Appendix 5.8 Irish Wetland Bird Surveys Data and Complete Bird Survey Data (2010/2012)

A. Irish Wetland Bird Surveys Data (2004-2009)

I-WeBS

Dunkettle, Cork Harbour

Species	1% National	1% International	2004/05	2005/06*	2006/07	2007/08	Mean	Peak
Mute Swan	110					2	1	2
Shelduck	150	3,000			2	6	3	6
Wigeon	820	15,000	40		16	58	38	58
Gadwall	20	600			5		2	5
Teal	450	5,000				10	3	10
Mallard	380	20,000	2			14	5	14
Red-breasted Merganser	35	1,700	4		3	12	6	12
Cormorant	140	1,200	50	*24*	29	27	35	50
Little Egret		1,300	1		6	4	4	6
Grey Heron	30	2,700	29		22	18	23	29
Oystercatcher	680	10,200	125	*163*	86	88	100	163
Lapwing	2,100	20,000	210		85	50	115	210
Dunlin	880	13,300	357		10	385	251	385
Snipe		20,000	1		5		2	5
Black-tailed Godwit	140	470	39	65	130	192	120	192
Bar-tailed Godwit	160	1,200			6	82	29	82
Curlew	550	8,500	96	*99*	232	228	185	232
Greenshank	20	2,300	5		2	15	7	15
Redshank	310	3,900	63		82	57	67	82
Turnstone	120	1,500	1		6	4	4	6
Black-headed Gull		20,000	271		200		157	271
Common Gull		16,000	1				0	1
Lesser Black-backed Gull		4,500	223		620	12	285	620
Herring Gull		13,000	4				1	4
Great Black-backed Gull		4,800	150		2		51	150
Kingfisher			1				0	1

* 2005/06 data not included in the calculation of the mean as based on one count only, in September 2005.

The counts presented in the table refer to the peak counts of species in each I-WeBS season.
Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

I-WeBS

Cork Harbour 2004/05-2008/09

Species	1% National	1% International	2004/05	2005/06	2006/07	2007/08	2008/09	Mean	Peak
Mute Swan	110		71	54	73	68	39	61	73
Whooper Swan	130	210	7			3	1	2	7
Black Swan					2			0	2
Greylag Goose	50	870	1	3	1	6		2	6
Canada Goose			23	11	13	22	5	15	23
Light-bellied Brent Goose		260	16	26	11	17	6	15	26
Feral/hybrid Goose			2			5		1	5
Shelduck	150	3,000	1,391	1,350	918	823	849	1,066	1,391
Wigeon	820	15,000	2,043	2,332	1,492	1,259	665	1,558	2,332
Gadwall	20	600	13	13	7		6	8	13
Teal	450	5,000	1,169	1,302	667	644	890	934	1,302
Mallard	380	20,000	628	406	423	484	305	449	628
Pintail	20	600	20	14	2		22	12	22
Shoveler	25	400	24	45	62	51	18	40	62
Pochard	380	3,500	7	7	2	3	2	4	7
Tufted Duck	370	12,000	14	14	19	16	22	17	22
Scaup	45	3,100		2			1	1	2
Eider	30	12,830		15	1			3	15
Common Scoter	230	16,000	3	7		1	1	2	7
Velvet Scoter						3		1	3
Goldeneye	95	11,500	7	10	5	14	17	11	17
Red-breasted Merganser	35	1,700	85	80	68	72	51	71	85
Red-throated Diver	20	3,000		1	1			0	1
Black-throated Diver		3,750					1	0	1
Great Northern Diver		50			4	3	2	2	4
Little Grebe	25	4,000	80	69	58	65	43	63	80
Great Crested Grebe	55	3,600	105	137	63	106	78	98	137
Slavonian Grebe		55	1	2				1	2
Cormorant	140	1,200	370	308	163	285	144	254	370
Shag			2		2	8	3	3	8
Little Egret		1,300	166	126	143	151	69	131	166
Cattle Egret							3	1	3
Grey Heron	30	2,700	135	76	84	72	75	88	135
Spoonbill						1		0	1
Water Rail			2	2	2	2	1	2	2
Moorhen	20		24	33	55	25	25	32	55
Coot	330	17,500	23	16	19	7	2	13	23
Oystercatcher	680	10,200	1,857	2,076	1,061	1,590	896	1,496	2,076
Ringed Plover	150	730	25	67	17	27	38	35	67
Golden Plover	1,700	9,300	6,200	3,002	3,266	5,232		3,540	6,200
Grey Plover	65	2,500	4	24	12	39	8	17	39
Lapwing	2,100	20,000	4,133	4,096	3,321	3,321	1,155	3,205	4,133
Knot	190	4,500	85	117	124	111	32	94	124
Sanderling	65	1,200		33				7	33
Curlew Sandpiper			3	4	1			2	4
Dunlin	880	13,300	4,325	3,874	4,456	3,579	5,091	4,265	5,091
Ruff		12,500		1		3		1	3
Snipe		20,000	14	49	32	75	7	35	75
Black-tailed Godwit	140	470	2,937	3,337	1,433	2,823	2,050	2,516	3,337
Bar-tailed Godwit	160	1,200	298	218	383	257	19	235	383
Whimbrel		2,000	1	4	1	1	1	2	4
Curlew	550	8,500	2,317	1,809	1,363	1,607	694	1,558	2,317
Common Sandpiper			2	2	1	4	3	2	4
Green Sandpiper			1	1				0	1
Spotted Redshank		900	2	1	1	1		1	2
Greenshank	20	2,300	83	68	72	71	44	68	83

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I-WeBS

Redshank	310	3,900	2,295	1,543	1,459	1,725	1,027	1,610	2,295
Turnstone	120	1,500	161	136	129	214	67	141	214
Mediterranean Gull			13	15	24	48	65	33	65
Bonaparte's Gull					1			0	1
Black-headed Gull		20,000	2,170	2,627	2,010	2,103	513	1,885	2,627
Ring-billed Gull			1					0	1
Common Gull		16,000	290	188	214	207	71	194	290
Lesser Black-backed Gull		4,500	496	31	630	72	57	257	630
Herring Gull		13,000	36	40	123	51	41	58	123
Iceland Gull							1	0	1
Glaucous Gull						1		0	1
Great Black-backed Gull		4,800	385	157	137	98	43	164	385
Sandwich Tern			2	225	2	17	1	49	225
Common Tern				1	1	1		1	1
Arctic Tern						1		0	1
Kingfisher			3	3	1	2	1	2	3

