic influence.

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	None Recorded	
C	Moderately Pollution Tolerant	Chironomidae (ex. *Chironomus sp.*)	14
D	Very Pollution Tolerant	*Lymnaea peregra*	2
E	Most Pollution Tolerant	Tubificidae	42
		Chironomus sp.	8

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
-	Taxa not assigned to Indicator group	Nematoda	1

3.6.2.3.3 Fishery Value

None

3.6.2.3.4 Freshwater ecological value

Low value.

3.7 SUMMARY OF EXISTING ENVIRONMENT

Potential Impact Location	Water Quality	Salmonid Habitat Quality at Potential Impact Location	Salmonid Habitat quality in 500m downstream	Estimated status of trout in the potentially affected area	Importance Rating of Potentially affected sections	Salmon in potentially affected section
A	Q3 Moderately Polluted	Fair	Fair	Low density	D. Moderate Local Value	
B	No water at time of survey	None	None	Unlikely to be present	E. Low Value	
C	Q3 Moderately Polluted	None	Fair	Low density	D. Moderate Local Value	
D	Q2-3 Moderately Polluted	None - Poor	Fair - Good	Moderate density	D. Moderate Local Value	
E	Q2 Seriously Polluted	Poor	Poor	Unlikely to be present	E. Low Value	
F	Q1-2 Seriously Polluted	Poor - None	Poor - Fair	Unlikely to be present	E. Low Value	
G	Q2-3 Moderately Polluted	Good	Fair - Good	Moderate density	C.High Local Value	
H	Q2-3 Moderately Polluted	Fair	Poor - Fair	Unlikely to be present	D. Moderate Local Value	
I	Q3 Moderately Polluted	Good	Good	Moderate density	C.High Local Value	
J	Q2-3 Moderately Polluted	Fair - Good	Fair - Good	Moderate density	C. High Local Value	
K	Q2 Seriously Polluted	None - Poor	None - Poor	Unlikely to be present	D. Moderate Local Value	

Potential Impact Location	Water Quality	Salmonid Habitat Quality at Potential Impact Location	Salmonid Habitat quality in 500m downstream	Estimated status of trout in the potentially affected area	Importance Rating of Potentially affected sections	Salmon in potentially affected section
L	Q3 Moderately Polluted	Fair	Fair	Low Density	D. Moderate Local Value	
M	Q3 Moderately Polluted	Fair	Good – Very Good	High Density	C. High Local Value	
N	Q3 Moderately Polluted	Good	Good	High Density	C. High Local Value	
O	Q3 Moderately Polluted	Fair - Good	Fair - Good	High Density	C. High Local Value	
P	Q3 Moderately Polluted	Fair - Good	Fair - Good	High Density	C. High Local Value	
Q	Q3 Moderately Polluted	Poor - Fair	Good	Low Density (stream). High density (Ballyboghil)	D. Moderate Local Value (stream) C. High Local Value (Ballyboghil)	
R	Q3 Moderately Polluted	Fair – Good (u/s road) Good (d/s road)	Good	High Density	C. High Local Value	Yes
S	Q2 (tentative) Seriously Polluted	Fair	Fair	Low Density	D. Moderate Local Value	
T	Brackish tidal water does not fall within remit of report					

Potential Impact Location	Water Quality	Salmonid Habitat Quality at Potential Impact Location	Salmonid Habitat quality in 500m downstream	Estimated status of trout in the potentially affected area	Importance Rating of Potentially affected sections	Salmon in potentially affected section
U	Q2/0 Seriously Polluted conditions with additional toxic influence	Poor	None- Poor	Unlikely to be present	E. Low Value	

4 ASSESSMENT OF IMPACT

4.1 IMPACT OF CONSTRUCTION AND OPERATION OF THE WOODLAND CONVERTER STATION

4.1.1 POLLUTION WITH SUSPENDED SOLIDS DURING CONSTRUCTION

Research in North America indicates that the equivalent of many decades of natural or even agricultural erosion may take place during a single year from areas cleared for construction (Wolman and Schick 1967). Suspended sediment due to runoff of soil from construction areas can have severe negative impacts on invertebrate and plant life and on all life stages of fish.

- Suspended sediment can settle on spawning areas, infill the intragravel voids and smother the eggs and alevins (newly hatched fish) in the gravel.

- Suspended sediment can reduce water clarity and visibility, impairing the ability of fish to find food items.

- Settled sediments can smother and displace aquatic organisms such as macroinvertebrates, reducing the amount of food items available to fish.

- Increased levels of sediment can displace fish out of prime habitat into less suitable areas. (Chilibeck *et al* 1992)

- Suspended solids can abrade or clog the gills of salmonid fish. It takes a high concentration of solid wastes to clog a fish gill and cause asphyxiation, but only a little to cause abrasions and thus permit the possibility of infections. (Solbe 1988)

4.1.2 POLLUTION WITH OTHER SUBSTANCES ASSOCIATED WITH THE CONSTRUCTION PROCESS

The potential exists for a range of serious pollutants to enter the river during construction works. For example any of the following will have deleterious effects on fish, plants and invertebrates if allowed to enter water.

