Appendix 6-4

Aquatic Report

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Aquatic Report

Shronowen Wind Farm

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TABLE OF CONTENTS

Table of Tables

Table of Figures

1 INTRODUCTION

2 METHODOLOGY

The flow characteristics of the watercourse draining the proposed development site were noted with reference to EA (2003). They were evaluated with cognisance to 'Ecology of the Atlantic Salmon' (Hendry and Cragg-Hine, 2003) to assess habitat suitability for salmonids. An evaluation of lamprey nursery habitat was also carried out based on the habitat requirements of juvenile lampreys as outlined in Maitland (2003).

Qualitative sampling of benthic macroinvertebrates was undertaken at locations on watercourses draining the proposed development during August and September 2020 (See **Table 1** and **Figure 1**). These sites are shown in **Plate 1** to **Plate 3.** Methodology for kick/sweep sampling followed Toner *et al.* (2005). The waterbodies within and in the immediate environs of the proposed development site are unsuitable for q-ratings, where macroinvertebrates are sampled from riffled areas.

Table 1 Locations surveyed on watercourses draining the proposed development during August and September 2020.

Site		Site 1	Site 2	Site 3	Site 4	Site 5
Coordinate	X	97825	104398	101847	99305	98356
	Y	137199	138384	140148	143412	141870
Hydrometric Area		23	23	23	24	24
Basin sub code		23_1	23_3	23_1	24_9	24_9
Watercourse		Galey	Galey	Tarmon Stream	Ballylongford	Ballylongford
RWB name		Galey_040	Galey_030	Tarmon Stream_010	Ballylongford_020	Ballylongford_010

The biological sampling procedure followed at both sites involved the use of a 'D' shaped hand net (mesh size 1mm;) which was submerged on the riverbed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute to dislodge invertebrates, which were subsequently caught in the net. This procedure was undertaken at three points along/across the watercourse. Stone washings and vegetation sweeps were also undertaken over a further 1-minute period to ensure a representative sample of the fauna present at the site was collected. Samples of macroinvertebrates from each substation were combined and live sorted on the river bank for 20 minutes with the assistance of a headband magnifier. The number of macroinvertebrate taxa was recorded on-site at each site. Macroinvertebrates were identified in detail in using keys produced by the Freshwater Biological Association (see references section). The Quality Rating (Q) System (Toner *et al.*, 2005) was used to rate biological water quality at appropriate locations. Physico-chemical water quality parameters were measured on-site using a calibrated Aquaread AP-5000 Portable multi-parameter water quality probe.

The presence of other features of aquatic interest at the proposed development site and study sites were noted e.g. barriers to migration, frogs. At all stages of field work, 'IFI Bio-security Protocol for

Field Survey Work' (IFI, 2010) were followed. All equipment (including waders etc.) was disinfected with spray bleach disinfectant after use, washed, dried out and put in storage.