Cork Harbour coverage 2004/05-2008/09

Subsite	Ss_Grid	2004/05	2005/06	2006/07	2007/08	2008/09
Rostellan Lake	W8765	7	7	6	6	6
Rathcoursey & Ahanesk	W8770	6	5	7	7	6
Lough Beg	W780630	5	5		1	
Owenboy Estuary	W750620	6	3		6	1
Ringaskiddy - Luc Strand	W790640	4	1		1	
Weir Island	W8171	7	7	7	7	
Harpers Island	W7872					3
Ballintubbrid	W840702	7	7	7	7	
Ballynacorra	W875715	6	5	6	7	6
Cuskinny	W817674	6	4	5	5	5
Dunkettle	W727723	5	1	4	6	
Brick Island	W8270	7	7	7	7	
Douglas Estuary	W720698	6	6	5	7	
Glounthane Estuary/ Slatty Water	W790727	6	5	6	5	3
Aghada	W8566	7	7	6	6	6
Whitegate Bay	W8363	7	7	6	6	6
North Channel - Ballintubbrid	W810702	6	4	5	5	5
Belvelly - Marino Point	W790708	6	4	5	1	5
Monkstown Creek	W760750	5	5		1	
Saleen	W8767	7	7	6	6	6
East Lough Mahon	W7670				6	
Carrigrenan Pools	W7771				4	
Belvelly Tower	W794707				6	
Belvelly Bridge - Railiway	W783705				6	
Carrigrenan - Great Island & Railway	W775705				6	

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Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

B. Complete Breeding Bird Survey Data (2011)

Common Name	Scientific name	Breeding Evidence at Dunkettle (BTO)	No. of Pairs at Dunkettle	Red-list Status	EU Status	Nest Locations at Dunkettle
Blackbird	*Sylvia atricapilla*	Confirmed	Many	-	-	Scrub/woodland throughout
Black-headed Gull	*Chroicocephalus ridibundus*	Non-breeder	0	Red	-	Non-breeding juvenile feeding in Pfizer mudflat
Blackcap	*Turdus merula*	Probable	3	-	-	Dunkettle Estate and Pfizer woodland
Blue Tit	*Parus caerulea*	Probable	Several	-	-	Woodland/ stone walls throughout
Chaffinch	*Fringilla coelebs*	Probable	Several	-	-	Scrub/woodland throughout
Chiffchaff	*Phylloscopus collybyta*	Probable	Many	-	-	Scrub/woodland throughout
Coal Tit	*Periparus ater*	Probable	Several	-	-	Scrub/woodland throughout
Curlew	*Numenius arquata*	Non-breeder	0	Red	-	Non-breeder - Flock of 14 feeding at Jack Lynch Tunnel intertidal polder. Single at Pfizer intertidal mudflats.
Dunnock	*Prunella modularis*	Confirmed	Many	-	-	Scrub/woodland throughout
Goldcrest	*Regulus regulus*	Confirmed	Many	-	-	Woodland throughout
Goldfinch	*Carduelis carduelis*	Confirmed	Many	-	-	Scrub/woodland throughout
Great Tit	*Parus major*	Probable	Several	-	-	Woodland throughout
Greenfinch	*Carduelis chloris*	Confirmed	Several	-	-	Scrub/woodland throughout
Grey Heron	*Ardea cinerea*	Confirmed	7	Amber	-	Breeding Colony at Pfizer. Forages throughout on intertidal mudflats
Hooded Crow	*Corvus corone*	Confirmed	2	-	-	Tree east of Pfizer grasslands, and Iarnrd Eireann Hedge.
Jackdaw	Corvus monedula	Confirmed	Several		-	Light masts above existnig interchange
Little Egret	*Egretta garzetta*	Confirmed	X	-	EU	Breeding Colony at Pfizer. Forages throughout on intertidal mudflats
Long-tailed Tit	*Aegithalos caudatus*	Confirmed	Several	-	-	Scrub/woodland throughout
Magpie	*Pica pica*	Confirmed	Many	-	-	Hedges/woodland throughout
Mallard	*Anas platyrhynchos*	Confirmed	1	-	-	Iarnrod Eireann Intertidal mudflat
Moorhen	*Gallinula chloropus*	Possible	1	-	-	Iarnrod Eireann Intertidal mudflat
Meadow Pipit	*Anthus pratensis*	Probable	1	-	-	Iarnrod Eireann storage yeard
Mistle Thrush	*Turdus viscivorus*	Probable	2			
Pheasant	*Phasianus colchicius*	Confirmed	3	-	-	Dunkettle Estate, Pfizer woodland, and Iarnrod Eireann scrub
Pied Wagtail	*Motacilla alba*	Probable	3	-	-	Iarnrod Eireann storage yard and BASF hardstanding
Reed Bunting	*Emberiza schoeniclus*	Probable	2	-	-	Pfizer grasslands
Ringed Plover	*Charadrius hiaticula*	Probable	0-1	Amber	-	Single bird holding territory in gravel at Pfizer southwest of wood. No second bird seen
Robin	*Erithacus rubecula*	Confirmed	Many	-	-	Scrub/woodland throughout
Rook	Corvus frugilegus	Confirmed	Many	-	-	Rookerie in Dunkettle Estate Parkland (Scot's Pine)
Shelduck	*Tadorna tadorna*	Possible	0-2	Amber	-	1-2 pairs feeding in Pfizer, Iarnrod Eireann, and North Esk intertidal mudflats. No juveniles observed.
Snipe	*Gallinago gallinago*	Non-breeder	0	Amber	-	Wintering birds roosting in early spring in Iarnrod Eireann and Pfizer (Peak 6)
Song Thrush	*Corvus monedula*	Confirmed	X	-	-	-
Starling	*Sturnus vulgaris*	Confirmed	1	Amber	-	Shed at Dunkettle Estate outside ZoI
Stock Dove	*Columba oenas*	Probable	0-1	Amber		Single pair in Dunkettle Estate treeline outside ZoI
Stonechat	*Saxicola torquata*	Probable	0-1	-	-	Pfizer grasslands
Swallow	*Hirundo rustica*	Confirmed	01-Feb	Amber	-	Aerial feeding throughout .Nest XX in Dunkettle XX
Whitethroat	Sylvia communis	Possible	2	-	-	Pfizer grasslands and Jack Lynch Tunnel grassland
Willow Warbler	*Phylloscopus trochilus*	Probable	Many	-	-	Woodland throughout
Wood Pigeon	Columba palumbus	Confirmed	Many	-	-	Woodland throughout
Wren	*Troglodytes troglodytes*	Probable	Many	-	-	Scrub/woodland throughout