- Raw or uncured concrete and grouts
- Wash down water from exposed aggregate surfaces, cast-in-place concrete and from concrete trucks
- Fuels, lubricants and hydraulic fluids for equipment used on the development site
- Bitumen and silanes used for waterproofing concrete surfaces
- Waste from on site toilet and wash facilities

4.1.3 POTENTIAL POLLUTION BY SURFACE WATER DRAINING FROM CAR PARKING, ROOFS, ACCESS ROADS, PATHS ETC.

It is proposed to discharge runoff from paved areas and roofs to the stream at Potential Impact Location 1. The main pollutants of concern would be petrol, fuel oils, lubricating oils and hydraulic fluids. In unmodified form these are liquid, virtually insoluble and lighter than water. EIFAC - The European Inland Fisheries Advisory Commission (Svobodova *et al* 1993) states that "*a sensory assessment is preferred to toxicological analysis in determining the highest admissible amounts of oil and oil products that can be present in water; on this basis the highest admissible concentrations are in the range of 0.002 to 0.025 mg per litre*".

Harmful effects include:

- The prevention of gaseous exchange at the water surface, leading to reduced dissolved oxygen in the underlying water (Solbe 1988)

- In the case of turbulent waters the oil becomes dispersed as droplets into the water. In such cases, the gills of fish can become mechanically contaminated and their respiratory capacity reduced (Svobodova *et al* 1993).

- Oil products may contain various highly toxic substances, such as benzene, toluene, naphthenic acids and xylene which are to some extent soluble in water; these penetrate into the fish and can have a direct toxic effect. It is generally agreed that the lighter oil fractions (including kerosene, petrol, benzene, toluene and xylene) are much more toxic to fish than the heavy fractions (heavy paraffins and tars) (Svobodova *et al* 1993).

4.1.4 POTENTIAL POLLUTION BY LEAKAGE OR SPILLAGE OF SUBSTANCES USED AT THE CONVERTER STATION

The proposed converter station would utilise 105m^3 of insulating mineral oil in each of four main transformers, with an additional 200l in each of thirty voltage and current transformers. The closed water cooling system would utilise 250m^3 of water/glycol mix. There will be no storage of these materials on site; all materials will be brought in during maintenance and repair. (ESBI, pers. comm.) For potential adverse effects of oil on the aquatic environment, see Section 4.2.1. Ethylene glycol is toxic to aquatic organisms at high concentrations, but has been found to biodegrade rapidly in the aquatic environment (CICAD 22, 2000).

4.1.5 POTENTIAL POLLUTION BY EFFLUENT FROM TOILET, WASH FACILITIES, CANTEEN ETC. IN THE ABSENCE OF ADEQUATE MITIGATION

4.1.5.1 Organic Pollution

Following the introduction of untreated or poorly treated sewage effluent to a stream, conditions of existence for many organisms becomes substantially degraded. Increased turbidity in the water will reduce light penetration, which in turn will reduce the volume of water capable of supporting photosynthesizing plants. Particulate matter in settling will flocculate small floating plants and animals from the water. As the material settles, sludge beds may be formed on the stream bed, and many of the areas that formerly could have been inhabited by bottom dwelling organisms become covered and uninhabitable. Within the zone of active decomposition the breakdown of organic products by bacteria may consume all available dissolved oxygen, resulting in the river becoming uninhabitable by fish and many other aquatic species.

4.1.5.2 Eutrophication: Phosphorus

The most serious threat to water quality of lakes and rivers in Ireland is eutrophication, defined as the enrichment of waters, beyond natural levels, principally by the nutrient phosphorus (P). This enrichment commonly results in excessive production of cyanobacteria (formerly referred to as blue-green algae), planktonic algae and rooted plants in such waters. Eutrophication of aquatic ecosystems also results in loss of biodiversity and degradation of aquatic habitats of high ecological quality (EPA 1997).

The adjacent stream is very small therefore the dilution available for any effluent directly discharged to surface waters or reaching surface waters via discharge to the ground will be extremely small. It is now EPA policy that except in exceptional circumstances the appropriate Environmental Quality Standard to be applied to all Irish freshwaters would be for salmonid water quality (EPA 1997). This means that the target is to attain a Q4 rating or higher (unpolluted status/Class A) under EPA biological quality classification system or a median

Molybdate Reactive Phosphorus concentration of 0.03 mg/l. The present Q-rating of the stream is Q3 i.e. moderately polluted.

4.2 IMPACT OF CABLE LAYING

The following principal types of impact could be expected as a result of water cable laying across or in close proximity to a stream or river.