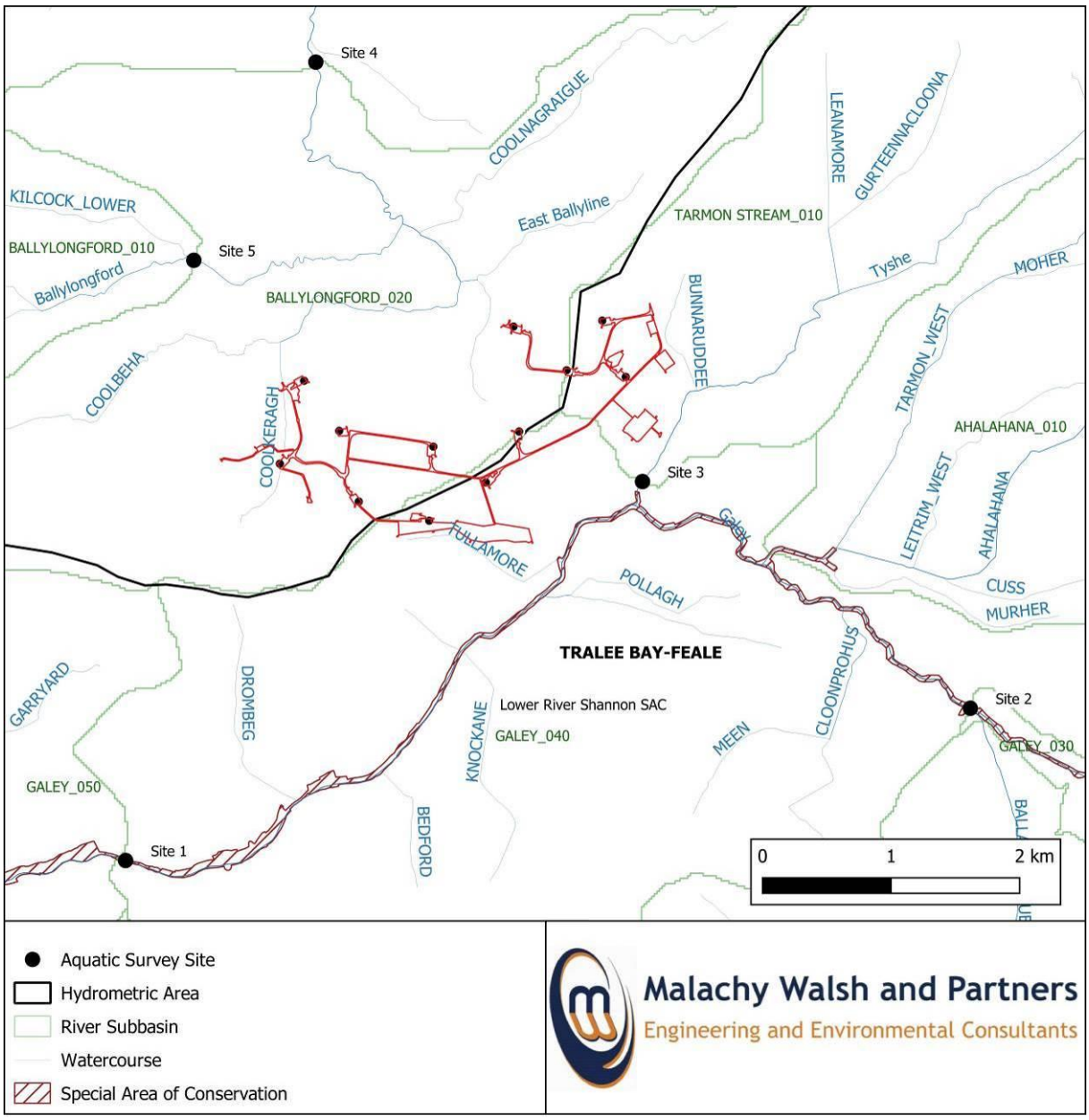

Figure 1 Locations surveyed on watercourses draining the proposed development during August and September 2020.

Plate 1 Site 1 on the River Galey at Shrone Bridge (left). Site 2 on the River Galey at Galey Bridge (right).

Plate 2 Site 3 on the Tarmon Stream at Gabbet's Bridge (left). Site 4 on the Ballylongford River downstream of Gortanacooka Bridge (right).

Plate 3 Site 5 on the Ballylongford River at the Bridge SW of Shrone. Cattle poaching of the riparian zone at Site 5 (right).

3 RESULTS

3.1 DESCRIPTION OF THE RECEIVING WATERS

The proposed development site overlies two Hydrometric regions. Within Hydrometric Area (HA) 24 at the north western extent of the site, the proposed development is drained by the 1st order Coolkeragh Stream and an unnamed 1st order stream (EPA segment code 24_1164). The Coolkeragh Stream flows into the Coolbeha Stream before feeding the Ballylongford River, also known as the Ballyline River (EPA code 24B03). The Coolkeragh Stream and other watercourses within the proposed development site are low gradient artificial channels with bed mostly of peat. These channels were created for the purpose of peat drainage. The Ballylongford River supports the submerged aquatic moss *Fontinalis squamosa*, the filamentous alga *Cladophora* sp. and emergent *Apium nodiflorum*. Some sheltered banks are lined with the crescent-cup liverwort *Lunularia cruciata*.