Table 1 Breeding Bird Data within ZoI (2011)

C. Complete Wintering Bird Survey Data (2010/2011)

Common Name	Scientific Name	Peak (EcIA Survey)	% Cork Harbour SPA	Peak outside Cork Harbour SPA (EcIA Survey)	% Cork Harbour SPA in Non-Designated Areas
Bar-tailed Godwit	*Limosa lapponica*	115	256	0	0
Black-headed Gull	*Chroicocephalus ridibundus*	203	21	2	0
Black-tailed Godwit	*Limosa limosa*	80	19	45	11
Common Gull	*Larus canus*	37	1	1	0
Coot	*Fulica atra*	0	0	7	30
Cormorant	*Phalacrocorax carbo*	74	20	1	0
Curlew	*Numenius arquata*	288	21	14	1
Dunlin	*Calidris alpina*	1027	21	0	0
Great Black-backed Gull	*Larus marinus*	5	1	0	0
Great Crested Grebe	*Podiceps cristatus*	7	8	0	0
Greenshank	*Tringa nebularia*	4	11	2	6
Grey Heron	*Ardea cinerea*	1	3	1	3
Herring Gull	*Larus argentatus*	10	8	1	1
Lapwing	*Vanellus vanellus*	32	1	0	0
Lesser Black-Backed Gull	*Larus fuscus*	11	4	0	0
Little Egret	*Egretta garzetta*	2	NA	1	NA
Little Grebe	*Tachybaptus ruficollis*	2	3	2	3
Mallard	*Anas platyrhynchos*	31	5	12	2
Mediteranean Gull	*Larus melanocephalus*	1	NA	0	NA
Mute Swan	*Cygnus olor*	2	5	0	0
Oystercatcher	*Haemotopus ostralegus*	68	9	0	0
Red Knot	*Calidris canutus*	135	3	0	0
Red-Breasted Merganser	*Mergus serrator*	4	4	0	0
Redshank	*Tringa totanus*	55	3	7	0
Ringed Plover	*Charadrius hiaticula*	4	6	0	0
Shelduck	*Tadorna tadorna*	40	3	0	0
Snipe	*Gallinago gallinago*	4	NA	13	NA
Teal	*Anas crecca*	11	1	11	1
Tufted Duck	*Aythya fuligula*	6	6	3	3
Turnstone	*Arenaria interpres*	11	5	0	0
Wigeon	*Anas penelope*	7	0	7	0

Habitat Descriptions (Heritage council)

Freshwater (F)

Artificial Lakes and Ponds (FL8)

There is a single freshwater lake within the ZoI of the proposed development (Eastgate Pond (WF13). The feature appears to discharge freshwater into the Pfizer Intertidal Mudflat, and is composed of two medium-sized ponds. Water quality appears poor as evidenced by the presence of filamentous green algae. There is little in-stream vegetation, although emergent vegetation occurs at the fringes and includes Common Reed *Phragmites australis*, Bulrush *Typha latifolia*, and Sedges *Carex* spp. *i*n stands reaching up to 15m in depth.

Depositing/Lowland Rivers (FW2)

All water features are numbered and illustrated in Figure 5.1.1. There is only one freshwater watercourse within the ZoI of the proposed development. This un-named freshwater stream (WF10) is located to the northeast of the existing Dunkettle Interchange and railway tracks. The stream flows through scrub and grassland below a recently built Gaelscoil, and originates from the higher wooded slopes to the north of the R623. This stream is a 1st order watercourse of approximately 1.7km long. It meets the sea at the north western Esk intertidal mudflat East (WF 4) to the north east of the Dunkettle Interchange. This stream passes through two culverts in its lower reaches, one under an old disused road and another under the Dunkettle Road. The substrate is a mixture of cobble and gravel with a small proportion of sand/silt. The mean water depth was 5cm in spring 2012, although occasional pooled areas reach 40cm depth

Drainage Ditches (FW4)

There is one unnamed drainage ditch (WF No 14) within the footprint of the proposed development on undeveloped greenfield lands belonging to BASF. The ditch appears to drain the Pfizer Intertidal Mudflat (East), as evidenced by the brackish influence in plant communities. The saline conditions are likely to be diluted by freshwater inputs from nearby industrial water treatment ponds. . It is, and is scrub-lined, with small volumes of standing brackish water in summer. The ditch is entirely culverted within the southern portion of BASF lands, but the open section to the north measures approximately 10m in width. A diverse mix of brackish and freshwater species occurs including locally dominant swarthes of Hard Rush *Juncus inflexus*, Sea Club Rush *Scirpus maritimus*, and a mix of other frequent species including Brookweed *Samolus verandi*, Fool's-water-cress *Apium nodiflorum*, Marsh Willowherb, Water Plantain *Alisma plantago-aquatica*, and False Fox Sedge *Carex otrubae*. The rare species Bristly Oxtongue *Picris echioides* occurs at a single location at the northern end of the ditch (Irish Grid W7403 720; target noted in Figure 5.1.7).

Grassland and Marsh (G)

A diverse range of grasslands occur in scattered patches and alongside the existing interchange. Formal agricultural land is limited to Dunkettle estate, but some areas of commonage beside intertidal areas are grazed by the travelling community.

Improved Grassland (GA1)

This common low value habitat is restricted within the ZoI due to the coastal/industrial landscape context and occurs only at Dunkettle Estate outside of the footprint proposed development. Cattle grazing here is intense leading to low species diversity dominated by Perennial Rye Grass *Lolium perenne* with frequent Sweet Vernal Grass *Anthoxanthum odoratum*, and Yorkshire Fog *Holcus lanatus*. Ranker margins contain additional species of such as Shepherds Purse *Capsella bursa-pastoris*, Fumitory *Fumaria cf bastardii*. This habitat intergrades with patches of ranker GS2 grass where grazing intensity is lower. However the latter never dominates significant areas.