1. Direct loss of habitat due to the excavations and machinery operation during the cable laying process.

2. Loss of salmon, trout, lamprey, crayfish and other aquatic life in sections of stream to be dewatered to facilitate cable laying.

3. Adverse impacts downstream due to suspended soils and sediment. Suspended solids can have severe negative impacts on invertebrate and plant life and on all life stages of trout and other fish species, particularly at the egg and early juvenile stages.

4. Contamination of water with other substances associated with the cable laying operation, e.g. fuel, lubricants etc. Salmonids, lampreys, invertebrates and other components of the aquatic biota will be sensitive to contamination of this kind. Also concrete, which contains lime in the cement, can kill fish by substantially altering the pH in stream water.

5. Obstruction to fish movement during the cable-laying operation.

4.3 SUMMARY OF POTENTIAL IMPACTS ON FRESHWATER IN THE ABSENCE OF MITIGATION

Potential Impact location	Suspended Solids Pollution	Other Pollutants	Potential Loss of Stream Habitat	Potential Obstruction to Fish Movement	Potential loss of fish and other aquatic life due to dewatering	Total Potential Impact
A	Moderate	Moderate	None	None	None	Minor
B	Minor	Minor	Not Significant	Not Significant	Not Significant	Minor
C	Minor	Minor	Minor	Minor	Minor	Minor
D	Minor	Minor	Minor	Minor	Minor	Minor
E	Minor	Minor	Not Significant	Not Significant	Not Significant	Minor
F	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
G	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
H	Minor	Minor	Minor	Minor	Minor	Minor
I	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
J	Moderate	Moderate	Minor	Moderate	Moderate	Moderate
K	Not significant	Not Significant	None	None	None	Not Significant
L	Minor	Minor	Minor	Minor	Minor	Minor
M	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
N	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
O	Moderate	Moderate	None	None	None	Moderate

Potential Impact location	Suspended Solids Pollution	Other Pollutants	Potential Loss of Stream Habitat	Potential Obstruction to Fish Movement	Potential loss of fish and other aquatic life due to dewatering	Total Potential Impact
P	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Q	Moderate	Moderate	Minor	Minor	Minor	Moderate
R	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
S	Minor	Minor	Minor	Minor	Minor	Minor
T	Brackish tidal water					
U	Not significant	Minor	Not significant	Minor	Not significant	Minor

5 MITIGATION MEASURES

5.1 WOODLAND CONVERTER STATION

5.1.1 MITIGATION OF IMPACTS FROM CONSTRUCTION ACTIVITIES

1. Earth moving and construction activities should be avoided in the area within 10m of the stream. These areas should be fenced off prior to the commencement of works and left undisturbed for the duration of the construction process.

2. Release of suspended solids to the river should be kept to a minimum by minimising erosion and preventing runoff from excavated areas to the river. The key factors in erosion and sediment control are to intercept and manage off- and on-site runoff. This limits the potential for soils to be eroded and enter surface waters in runoff. Runoff and surface erosion control is more effective and less expensive than sediment control with sediment control ponds only. Eroded sediments should be retained on site with erosion and sediment control structures such as sediment traps, silt fences and sediment control ponds. Sediment ponds and grit/oil interceptors should be placed at the end of drainage channels.

3. Sediment control ponds should be designed to ensure that water discharged to surface waters will not exceed 25mg/l of suspended solids (Southern Regional Fisheries Board 2007).

4. Provision should be made at the planning stage for a sufficient land area to accommodate the necessary sediment control measures.

5. Works with a significant risk of suspended solids contamination of streams should not be carried out between the end of September and the end of April unless otherwise agreed with the Eastern Regional Fisheries Board.

6. Raw or uncured waste concrete should be disposed of by removal from the site.

7. Wash down water from exposed aggregate surfaces, cast-in-place concrete and from concrete trucks should be trapped on-site to allow sediment to settle out and reach neutral pH before clarified water is released to the river or drain system or allowed to percolate into the ground.

8. Fuels, lubricants and hydraulic fluids for equipment used on the construction site, as well as any solvents, oils, and paints should be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to codes of practice.

9. Fuelling and lubrication of equipment should not be carried out close to watercourses.

10. Any spillage of fuels, lubricants of hydraulic oils should be immediately contained and the contaminated soil removed from the site and properly disposed of.

11. Waste oils and hydraulic fluids should be collected in leak-proof containers and removed from the site for disposal or re-cycling.

12. Foul drainage from site offices etc. should be removed to a suitable treatment facility.

13. Sites for use as storage areas, machinery depots, site offices, temporary access roads or the disposal of spoil should be located as far as is practicable from watercourses. In general any site which is at least 50m from the nearest watercourse may be chosen. Disposal of spoil or storage of soils should not be carried out in any location where runoff can occur into watercourses.