The south eastern extent of the proposed development is within HA 23. Primary drainage of the propsied development site is via the River Galey (EPA code 23G01) and Tarmon Stream (EPA code 23T03). The reach of the River Galey south of the proposed development site has been subjected to arterial drainage dating from the 20th Century. It is a stretch with the character of a typical drained river. The morphology of the channel has been affected by deepening with consequent alteration of flows and substrate composition. The river characterised primarily by a series of shallow riffle-glide-pool sequences. The River Galey supports the aquatic moss *F. squamosa* as well as *Leptodictyum riparium, Chilosyphus polyanthus, Cladophora* sp. instream and *Phalaris arundinacea* along its banks.

The Tarmon Stream is also drained where it flows to the east of the proposed development. It is a highly modified channel with a bank height of ca. 4.5m, formed presumably from spoil excavated from the channel. Emergent *Alisma plantago-aquatica* and *Sparganium erectum* were recorded in the Tarmon Stream as well as marginal *A. nodiflorum* and *P. arundinacea*. *C. polyanthus, Lyngby sp., Concephalum* sp. and *Cladophora* sp. were also recorded.

All sites investigated were rated suboptimal for macroinvertebrates with reference to criteria in Barbour and Stribling (1991). This was due to poor pool quality and substratum condition (siltation).

3.2 FISH HABITATS AND FISH

In McGinnity *et al.* (2003), which gives the distribution of migratory salmonids in Irish watercourses, all watercourses larger than 2nd order are indicated as supporting salmon and sea trout. Biological water quality of the main watercourses draining the proposed development is unsatisfactory and therefore deemed marginal/suboptimal for salmonids (see nest section). The River Galey and Ballylongford River likely support important populations of salmonids but the 1st order streams draining the proposed development site are considered unsuitable for spawning and the early life stage of salmon with reference to 'Ecology of the Atlantic Salmon' by Hendry and Cragg-Hine (2003). These watercourses are deemed too small to be of importance to adult salmonids. The Tarmon Stream to the east of the proposed development is also evaluated as unsuitable as a spawning and nursery area for salmonids. Likewise, lamprey nursery habitat in these stream reaches is regarded unsuitable based on the habitat requirements of juvenile lampreys as outlined in Maitland (2003).

The River Galey is a suitable spawning, nursery and holding area for salmonids, though the hydromorphological character and thus the river habitat quality of this channel has been drastically reduced by lowering of the riverbed, decreased physical heterogeneity and severance of floodplain connectivity. It is considered that most salmon in the river spawn in reaches of the main stem upstream of the proposed development and its tributaries. The Ballylongford River is best suited to the early life stages of salmonids, with few pools of adequate depth to hold adult salmon during low water. This river has been degraded by channelisation along some reaches, agricultural intensification, bankside works and installation of bank protection and at least one weir but supports a good stock of brown trout.

The Ballylongford and Galey Rivers likely support a population of brook lamprey and possibly migratory lampreys (river and sea). The occurrence of lampreys in watercourses nearer and within the proposed development site is doubtful as spawning areas are a limiting factor here. European Eel *Anguilla anguilla* and stone loach *Barbatula barbatula* was recorded at Site 1 in the River Galey. European eel is listed as 'Critically endangered' and is now 'Red Listed' according to 'Red List No. 5: Amphibians, Reptiles & Freshwater Fish' (King *et al.,* 2011).

Plate 4 Reach of the Tarmon Stream downstream of Gabbet's Bridge (left): the bridge apron in the background is deemed an impassable obstacle for upstream migrating lampreys. The Tullamore Stream (right) drains the southern extent of the proposed development site and discharges to the River Galey. Note the fish passage problems associated with a sluice gate and a perched foundation.

Plate 5 Brown trout captured by angling on a reach of the Ballylongford River ca. 1km north of the proposed development site. The weir and associated sill in the background is deemed an impassable obstacle for upstream migrating lampreys. Stone Loach recorded in the River Galey at Shrone Bridge (right).