Amenity Grasslands (GA2)

This habitat occurs around Dunkettle Estate and in a recently seeded field below the new Gaelscoil. It is composed of artificially seeded grass species already described under improved grassland species and is regularly mown.

Dry Calcareous and Neutral Grassland (GS1)

Except in the roundabout by the Jack Lynch Tunnel, this rarely occurs as a distinct habitat. Grazing throughout is by horses belonging to the travelling community. Grazing at the Jack Lynch Tunnel Roundabout is generally intense in the centre, with rank margins towards the hedged boundary. This habitat occurs in other areas grazed by the travelling community on the margins of intertidal areas, where it forms intimate mosaics with coarser ungrazed grasslands (GS2), wet grassland (GS4) and upper saltmarsh (CM2). The floristic diversity is highest at the junction with other habitat types. Distinct communities are characterized by a relatively tight sward containing a range of common grasses (Bent Grasses *Agrostis* spp., Red Fescue *Festuca rubra*, Perennial Rye Grass, Yorkshire Fog, Sweet Vernal Grass, Smooth-leaved Meadow Grass *Poa pratensis)* interspersed with scattered forbs including Creeping Thistle Cirsium *arvense,* Spear Thistle *Cirsium vulgare* Knapweed *Centaurea nigra,* Cut-leaved Geranium *Geranium dissectum* , Bird's Foot Trefoil *Lotus corniculatus*, Black Medick *Medicago lupulina*, Field Speedwell *Veronica arvensis*, Changing Forget-me-not *Myosotis* discolor, Common Figwort *Scrophularia nodosa*. Yellow-wort *Blackstonia perfoliata* occurs only at the Jack Lynch and is indicative of calcareous conditions.

Dry Meadows and Grassy Verges (GS2)

This habitat is species-rich, and occurs primarily as ungrazed, mown species-rich wildflower meadow communities on roadsides throughout. It also occurs in small patches in transition to recolonising bare ground (ED3) on thin soils near the railway line, and along the disturbed margin of the Pfizer woodland and willow carr/wet grassland (GS4). Soft Brome *Bromus hordaceus*, Ox-eye Daisy *Leucanthemum vulgare*, Meadow Fescue *Festuca pratensis*, Spring sedge *Carex caryophyllea*, Rough Hawk's-beard, *Crepis biennis,* and non-native Soapwort *Saponaria officinalis* occur, alongside the common rank grasses Meadow Foxtail *Alopecurus pratensis*, Timothy Grass *Phleum pratense*, False Oat Grass *Arrhenatherum elatius* and Cock' s Foot *Dactylis glomerata*. Tall Fescue *Festuca arundinacea* is occasional. Common couch *Elytrigia repens*, Field Woodrush *Luzula campestris,* Silverweed *Potentilla anserine,* and Creeping cinquefoil *Potentilla repens* are locally abundant beside the Jack Lynch Tunnel where Eyebright *Euphrasia* agg. occurs on the seaward side of the grassland indicating calcareous conditions. Hairy Lady's mantle *Alchemilla filicaulis* occurs on the western edge of the Pfizer wood amongst Primroses *Primula vulgaris*.

Wet Grassland (GS4)

This habitat is restricted within the ZoI, and occurs north of the Pfizer pNHA woodland, and in mosaics under brackish conditions with upper saltmarsh (CM2) and mudflats (LS4) on the margins of the intertidal areas. It has also recently formed on recolonising bare ground east of Pfizer on the BASF lands. The sward is generally not species rich, and is dominated by Creeping Bent *Agrostis stolonifera,* Sweet Vernal Grass, Soft Rush *Juncus effusus,* Hard Rush, and Toad Rush *Juncus bufonius with* scattered *Common Reed Phalaris arundinacea*. Floating Sweet-Grass *Glyceria fluitans* occur in wetter areas. Broad-leaved components are usually sparse, but include Creeping buttercup *Ranunculus*

repens (frequent throughout) Marsh Willowherb *Epilobium hirsutum* (abundant at Pfizer), Sea Bindweed *Calystegia soldanella*, Hedge Bindweed *C. sepium*, and Crisped Dock *Rumex crispus*. Celery-leaved Buttercup *Ranunculus sceleratus* is locally abundant only on the mud edge in the western end of the Iarnrod Eireann mudflat.

Woodland and Scrub (W)

Woodland habitat is abundant throughout the ZoI due to the presence of young semi-mature roadside plantations which serve a screening function along the existing Dunkettle Interchange, and due to the presence of several mature estate plantations. Woodland and is distinguished from hedges by it's the width which is greater than 10m.

(Mixed) Broad-leaved Woodland (WD1)

This habitat occurs as estate woodlands of several different compositions at Dunkettle Estate and Pfizer respectfully, and in roadside plantations. A minor component of the canopy species is coniferous.

This is the mature estate woodland in a band along the southern slope, and eastern section of Dunkettle Estate, where it is frequently dominated by mature Beech *Fagus sylvatica* with scattered Scot's Pine *Pinus sylvestris*. There is a small area of younger plantation to the east where Alder *Alnus glutinosa*, Silver Birch *Betula pendula*, and Ash have been planted. The understorey of mature plantations is generally open and represented by scattered Elder and Holly. Common Dog Violet, Enchanter's Nightshade, and Ground Ivy *Glechoma hederacea*, Primrose *Primula vulgaris*, Wood Dock *Rumex sanguineus*, and Lords and Ladies *Arum maculatum* are frequent in the woodland flora. Nettles *Urtica dioica* are locally abundant indicating enrichment (e.g. by dumped garden waste). Yew *Taxus baccata* '*Fastigiata'* is locally abundant in the understorey of woodland by avenues to the rear of Dunkettle House outside the ZoI. Notable species include Ivy Broom rape *Orobanche hederae* and a single population of cowslip *Primula veris* occurs in glades near the Dunkettle gate lodge, and Early Dog Violet *Viola reichenbachiana* throughout. These plants are uncommnon, but widespread. Several invasive species are common throughout the Dunkettle woodlands, including invasive non-native Hybrid Bluebells *Hyacinthoides x massartiana*. (mixed with occasional of native Bluebell *Hyacinthoides non-scripta*), Snowberry, and *Rhododendron*.