5.1.2 MITIGATION OF POTENTIAL POLLUTION BY SURFACE WATER DRAINING FROM CAR PARKING, ROOFS, ACCESS ROADS, PATHS ETC.

A sustainable drainage system should be installed for all surface waters draining from the non-process area of the proposed development (including roofs). The system installed should have a proven capability of achieving and sustaining at least the following percentage pollution reduction in runoff:

Total Suspended Solids	85%
Heavy Metals	50 – 80%
Chemical Oxygen Demand	50%
Hydrocarbons	90%

Petrol/oil and grit interceptors should be located at outfalls to watercourses. Design of those interceptors should conform to the recommendations of CIRIA Report No. 142 (Luker & Montague 1994). The drainage system should have a shut off valve system and the capacity to contain a major accidental spillage.

As virtually all treatment options require proper maintenance in order to function properly, and as some such as oil interceptors can become a source of pollution if not properly maintained, a program of regular cleaning, maintenance and inspection of the runoff treatment system should be put in place to ensure it functions correctly.

5.1.3 MITIGATION OF POTENTIAL POLLUTION BY LEAKAGE OR SPILLAGE OF SUBSTANCES USED AT THE CONVERTER STATION

The transformers should be bunded. The area in which oil and anti-freeze are brought into and removed from the site during maintenance should be positively drained on an impervious surface. Any joint in the surface must be adequately sealed and those sealants must be resistant to attack from petrol and oil

products. Best practice should be employed to prevent accidental spillages/leakage. Failsafe spill contingency procedures should be put in place to minimise the risk of accidental emission of oil or cooling water/glycol during operation or maintenance of the converter station, and to prevent their entry into surface water drains and the aquatic environment should spillage occur. Any spillages should be contained and removed for treatment/disposal. Sufficient storage should be provided to ensure that this can be achieved. Any emergency firewater collection system should also take account of the additional firewater flows or fire-fighting foams. Emergency storage may be needed to ensure that contaminated firewater could not reach surface waters.

A pollution incident response plan (PIRP) should be in place including as a minimum, the following:

i. details of the plan owner and procedures for keeping it up to date;
ii. emergency contact details for site operators etc and for all holders of the PIRP;
iii. emergency contact details for third parties (e.g. Fire Brigade, EPA, specialist contractors, environment section of Local Authority etc);
iv. product inventory and site layout plan;
v. site drainage plan;
vi. emergency procedures;
vii. location of emergency response equipment (e.g. fire extinguishers, absorbents, emergency bunding, temporary fencing etc); and location of buried services, including water supply pipes

5.1.4 MITIGATION OF POTENTIAL POLLUTION BY EFFLUENT FROM TOILET, WASH FACILITIES, CANTEEN ETC.

Foul effluent will be stored and transported to a wastewater plant for treatment. (ESBI, pers. comm.) There will be no discharge of foul water to the stream.

5.1.5 MITIGATION OF HYDROLOGICAL IMPACTS

The surface water drainage system for the proposed development should include sufficient flow attenuation to ensure no significant changes in maximum and minimum flow rates of the streams to which the site drains.

5.2 CABLE LAYING

1. Cable-laying activities with a high risk of suspended solids contamination of surface waters, such as laying under or close to the watercourses, should not take place between the end of September and the end of April to prevent damage to spawning and early juvenile trout.

2. The method of de-watering streams/rivers to facilitate cable-laying should be agreed in advance with the Eastern Regional Fisheries Board and the area of stream to be dewatered should be kept to the minimum necessary.

3. If the stream/river bed is dewatered by directing flow into a temporary stream diversion, the temporary stream diversion should be excavated in isolation of stream flow, starting from the bottom end of the diversion channel and working upstream to minimise sediment production. The temporary channel should be lined with a suitable non eroding material. Disturbance to the de-watered stream bed should be kept to a minimum, and machinery crossing the de-watered stream should be by way of temporary bridging structures. Upon completion of the instream work, the stream should be restored to its original configuration and stabilised to prevent bank erosion around the temporary diversion.

4. If a watercourse is to be directed into a pipe ‘flume’ to facilitate cable laying and/or machinery crossing, the pipe should be of sufficient length to avoid

discharging water onto disturbed or excavated substrate. Such pipe 'flumes' should only be bedded in coarse silt free material.

5. Operation of machinery in the immediate vicinity of the streams should be kept to a minimum and disturbance of bankside vegetation should be kept to a minimum.

6. Contamination of water with fuels, lubricants and other pollutants should be avoided.

7. Disturbance of bankside soils and instream sediments should be kept to the minimum required for the cable laying process.

8. Pre-cast concrete should be used if possible; otherwise all cast-in-place concrete should be isolated from flowing water for a minimum of 48 hours to allow pH to reach neutral levels.

9. Top infilling over the cable at stream crossings should be with coarse silt-free material.

10. If pumping is required from dewatered areas or from excavations, the water should be directed first to a suitably constructed settlement pond before discharge to the stream, to prevent suspended solids contamination. This should also apply to discharges to any watercourses including field drains within 250m of the river/stream. It is important that sufficient area is available to allow for suitably sized settlement ponds. Suspended solids in discharges to surface waters should not exceed 25mg/l.