3.3 AQUATIC MACROINVERTEBRATES

The macroinvertebrates recorded during the biological sampling carried out on watercourses draining the proposed development site are listed in **Table 2**. The macroinvertebrate assemblage recorded comprised mostly of pollution tolerant indicators including larvae of the mayfly *Baetis rhodani,* Dipteran larvae (*Similium* sp., *Dicronata sp.,* green chironomids), Coelopterans (the riffle beetles *Elmis aenea* and *Limnius* volckmari, diving beetles) and snails (*Ancylus fluviatilis, Potamopyrgus antipodarium*). The only pollution sensitive macroinvertebrates recorded were larvae of the stonefly *Protonemura* sp. and the Heptagenid mayfly *Ecdyonurus sp*.

Drains and ponds at the proposed development site are considered used by a range of macroinvertebrates such as Coeloptera (beetles) and Hemiptera (bugs) as well as Diptera (flies) and Odonata (damselfly and dragonfly) during their aquatic stages.

Plate 6 Pollution sensitive mayfly larvae of *Ecdyonurus* sp. and caseless caddisfly larvae of *Rhyacophila* sp. (left) and the molluscs *Potamopyrgus antipodarum* and *Ancylus fluviatilis* recorded during the current survey (right).

Plate 7 The most common macroinvertebrate encountered was mayfly larvae of *Baetis rhodani* (left). Duck mussel *Anodonta anatina* recorded in the Tarmon Stream (right).

Table 2 Macroinvertebrates recorded during biological sampling carried out on watercourses draining the proposed development site during August 2020.

	Pollution sensitivity group	Site 1	Site 2	Site 3	Site 4	Site 5
MAYFLIES (Uniramia, Ephemeroptera)						
Family Heptagenidae						
Autumn dun *Ecdyonurus* sp.	A		*			*
Yellow upright *Rhithrogena semicolorata*	A	*				
Spiny crawler mayflies (Seratellidae)						
Blue-winged olive *Seratella ignita*	C	*				
Baetidae						
Large dark olive *Baetis rhodani*	C	**	***			***
Iron blue dun *Baetis muticus*	B				*	*
STONEFLIES (Order Plecoptera)						
Brown stoneflies (Nemouridae)						
Protonemura sp.		*				
Needle stoneflies (Leuctridae)						
Leuctra sp.	B	*				
CASED CADDIS FLIES (Tricoptera)						
Northern caddisflies (Limnephilidae)	B	*	*	*	*	*
Green sedges (Rhyacophilidae)						
The sandfly *Rhyacophila* sp.	C				*	*
Glossosomatidae	B	*	**		**	**
Primitive caddisflies (Sericostomatidae)						
Black caperer *Sericostoma personatum*	B	*	*	*	*	*
Odontoceridae						
Family Goeridae	B				*	
CASELESS CADDIS FLIES (Trichoptera)						
Grey flags (Hydropsychidae)						
Hydropsyche sp.	C	*	*			
Green sedges (Rhyacophilidae)					*	
The sandfly *Rhyacophila* sp.	C	*	*			
Trumpet-net caddisflies (Polycentropodidae)						
Polycentropus sp.	C	*	*	*	*	
DAMSELFLIES (Odonata, Zygoptera)						
Jewelwings/Demoiselles (Calopterygidae)						
Agrion sp.	B			*		
TRUE FLIES (Diptera)						
Blackfly (Simulidae)						
Simulium sp.	C	*	**		***	
Pediciidae						
Dicranota sp.	C		*			
Solitary Midges (Thaumaleidae)	C	*				
Family Chironomidae						
Bloodworm *Chironomous sp*.	E					*
Green chironomid	C		*			
Biting Midge (Ceratopogonidae)	C	*				*
BEETLES (Coleoptera)						
Whirligig beetle larvae (Gyrinidae)	C					
Common whirligig beetle *Gyrinus substriatus*	C			*		
Diving beetles (Dytiscidae)						*
Riffle Beetle (Elmidae)						
Elmis aenea	C	*	*	*	*	