The woodland at Pfizer (within the pNHA) is dominated by semi-mature planted Holm Oak *Quercus ilex*, but also frequent invasive planted Sycamore *Acer pseudoplatanus* in addition to occasional Ash *Fraxinus excelsior* trees. The habitat is likely to have been included within the Dunkettle shoreline pNHA because of the Egret colony as it is dominated by the non-native canopy species Holm Oak Quercus ilex. The understorey is open, and dominated by invasive Cherry Laurel *Prunus laurocerasus* and Hazel, with rare Holly. A single sapling Yew was found in the understorey in the eastern half, and appears wild-sown. The habitat is of limited floristic value, with a few notable woodland indicator species such as Common Dog Violet, Wood Sorrel *Oxalis acetosella*, Enchanters nightshade, and a mix of native Bluebell and invasive non-native Hybrid Bluebells. Ferns are abundant but limited to Shield Ferns *Polystichum* spp., and Hard Fern *Blechnum spicant*. Wood Meadow Grass *Poa nemoralis* is occasional. Comfrey *Symphytum officinalis* occurs on the woodland edge.

The component species of roadside plantations are highly varied and include Holm Oak, White beam *Sorbus aria,* Alder, Birch *Betula* spp, and Pedunculate Oak *Quercus robur*.The nationally rare Sweet Briar *Rosa rubiginosa* is locally abundant in the narrow young woodland strip atop the existing Jack Lynch Tunnel, occurring on the seaward edge of the plantation within a linear length of approximately 20m. This plant is widespread but nationally rare, and is of county importance.

(Mixed) Broad-leaved Woodland (WD2)

WD2 includes significant proportions of both broadleaved and coniferous trees, and is the dominant habitat in some roadside plantations along the existing road infrastructure where evergreen planting was included for screengin purposes. The habitat also occurs in a small block in the Dunkettle Estate, on the upper slope above the existing road, on the boundary with the estate grasslands. The broad-leaved component includes a varied mix of species occurring in WD1, with a coniferous component dominated by Scot's Pine Pinus sylvestris. There is a limited understorey, which often includes Dog Rose *Rosa canina* and Japanese Rose *Rosa rugosa*. The field and ground flora is generally species-poor due to the density of canopy species. In addition to locally abundant carpets of Ivy *Hedera helix*, the field layer includes a number of common species, including Common Dog Violet, Hart's Tongue, and Hard Shield Fern. The stand at Dunkettle includes a mix of native, and invasive non-native hybrid Bluebells, in addition to invasive Snowberry *Symphaericarpos alba*.

Scattered Trees and Parkland (WD5)

This habitat does not occur within the ZoI and occurs on the upper lawns around the Dunkettle Estate House. Here, mature coniferous and broad-leaved estate trees are scattered throughout improved grazing pastures. Beech, Oak, and Scot's Pine dominate amongst non-native mature ornamental conifers, and the field layer is nutrient enriched due to the impact of sheltering cattle. There is a rookery in one of the Scot's Pine trees.

Scrub (WS1)

Scrubby banks less than 4m wide and 5m high have been mapped as hedges (WL1). Areas of scrub greater than these dimensions qualify for this habitat type. These commonly occur along the steep embankments beside intertidal mudflats where scrub has encroached following the construction of the existing Dunkettle Interchange. Floristic diversity is usually low and dominated by Brambles *Rubus fruticosus*, and Gorse Ulex spp. Brome *Cytisus scoparius* and Sally *Salix cinerea* occur occasionally, while Goat Willow *Salix capraea* is locally dominant in the scrub at Pfizer with the non-native Himalayan Honeysuckle *Leycesteria Formosa*.

Hedgerows (WL1)

There are relatively few boundary hedges within the proposed development area, in large part due to the few parcels of agricultural land occurring. Roadside landscape plantations are mapped as hedges if less than 10m in width. The canopy is generally dominated by Ash and invasive Sycamore. English Elm *Ulmus procera*, White Poplar *Populus alba* and Sessile Oak *Q. petraea* spp are locally frequent in sections of the hedges between the Iarnrod Eireann storage yard and the small Iarnrod Eireann intertidal mudflat (WF7). Understorey components are typically dominated by Hawthorn *Crataegus monogyna*, Elder *Sambucus nigra*, and Honeysuckle *Lonicera periclymeum*, but also include Hazel , Holly, Japanese Rose and Dog Rose. The understorey is occasionally dominated by invasive non-native shrubs like *Sn*owberry Sea buckthorn *Hippophae rhamnoides* (around Jack Lynch tunnel GS1 grassland only) and the non-native tree Laburnum *Laburnum anagyroides* at Iarnrod Eireann. The field layer includes abundant Ivy, Ground Ivy, Hedge woundwort *Stachys sylvatica* and Germander speedwell *Veronica chamaedrys,* occasional Pignut *Conopodium majus* (at Dunkettle) are occasional in the field layer. and locally abundant Remote Sedge *Carex remota*. The invasive species Three-cornered Garlic *Allium triquetrum* occurs in a hedge on a local road by the Gaelscoil. The invasive herb Winter Heliotrope *Petasites fragrans* is locally dominant in the field layer at Dunkettle and elsewhere.

Treelines (WL2)

There are few treelines, but they occasionally occur on roadsides or on property boundaries. Sycamore, Ash, and Hawthorn are common canopy dominants. The field layer contains a mix of species present in hedges and adjacent roadside verges, but notably contains Ivy Broom Rape. Early Dog Violet occurs in a treeline to the rear of Dunkettle Estate outside of the ZoI.

Recolonising Bare Ground (ED3)

This habitat occurs on thin soils on paths, tracks, and gravel waysides. There is also an area of sandy undeveloped ground on the BASF lands to the east of Pfizer. The habitat throughout is species-rich as it contains plant communities from dry and wet grassland, and stony habitats. Sea Mayweed *Triplospermum maritimum*, Rue-leaved Saxifrage *Saxifraga tridactylites*, *Cerastium tomentosum, Colt's Foot Tussilago farfara* and Cut-leaved Geranium are abundant throughout, Lesser Trefoil *Trifolium dubium*, Red Valerian *Centranthus ruber,* Teasel *Dipsacus fulvonum* and Common Winter Cress *Barbarea vulgaris,* are frequent. Species of interest include White Campion *Silene latifolium* (track by Jack Lynch Tunnel Intertidal Polder), Field Penny Cress *Thlapsi arvense* (disused road below the Dunkettle Estate), and Yellow Bartsia *Parentucellia viscosa* (sandy ground at BASF east of Pfizer). Wild Mignonette *Reseda lutea* is an uncommon species, but is introduced. Bristly Oxtongue is a very rare species in county Cork and nationally that also occurs here on the banks of the un-named stream (WF14).