11. Banks and stream beds should be reinstated in a manner that will minimise the potential for erosion and return the river/stream to as close to its original condition as possible. Banks should be reformed with original excavated material which will contain roots and seeds of the natural bankside vegetation. Where this is likely to result in erosion the material can be used for revetting in hessian sacks. Care should be taken to ensure that reformed

banks do not encroach into the stream's cross-sectional width. Encroachment can create backwatering and increased stream velocities that may cause scouring and erosion. Plastic or nylon sacks should not be used in revetment construction and sacks filled with concrete must not be used. Any stone pitching used in bank reinstatement must be set to allow a covering of soil up to the original stream profile. Reinstated banks should be stabilised as soon as practicable by sowing grass seed and, where trees or bushes have been removed, by planting with hawthorn and/or native willow.

12. Where the cable is to cross or be laid in close proximity to streams, to protect stream side hedgerows and trees from damage prior to construction a leave strip should be marked delimiting areas where construction activity is not necessary and which are to remain off limits and undisturbed.

13. Unless otherwise agreed with the Eastern Regional Fisheries Board, before dewatering takes place the area to be dewatered should be electrofished to remove any fish present and transfer them to suitable adjacent habitat. The details and timing of this operation should be agreed in advance with ERFB and will require a Section 14 permit from the Department of the Marine.

14. The cable crossing at Potential Impact Location 20 on the Corduff River should be by means of trenchless techniques without any instream works or disturbance of river substrates. Juvenile salmon have recently been recorded in the potentially affected section of river. This is the first record of salmon in this river for many years. The salmon population of the river is therefore likely to be very small, very limited in extent and very vulnerable. To maximise the chance of salmon becoming established in the river all possible means of avoiding disturbance are desirable.

5.3 SUMMARY OF MITIGATION MEASURES FOR CABLE LAYING

	MITIGATION MEASURES													
Potential Impact Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
A					✓	✓	✓							
B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
E		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
F		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
H	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
J	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
K					✓	✓		✓						
L	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

	MITIGATION MEASURES													
Potential Impact Location	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
N	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
O	✓				✓	✓	✓					✓		
P	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Q	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
R	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
S		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
T	Brackish Tidal Water													
U					✓	✓	✓	✓	✓	✓	✓			
Any other watercourse crossings		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

*Field assessment and consultation on revised route not yet carried out, precautionary principle therefore applied to impact assessment. Some reduction in mitigation may occur following field assessment and consultation.

5.4 SUMMARY OF RESIDUAL POTENTIAL IMPACTS

(This table refers to potential impacts if all recommended mitigation measures are implemented)

Potential Impact location	Suspended Solids Pollution	Other Pollutants	Potential Loss of Stream Habitat	Potential Obstruction to Fish Movement	Potential loss of fish and other aquatic life due to dewatering	Total Potential Impact
A	Minor	Minor	None	None	None	Minor
B	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
C	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
D	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
E	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
F	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
G	Not Significant	Not Significant	Minor	Not Significant	Minor	Minor
H	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
I	Not Significant	Not Significant	Minor	Not Significant	Minor	Minor
J	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
K	Not significant	Not Significant	None	None	None	Not Significant
L	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
M	Not Significant	Not Significant	Minor	Not Significant	Minor	Minor
N	Not Significant	Not Significant	Minor	Not Significant	Minor	Minor

Potential Impact location	Suspended Solids Pollution	Other Pollutants	Potential Loss of Stream Habitat	Potential Obstruction to Fish Movement	Potential loss of fish and other aquatic life due to dewatering	Total Potential Impact
O	Not Significant	Not Significant	None	None	None	Not Significant
P	Not Significant	Not Significant	Minor	Not Significant	Minor	Minor
Q	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
R	Not Significant	Not Significant	None	None	None	Not Significant
S	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant	Not Significant
T	Brackish tidal water					
U	Not significant	Not Significant	Not significant	Not Significant	Not significant	Not Significant

6 NON-TECHNICAL SUMMARY

6.1 POTENTIALLY AFFECTED WATERBODIES

The proposed EIRGRID E-W Interconnector and 400kV converter station at Woodlands intersect or are in close proximity to streams/rivers shown on the O.S. 1:50,000 scale map at 21 locations. The potential impact locations are on five stream/river systems: the Tolka, the Broadmeadow, the Ballyboghil Stream, the Corduff Stream and the Hurley/Nanny system, and on three small streams entering Rogerstown Estuary.

The catchments of these rivers are characterised by intensive agriculture, land drainage, suburban housing developments and industry; this situation renders any remaining ecological value of more than usual importance.