	Pollution sensitivity group	Site 1	Site 2	Site 3	Site 4	Site 5
Limnius volckmari	C	*	*		*	*
Minute moss beetles (Hydraenidae)						
Hydraena sp.	C	*	*			
SNAILS (Mollusca, Gastropoda)						
Family Lymnaeidae						
Wandering snail *Radix balthica*	D	*	*	**		*
Family Planorbiidae						
Keeled Ramshorn Snail *Planorbis carinatus*	C	*				
Family Hydrobiidae						
Jenkin's spire shell *Potamopyrgus antipodarium*	C	*		***		
Family Ancylidae						
River limpet *Ancylus fluviatilis*	C		**		**	**
MUSSELS (Mollucsa, Bivalva)						
Orb/Pea Mussels (Sphaeridae)	D					
Pisidium sp.	D					*
Unionidae						
Duck Mussel *Anodonta anatina*	C			*		
CRUSTACEANS (Crustacea)						
Amphipods (Amphipoda, Gammaridae)						
Freshwater shrimp *Gammarus* sp.	C	**	***	***	***	***
Isopods, Asellidae						
Asellus aquaticus	D		*	*	*	
LEECHES (Hirudinae)						
Erpobdellidae						
Erpobdella sp.	D		*	*	*	*
Glossiphonidae						
Glossiphonia complanata	D		*	*	*	*
Helobdella stagnalis	D					*
BUGS (Hemiptera)						
Broad shouldered water skaters (Gerridae)						
Gerris sp.	C	*				
Water scorpion (Nepidae)	C			*		
SPIDERS (Crustacea, Arachnida)						
Water mite (Order Hydracarina)	C	**	**		*	
SEGMENTED WORMS (Annelida, Clitellata)						
Aquatic earthworm (Lumbricidae)	D				*	
Aquatic earthworm (Lumbriculidae)	D				*	
Sludge words (Tubificidae)	E	*	*		*	*

Few (<5%), Common (6-20%), Numerous (21-50%), Dominant (51-74%), Excessive (>75%)

3.4 WATER QUALITY

Substrates at all five survey locations were silted to a degree consistent with unsatisfactory water quality, with significant overlying silt and moderate – heavy plumes emitted during substrate sampling. Algal growth which is indicative of enrichment was recorded at all locations. **Table 3** gives the EPA biological water quality ratings at the nearest stations on watercourses draining the proposed development site. The biological water quality results for 2020 are given in **Table 4** and **Figure 2**, these ratings based on the relative abundance of macroinvertebrate pollution sensitivity groups as well as other factors including siltation and algal growths. Biological water quality at Site 3

was rated 'Moderately polluted, Q3'. A rating of Q3 corresponds with Water Framework Directive (WFD) 'poor' status with reference to macroinvertebrates. The remainder of the locations were rated Q3-4 corresponding to WFD 'moderate' status .