Earth Banks (BL2)

These are vegetated, and occasionally occur below hedges, treelines, or beside watercurses. A treeline/earth bank contains a potential Otter holt in the east of the North Esk Intertidal Mudflat (WF4). Species have already been listed under hedgerows. A single notable species occurs in an earth bank beside the freshwater stream at the Gaelsciol, and does not occur in hedgerows. Field Pansy *Viola arvensis* is uncommon in some parts of Ireland but widespread in the south of the country.

Buildings and Artificial Surfaces (BL3)

There is a derelict stone structure in the Pfizer woodland. An ice house was located in the southwestern corner of the Dunkettle Estate under trees beside the cluster of occupied residences, but this was found to have no bat hibernacula presebnt. (See faunal section). There are temporary storage sheds in the recolonising bare ground/scrub (ED3/WS1) in the storage yard beside the North Esk Intertidal Mudflats (WF3 and WF4). None of these areas contain significant vegetation except for occasional common ferns including Wall-rue *Asplenium ruta-maria* which also grows on shady walls in Dunkettle Estate, and common bryophytes including Grey-cushioned Grimmia *Grimmia pulvinata*.

Lower Salt Marsh (CM1)

This habitat occurs in the saline conditions at the tidal edge of intertidal mudflats, and is often poorly developed. It grades into upper saltmarsh (CM2). The sward is dominated by the invasive Cord Grass *Spartina sp.* at the Jack Lynch Intertidal Polder and the northern wetland at North Esk (northeast of WF4), and Cord Grass occurs in smaller pockets at other intertidal mudflats. Common Saltmarsh-grass *Puccinellia maritima* is often co-dominant with Cord Grass. Sea Rush *Juncus maritimus* is dominant at the small Iarnrod Eireann Intertidal Mudflat. Other common species in this habitat are fleshy and salt-tolerant and include Glassworts *Salicornia* agg, Spear-leaved Orache *Atriplex prostrata*, and Sea Aster *Aster tripolium*, and Common Scurvy grass *Cochlearia officinalis.* Lax-flowered Sea-lavender *Limonium humile* is locally frequent. This habitat type corresponds to three different EU Annex 1 Habitats, due to the presence of different local dominants in Common Salt-Marsh Grass (1330 Atlantic Salt Meadows), Cord Grass (1320 Spartina Swards), and Sea Aster (1340 Inland Salt Meadows).

Upper Salt Marsh (CM2)

This forms the brackish transition from Lower Salt Marsh (CM1) to non-saline dry (GS1/GS2) or wet grasslands (GS4) and is subject to less frequent and prolonged inundation than Lower Salt Marsh (CM1). This habitat occurs in greater extent than Lower Salt Marsh. The grassy/rushy sward is varied in its dominants, which include Creeping Bent Grass, Saltmarsh Rush *Juncus gerardii*, and Sea Club Rush *Scirpus maritimus*. Spear-leaved Orache, Curled Dock *Rumex crispus* and Common Scurvy Grass are frequent. A small area of more brackish marsh occurs in the Eastgate Saltmarsh, where the stand is dominated by Grey Club Rush *Schoenoplectus tabarnaenmontae*, and False Fox Sedge *Carex otrubae*. Overall, this habitat varies, and corresponds to a mixture of two Annex 1 Salt Marsh Habitats, namely 1330 Atlantic Salt Meadows, and 1410 Mediterranean Salt Meadows. Creeping Bent occurs in 1340 but not in 1410. Sea Rush occurs in 1410, but not in 1340. Both are present as local dominants in Upper Saltmarsh habitats within the survey area.

Sea Walls and Jetties (CC1)

This habitat is composed of the rock armour present on the banks of all intertidal mudflats. Vegetation is sparse but includes occasional saline species such as Sea Beet and Sea Plantain *Plantago maritima* in addition to a freshwater species Water Dropwort *Oenanthe* sp. The habitat also applies to the seawall at the southern end of the Jack Lynch Tunnel Intertidal Polder (WF1), in which several pairs of culverts allow the enclosed mudflat area to drain and fill with tidal flows. Vegetation cover on this habitat is sparse and includes Sea Beet, Bittersweet *Solanum dulcamara*, Spear-leaved Orache, and tussocks of Common Couch *Elytrigia repens.*

Sheltered Rocky Shores (LR3)

This habitat occurs within the littoral zone below the rock armoured seawall, and above the intertidal mudflat (LS4) that dominates most water features. It is described in detail under the JNCC Marine Biotope habitat descriptions in the next section.

Mud Shores (LS4)

These are muds that have accumulated from depositing tidal waters. Muds dominate below the low tide water mark, along which fringing saltmarsh has formed in several of the intertidal wetlands. A detailed description of this habitat is provided in the JNCC Marine Biotope habitat section.

Sea inlets and bays (MW2)

The shallow bay of Lough Mahon (Cork Harbour) is located immediately off-shore of the proposed development. The bay is relatively sheltered, and affords feeding opportunities to deep water wetland birds (e.g. diving ducks, divers, and Cormorants), and cetaceans.

Estuaries (MW4)

The Glashaboy River is fully tidal as far north as Glanmire Village, and all sections of the River within the ZoI are estuarine. The Glashaboy River rises in the hills just north of Glashaboy South in County Cork and follows a clear north west to south-east line until it meets the sea at Lough Mahon approximately 150m south of the N8 Dunkettle Bridge, where the estuary discharges to Upper Cork Harbour. Mud substrates exposed at low tide provide valuable foraging resources to wetland birds. The Estuary is up to 140m at its widest point near the Dunkettle roundabout.