RIVER TOLKA

The River Tolka rises near Dunshaughlin, in Co. Meath, and flows east via Dunboyne, Clonee, Blanchardstown and Finglas, before entering the sea at Clontarf on the north side of Dublin City. The river has suffered from serious pollution problems for at least the last thirty five years. Improvements in water quality have been recorded in recent years. Though under severe pressure from pollution, a population of wild brown trout and sea trout have survived in the Tolka River. The Tolka has the potential to be an important amenity resource for the rapidly developing hinterland of Dublin through which the river flows.

The proposed converter station will be in close proximity to a small tributary of the Tolka at one location, and the proposed E-W Interconnector will cross small tributaries of the Tolka at four locations. Of the total of five locations, one was found to ne dry at the time of assessment, three were found to be moderately polluted and one was found to be seriously polluted. On the basis of absence of suitable habitat, trout are unlikely to be present at all but one of these locations.

Three locations are classified as of moderate local ecological value; the remaining 2 are classified as of low ecological value.

BROADMEADOW RIVER

The Broadmeadow River rises in the vicinity of Dunshaughlin, Co. Meath and flows via Ratoath and Ashbourne to Malahide Estuary. Having been absent for many years, brown trout and salmon have recently been recorded in the lowermost stretches of the Broadmeadow. Water quality in the Broadmeadow system has been poor since monitoring began in 1971, making it one of the more chronically polluted river catchments in the country.

The proposed E-W Interconnector will cross tributaries of the Broadmeadow at 5 locations. Three of these locations are classified as of high local value, and applying the precautionary principle trout are presumed to be present at each of these sites, a single site is classified as of moderate local value and one is classified of low value and is seriously polluted.

BALLYBOGHIL RIVER

The headwater tributaries of the Ballyboghil River rise in the area between Ashbourne and Garristown Co. Meath and join the Corduff River just upstream of Rogerstown Estuary. Recent surveys have recorded brown trout in the Ballyboghil River and sea trout in the lower stretches of the river. Recent EPA monitoring and the results of the present survey indicate that the Ballyboghil system is moderately polluted.

The proposed E-W Interconnector will have a potential impact on the Ballyboghil system at 6 locations. All of the sections of stream potentially affected by the proposed development are moderately polluted and all have habitat quality suitable for trout. Three of the potential impact locations will potentially affect sections of the main channel of the Ballyboghil River which are classified as good or good to very good trout habitat. Applying the precautionary

principle it is assumed for the purposes of this report that trout are present in all six potentially affected stream/river sections. Five of the potential impact locations will potentially affect streams that are classified as of high local ecological value, and one will potentially affect a section classified as of moderate local ecological value.

CORDUFF RIVER

The headwater tributaries of the Corduff River rise in the area between Naul Co. Meath and Ballyboghil Co. Dublin. The River flows to Rogerstown Estuary. Recent surveys of the Corduff River indicate that brown trout and sea trout are widespread in the system. Juvenile salmon have recently been recorded downstream of Corduff Bridge. This is the first record of salmon in this river for many years. The salmon population of the river is therefore likely to be very small, very limited in extent and very vulnerable. To maximise the chance of salmon becoming established in the river all possible means of avoiding disturbance are desirable. Moderately polluted conditions have been recorded in recent EPA surveys and in the present survey in the lower reaches of the Corduff River.

The proposed E-W Interconnector will have a potential impact on the Corduff River at a singe location. The section of stream potentially affected by the proposed development is moderately polluted and has good habitat quality for all life stages of trout, and for spawning and juvenile salmon and sea trout. Trout and sea trout have been recorded repeatedly in this section of river, and recently juvenile salmon were also recorded. The potentially affected section of freshwater habitat is classified as of high local ecological value.

HURLEY/NANNY RIVER SYSTEM

The River Hurley rises north west of Ashbourne and flows north to join the Nanny River about 3km upstream of Duleek. The River Nanny rises west of Kentstown and flows east through Duleek and Julianstown to enter the sea at Laytown. The Nanny/Hurley system gets a small run of sea trout and has a

good population of brown trout. Lamprey which are listed in Annex II of the Habitats Directive have been recorded in the Nanny/Hurley system. Most recent data indicate that water quality was unpolluted or slightly polluted at EPA monitoring sites on the Hurley River. The proposed E-W Interconnector will be constructed close to the Hurley River at a single location but will not cross the river. The potentially affected section of the Hurley is seriously polluted, has low habitat value and is classified as of low value.

SMALL STREAMS FLOWING TO ROGERSTOWN ESTUARY

Three streams flowing to the north side of Rogerstown estuary will be potentially affected by the proposed development. As these streams are not named on the O.S 1:50,000 map they are named for the purposes of this report the Balleally West Stream, the Whitestown Stream, and the Rush West Stream.