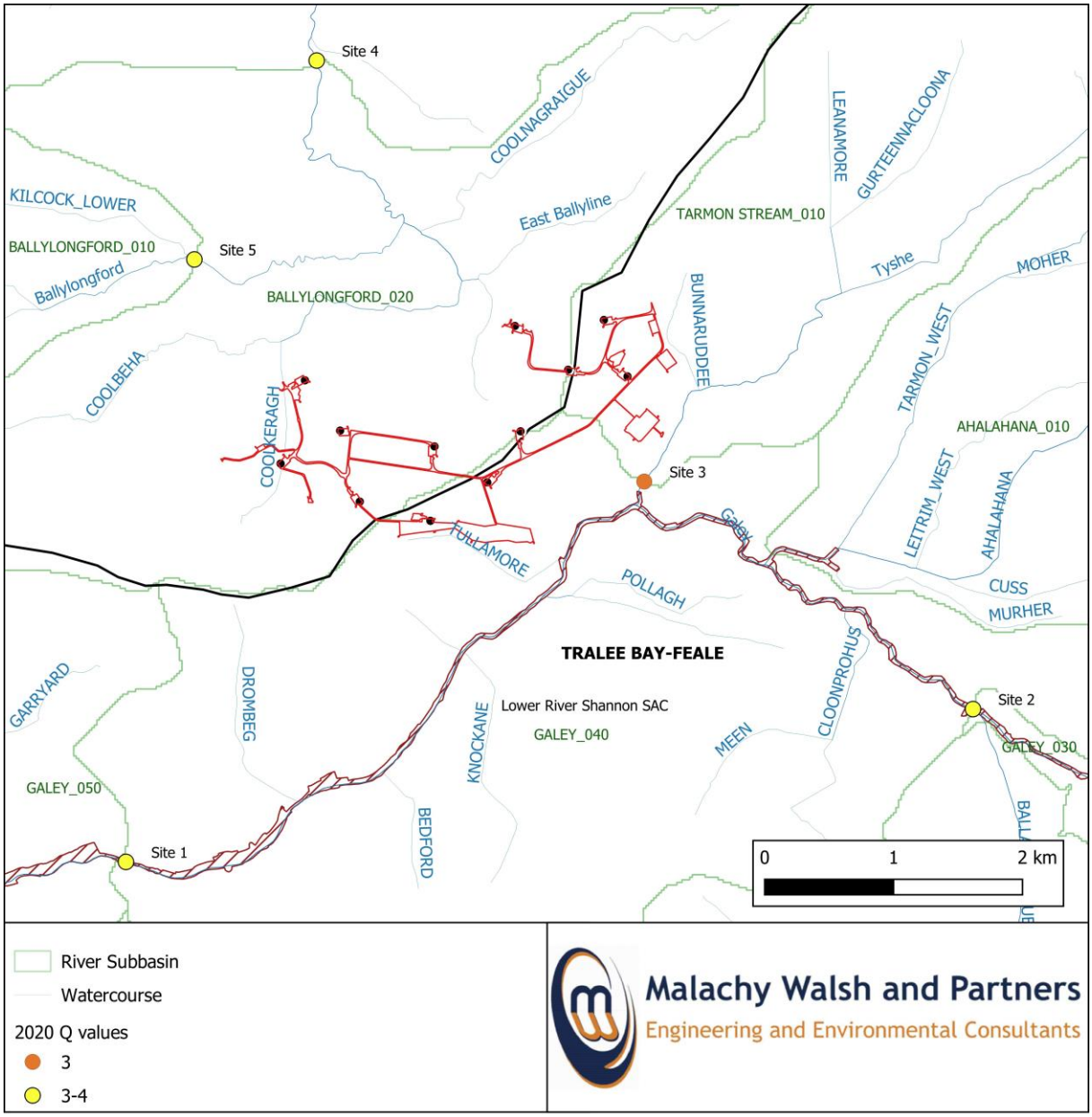

Figure 2 Biological water quality results at sites examined for the proposed development in 2020.

Plate 8 Excessive siltation in the Ballylongford Stream upstream of the Coolbeha Stream confluence (left). Riverbed siltation evident at Galey Bridge (right).

Table 3 EPA biological water quality ratings at stations on watercourses draining the proposed development site.

Watercourse		**Galey**	**Galey**	**Tarmon Stream**	**Ballylongford**	**Ballylongford**
EPA station		23G010500	23G010400	23T030500	24B030700	24B030400
Station description		Shrone Bridge	Galey Bridge	Gabbets Bridge	Gortanacooka Bridge	Bridge SW of Shrone
Year	2001	Good	Moderate	Poor	Moderate	
	2005	Good	Moderate	Poor	Moderate	Poor
	2007	Moderate	Good	Poor	Good	Moderate
	2011	Good	Moderate	Poor	Good	Moderate
	2014	Moderate	Moderate	Moderate	Moderate	Poor
	2017	Good	Moderate	Moderate	Good	Good

Table 4 Results of the 2020 biological sampling showing taxa richness and biological water quality ratings at stations on watercourses draining the proposed development site.

Watercourse	**Galey**	**Galey**	**Tarmon Stream**	**Ballylongford**	**Ballylongford**
Q-value	3-4	3-4	3	3-4	3-4
Corresponding WFD Status	Moderate	Moderate	Poor	Moderate	Moderate
No. of taxa	24	22	14	19	20

3.5 AMPHIBIANS

Drains at the proposed development site were found to be used by breeding frogs. Spawning density was considered low throughout the site.

Plate 9 Drains at the site are used by breeding frogs.

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