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Appendix 5.10 Criteria for Ecological Evaluation (NRA, 2009)

Ecological valuation: Examples

International Importance:

- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
- Proposed Special Protection Area (pSPA).
- Site that fulfills the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).
- Features essential to maintaining the coherence of the Natura 2000 Network.[4]
- Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
- Resident or regularly occurring populations (assessed to be important at the national level)[5] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
- World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
- Biosphere Reserve (UNESCO Man & The Biosphere Programme).
- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
- Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
- Biogenetic Reserve under the Council of Europe.
- European Diploma Site under the Council of Europe.
- Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[6]

National Importance:

- Site designated or proposed as a Natural Heritage Area (NHA).
- Statutory Nature Reserve.
- Refuge for Fauna and Flora protected under the Wildlife Acts.
- National Park.
- Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
- Resident or regularly occurring populations (assessed to be important at the national level)[7] of the following:
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing 'viable areas'[8] of the habitat types listed in Annex I of the Habitats Directive.

4 See Articles 3 and 10 of the Habitats Directive.

5 It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

6 Note that such waters are designated based on these waters' capabilities of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*).

7 It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

8 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

County Importance:

- Area of Special Amenity.[9]
- Area subject to a Tree Preservation Order.
- Area of High Amenity, or equivalent, designated under the County Development Plan.
- Resident or regularly occurring populations (assessed to be important at the County level)[10] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.
- County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP,[11] if this has been prepared.
- Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
- Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (higher value):

- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;
- Resident or regularly occurring populations (assessed to be important at the Local level)[12] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;
- Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value):

- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;
- Sites or features containing non-native species that are of some importance in maintaining habitat links.

Table 1: *Examples of valuation at different geographical scales*

9 It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

10 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

11 BAP: Biodiversity Action Plan

12 It is suggested that, in general, 1% of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

Ecological receptors subject to impacts associated with a new road scheme	Summary descriptions of the ecological receptors	Value of the ecological receptors	Selection as key ecological receptors
Hedgerow network (managed by regular cutting to a height of approximately 1.5m)	The hedgerows comprise mainly hawthorn (*Crataegus monogyna*), with ash (*Fraxinus excelsior*) and occasional sycamore (*Acer pseudoplatanus*). Dog-rose (*Rosa canina*) and ivy (*Hedera helix*) are common and frequently grow extensively up into the canopy, along with brambles (*Rubus fruticosus Agg.*) The ground flora is relatively species-poor and includes cow parsley (*Anthriscus sylvestris*), hart's tongue-fern (*Phyllitis scolopendrium*), ivy and herb-robert (*Geranium robertianum*).	These hedgerows are not particularly species-rich and are of limited intrinsic ecological value. They also do not link other features of particular ecological importance and, thus, the local hedgerow network should be valued as of Local Importance (lower value).	As set out in Section 3.4.1, in the context of national road projects ecological resources of below Local Importance (Higher Value) do not represent 'key ecological receptors' for which detailed assessment is required.
Two fields of species-poor damp grassland (each 0.5ha in size)	This area of grassland is subject to periodic flooding, is grazed irregularly and is dominated by rushes (*Juncus spp.*). Meadow-grasses (*Poa spp.*) dominate the grass sward, with yorkshire-fog (*Holcus lanatus*) also present. The fields support a low diversity of common herb species. A limited assemblage of invertebrates was noted during the walkover surveys and no other records of animal or plant species exist for this area.	This small area of grassland is likely to be of some local importance for wildlife but lacks the diversity and other characteristics of a more valuable site and should therefore be valued as of Local Importance (lower value).	As set out in Section 3.4.1, in the context of national road projects ecological resources of below Local Importance (Higher Value) do not represent 'key ecological receptors' for which detailed assessment is required.
Relict demesne woodland approximately 40 Ha in size with mixed deciduous/ coniferous trees, an associated stream, and supporting rare/protected species.	This woodland contains a mix of native and non-native tree species including oak (*Quercus sp.*), ash, sycamore, beech (*Fagus sylvatica*), hazel (*Corylus avellana*) and yew (*Taxus baccata*). The ground flora is dominated by ivy with wood speedwell (*Veronica montana*), wood avens (*Geum urbanum*), dog-violet (*Viola riviniana*), wild angelica (*Angelica sylvestris*) and ramsons (*Allium ursinum*) also present. A moderately polluted (Q-value 3) stream, approximately 1m wide and 30cm deep runs through the woodland. Hairy St. John's wort (*Hypericum hirsutum*), a species legally protected under the Flora Protection Order, 1999, and green figwort (*Scrophularia umbrosa*) (listed in the Irish Red Data Book 1: Vascular Plants), have both been recorded near the stream in the recent past. There is a resident population of red squirrel present within the woodland and a 'main' badger sett has been found on one of the woodland boundaries. These species are protected under the Wildlife (Amendment) Act, 2000.	The site does not fulfill the relevant criteria for designation as a site of National Importance, nor is it likely to support protected species in nationally-important numbers. However, on the basis of the woodland's size and quality, the population of red squirrels is likely to be of County Importance in terms of its size. In addition, this represents a substantial area of semi-natural habitat with high intrinsic biodiversity. It also supports rare/declining species. On this basis, it should be valued as of County Importance.	As this site has been identified as being of County Importance, and a significant impact upon it is possible, it should be selected as a 'key ecological receptor' and as such requires detailed assessment.

Table 2: Examples of the valuation and selection of ecological receptors

Appendix 5.11 Impact Assessment Methodology

The impact significance for terrestrial and aquatic habitats has been assessed using the *Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM, 2006),* taking full cognisance of the NRA's *Guidelines for assessment of Ecological Impacts of National Road Schemes* (NRA, 2009a). Ecological Impact Assessment was undertaken for all Key Ecological Receptors (KER's are defined in the NRA guidelines (2009a), as "both of sufficient value to be material in decision making, and likely to be affected significantly". According to the NRA guidelines, KER's are of Local Importance (Higher Value) or higher as per NRA value criteria. Features of Local Importance (Lower Value) are not Key Ecological Receptors and are excluded from impact assessment. The Zone of Influence for each KER is defined in section 5.3.4, the criteria used to characterise impacts are outlined in the Table below.