The Balleally West Stream rises on the south west side of Lusk and flows for c.3km to the estuary. The potentially affected section of the Balleally West stream is tentatively classified as seriously polluted; this classification is tentative due to the possibility of saline conditions in some tidal conditions which would render the fauna unsuitable for the Q-rating method. The potentially affected freshwater habitat is classified as fair trout habitat, and applying the precautionary principle it is assumed for the purposes of this report that trout are present at low density. The potentially affected freshwater habitat is classified as of moderate local ecological value.

The Whitestown Stream is formed by the confluence of two streams which drain the area to the north of Lusk and flow c.8km to their confluence close to the R128 road from where the stream flows c.0.75km to the estuary. The invertebrates at the proposed crossing point indicate brackish estuarine conditions. Tidal conditions are evident in the potentially affected channel. This potential impact location therefore does not fall within the remit of this report.

The Rush West Stream drains the area immediately west of Rush from where it flows c.2km to the estuary. The stream at the proposed crossing point is

seriously polluted. The potentially affected stream downstream of the proposed crossing point is culverted. The potentially affected freshwater habitat is classified as of low ecological value.

6.2 POTENTIAL IMPACTS

The following principal types of impact could be expected as a result of the construction and operation of the converter station:

1. Adverse impacts downstream due to suspended soils and sediment during construction of the station. Suspended solids can have severe negative impacts on invertebrate and plant life and on all life stages of trout and other fish species, particularly at the egg and early juvenile stages.

2. Contamination of water with other substances associated with the construction process, e.g. fuel, lubricants etc. Salmonids, lampreys, invertebrates and other components of the aquatic biota will be sensitive to contamination of this kind. Also concrete, which contains lime in the cement, can kill fish by substantially altering the pH in stream water.

3. Potential pollution by surface water draining from car parking, roofs, acces roads, paths, etc. during the operation of the converter station. The main pollutants of concern would be petrol, fuel oils, lubricating oils and hydraulic fluids.

4. Potential pollution by leakage or spillage of substances used at the converter station. The converter station would use insulating mineral oil in the transformers, and would use antifreeze (glycol) in the closed water cooling system.

5. Potential pollution by effluent from toilet, wash facilities, canteen etc.

The following principal types of impact could be expected as a result of cable laying across a stream or river.

1. Direct loss of habitat due to the excavations and machinery operation during the cable laying process.

2. Loss of salmon, trout, lamprey, crayfish and other aquatic life in sections of stream to be dewatered to facilitate cable laying.

3. Adverse impacts downstream due to suspended soils and sediment. Suspended solids can have severe negative impacts on invertebrate and plant life and on all life stages of trout and other fish species, particularly at the egg and early juvenile stages.

4. Contamination of water with other substances associated with the cable laying operation, e.g. fuel, lubricants etc. Salmonids, lampreys, invertebrates and other components of the aquatic biota will be sensitive to contamination of this kind. Also concrete, which contains lime in the cement, can kill fish by substantially altering the pH in stream water.

5. Obstruction to fish movement during the cable-laying operation.

At 11 of the 20 potential freshwater impact locations the potential impact on freshwater flora, fauna and habitats is classified as minor. Potential impact at the remaining 9 locations is classified as moderate.

6.3 RECOMMENDED MITIGATION MEASURES

A suite of mitigation measures are recommended to prevent or minimise pollution of watercourses and loss of habitat. Seasonal constraints on river

crossing works are recommended at 14 locations to minimise potential impacts on spawning and juvenile salmonid fish.

6.4 RESIDUAL IMPACTS

If all recommended mitigation measures are fully implemented, and applying the precautionary principle at sites on the section of realigned cable route, the residual impact of the proposed development on freshwater flora, fauna and habitats will be minor at six locations and not significant at 14 locations.

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APPENDIX 1

EPA BIOLOGICAL MONITORING DATA

River and Code : **TOLKA** **09/T/01**
Tributary of : Sea - Dublin Bay OS Catchment No: 167
OS Grid Ref : O 176 358

Sampling Stations — Biological Quality Ratings (Q Values)

No.	1973	1975	1977	1979	1981	1983	1985	1987	1988	1989	1990	1991	1994	1996	1998	2002	2005
0280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
0300	-	-	-	-	-	-	**3**	-	**3**	-	-	**3**	**3**	**2**	**3**	**3**	**3-4**
0400	-	-	-	**3-4**	**3-4**	**3-4**	**3-4**	-	**3**	-	-	**3**	**3-4**	-	-	-	-
0500	**2**	**1-2**	**3**	-	**2-3**	-	-	-	**2**	**2**	**2**	-	**2**	**2**	**2**	**2-3**	**3**
0600	4	**3-4**	**3-4**	**3-4**	**3-4**	**3-4**	**3-4**	-	**2**	**2**	**2**	**2-3**	**3**	**3**	**3**	**3-4**	**3-4**
0700	**3-4**	**2-3**	**3-4**	**2-3**	**3**	**2-3**	**2-3**	-	**2**	-	-	**2**	**2-3**	-	-	-	-
0800	**2**	**2-3**	**3-4**	**3**	**3**	**3**	**2**	**3**	**2**	**2-3**	-	**2-3**	**3**	**2-3**	**3**	**3**	**3**
0890	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0900	**3-4**	4	**3-4**	**3**	**3-4**	**3-4**	**3**	-	**2**	**3**	-	**3**	**3**	-	-	-	-
1000	4	**2-3**	**3**	**2-3**	**2-3**	**2-3**	**2-3**	-	**2-3**	**3**	-	**2-3**	-	**3**	**2-3**	**2-3**	**3**
1030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1050	-	-	-	-	**3**	**3**	**3**	-	**3**	**3**	-	**3**	**3**	-	-	-	-
1070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1080	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1100	**1**	**1/0**	**1**	**1**	**3/0**	**1/0**	**2**	**2**	**1-2**	**1-2**	**1**	**1/0**	**2-3/0**	**3**	**2-3**	**2-3**	**2/0**
1110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1200	**1**	-	**1**	**1**	**1-2**	**2**	**2**	**2**	**2**	**1/0**	**1-2**	**2**	**2-3**	-	-	-	
1300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

No.	Location
	*Portan Branch**
0280	Br ESE of Piper Hill
	Main Channel
0300	Br at Black Bull
0400	Br NNE of Dunboyne
	Dunboyne Branch
0500	Rusk Br
	Main Channel (Continued)
0600	Dunboyne Rd Br u/s Clonee
0700	Clonee Br
0800	Mulhuddart Br
0890	Snugborough Rd Br
0900	Br u/s Blanchardstown
1000	Abbotstown Br
1030	Ashtown Br
1050	Cardiff's Br
1070	Tolka Lodge u/s Finglas R
1080	Royal Oak d/s Finglas R
1100	Violet Hill Drive Finglas
1110	Botanic Rd Br
1200	Drumcondra Rd Br
1300	Annesley Rd Br

River and Code : **BROADMEADOW** **08/B/02**
Tributary of : Sea - Malahide Estuary OS Catchment No: 164
OS Grid Ref : O 192 423

Sampling Stations No.	Biological Quality Ratings (Q Values)														
	1974	**1976**	**1981**	**1983**	**1985**	**1987**	**1988**	**1989**	**1990**	**1991**	**1994**	**1996**	**1998**	**2001**	**2005**
0100	-	-	-	2	1-2	1	1-2	2	1-2	2	2	-	-	-	-
0150	-	-	-	-	-	-	2	2	2	2	2	2	2	2-3	3
0200	-	**1**	1	2	2	2	2	1	1	1-2	2	-	-	-	-
0300	**2**	**2**	2	2-3	2	2-3	3	2-3	-	-	-	1-2	3	2-3/0	3
0400	-	-	-	3	2-3	-	3	2-3	-	2	3	3	2-3	2-3	2-3
0420	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0500	**2-3**	**2**	3	1	2-3	-	2	2-3	-	1-2	2-3	1-2	1	2-3	2-3
0550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0600	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3
0640	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0700	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3*
0710	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0800	-	-	-	-	-	-	-	-	-	-	-	-	-	3	2-3

No.	Location
	Ratoath Branch
0100	Green Hill Br
0150	Br in Ratoath
0200	Moulden Br
	North Branch
0300	Cookstown Br
	Main Channel
0400	Br 0.5km u/s Ashbourne Br
0420	Br in Ashbourne
0500	Milltown Br
0550	Robertstown Br

No.	Location
0600	WSW of Fieldstown Ho
0640	2nd Br u/s Lispopple Br
0700	Lispopple Br
0710	Roganstown Br
0800	Br nr Waterworks

River and Code : **BALLYBOGHIL** **08/B/01**
Tributary of : Rogerstown Estuary, Rush OS Catchment No: 163
OS Grid Ref : O 203 514

Sampling Stations		Biological Quality Ratings (Q Values)			
No.	Location	**1996**	**1998**	**2001**	**2005**
1900	Br S of Trallie Lodge	-	**3**	**3-4**	**3**
2200	Br in Ballyboghil	**3**	**3**	**3/0**	**3**

River and Code : **HURLEY** **08/H/01**
Tributary of : Nanny (Meath) OS Catchment No: 160
OS Grid Ref : O 003 655

Sampling Stations		Biological Quality Ratings (Q Values)					
No.	Location	**1988**	**1991**	**1996**	**1998**	**2001**	**2005**
0200	Bridge at Painestown	**3**	**3**	**3-4**	**3-4**	**3-4**	**3-4***
0280	Rathfeigh Old Bridge	**3**	**3**	**3-4**	4	4	4
0400	Just u/s Nanny River confl	**3-4**	**3**	**3-4**	**3-4**	**3**	**4**

* Heavy siltation

APPENDIX 2

HABITAT AT SAMPLING SITES

APPENDIX 3

PHOTOGRAPHS