Parameter	Categories
Type of impact	Positive/ Negative
Magnitude of impact	Size or amount of impact
Extent	Area over which impact occurs (may be the same as magnitude if whole habitat impacted)
Duration	Time over which impact is expected to last. For example, described as Short-term, Medium-term or Long-term in relation to relevant species/ habitat time-scales.
Reversibility	Temporary/ Permanent
Timing and frequency	Timing of impacts in relation to relevant life-stages or seasons
Likelihood of impact occurring	Near-certain: probability >95% Probable: probability 50-95% Unlikely probability 5-50% Extremely unlikely: probability <5%

Table of Magnitude Parameters

An impact is considered to be ecologically significant if it impacts the conservation status of a Key Ecological Receptor within a specified geographical area. If impacts are not found to be significant at the highest geographical level at which the Key Ecological Receptor has been valued using NRA Valuation Criteria (Appendix 5.10), then the impacts may be significant at a lower level. For instance, there may be a significant impact at a local level on a species which is valued at an international level. The highest levels of impact significance for each Key Ecological Receptor 'value' rating are shown in Table B.

Ecological Sensitive Receptor 'value' rating	Highest significance level
International Importance	Significant Positive/ Negative impact at International level
National Importance	Significant Positive/ Negative impact at National level
County Importance	Significant Positive/ Negative impact at County level
Local Importance (higher value)	Significant Positive/ Negative impact at Local level
Local Importance (lower value)	Significant Positive/ Negative impact at Local level

Table of Highest Levels of Impact Significance

Flora and fauna species have been evaluated in relation to the NRA criteria set out in Appendix 5.10 which includes for example legal protection they may be afforded (at International or National level), their conservation status and local abundance. For instance, a species that is listed on Annex II or IV of the EC Habitats Directive is considered to be of 'International' importance. As above, this does not mean that an impact will necessarily be significant at an International level.

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Appendix 5.12 Native Grassland Seed Mixes for Landscaped Areas

Product Name: Biodiversity Wildflower Meadow Mixture.

Product Code: WF03

Number of Species: 36

Description:
This Biodiverse mixture contains the very best wildflowers that will attract wildlife in abundance.
This all purpose wildflower seed mixture is best sown without grasses on small plots, < 1 acre.
In the long term, WF03 will tend to give an even colour throughout.
WF03 is a special mixture for any normal soil, moist or dry.
Suitable for most soils that are not overly acid or alkaline.
WF03 is a general mixture only, and not intended to be sown on very wet or very dry soils,

Mixture Specifications:
pH range: Suits all soils.
Aspect: Sunny
Life Cycle: Contains Cornfield Annuals, Perennials and Biennials .
Height Range: 30cm - 160cm
Flowering Period: May to August.
Fertility Range: Will grow on any soil, the less fertile the soil, the less cutting will be required.
Wintergreen: Moderate

Species List:
Birdsfoot Trefoil, Black Meddick, Cowslip, Devil's Bit Scabious, Meadow Buttercup, Field Scabious, Hemp Agrimony, Kidney Vetch, Lady's Bedstraw, Lesser Knapweed, Meadowsweet, Mullein, Ox-eye Daisy, Purple Loosestrife, Ragged Robin, Red Campion, Red Clover, Ribwort Plantain, Rough Hawksbit, Sorrel, St Johnswort, Wild Angelica, Wild Carrot, Wild Parsnip, Yarrow, Yellow Agrimony, Yellow Rattle, Salad Burnet.
20% annuals Corn Chamomile, Corn Marigold, Corn Poppy, Corncockle, Cornflower, Scented Mayweed,

Product Name: Wetland Wild Flora (Seasonally Flooded)

Product Code: EC05

Number of Species: 36

Description:

EC05 is a vigorous. medium tall mixture which can compete with the often fertile wetland soils on which many wetlands are situated.

Mixture Specifications:
Suitable for soil type: All types of wet soil Clay, Loam, Sand, Heavy Soil, and Peat, as long as it remains wet throughout the year. but not raised Peat Bog.,
Moisture Level: Moist, Very wet or flooded.
pH range: Best between 5.5 - 7.5
Morphology:
Aspect: Sunny, part shade and not Shaded.
Life Cycle: Annual / Biennial / Mostly Perennial.
Height Range: <30cm to >140cm
Flowering Period: Spring to May to September.
Fertility Range: Will grow in very fertile soil to poor, if very infertile apply fertiliser (see below).
Wintergreen: No.

Species List:
Devils Bit Scabious, Fleabane, Greater Trefoil, Hemp Agrimony, Lesser Knapweed, Marsh Marigold, Marsh Ragwort, Meadowsweet, Purple Loosestrife, Ragged Robin, Water Avens, Wild Angelica, Wild Valerian, Yellow Flag Iris,

Product Name: Meadow Mixture

Product Code: MM)9

Number of Species: 36

Description:
Meadow Mixture - MM09 - Dry Alkaline/Limey Soil attracts butterflies & is one of our most beautiful collections of flowers. In high summer its a field of blue and purple, orange and yellow
This mixture is a favourite amongst our customers as MM09 forms blocks of tall single species colour capable of surviving extreme drought.

Mixture Specifications:
Origin: Native Irish Origin, Wildflower Seed Mixture.
Moisture Level: For very dry soil, suits normal, but not moist or flooded wet.
pH range: Best between 6.5 - 7.9
Aspect: Sunny
Life Cycle: Annual / Biennial / Perennial.
Height Range: 30cm - 120cm
Flowering Period: May to August.
Fertility Range: The less fertile the soil, the less cutting will be required.
Wintergreen: Moderate

Species List:

Field Scabious, Kidney Vetch, Quaking-Grass, St Johnswort. Musk Mallow, Red Campion, Bladder Campion, White Campion, Wild Carrot, Wild Parsnip, Wild White Clover, Yarrow, Yellow Agrimony, Yellow Rattle, Meadow Buttercup, Salad Burnet, Birds-foot Trefoil, Black Meddick, Burdock, Century, Corn Chamomile, Corn Marigold, Corn Poppy, Corn Cockle, Cornflower, Cowslip, Lady's Bedstraw, Lesser Knapweed, Marjoram, Scented Mayweed, Mullein, Ox-eye Daisy, Purple Toadflax, Red Bartsia, Red Clover, Ribwort Plantain, Selfheal, Hawksbit.

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Appendix 5.13 Invasive Species for Exclusion from Landscaping Proposals

National Invasive Species Database

NATIONAL BIODIVERSITY DATA CENTRE
Documenting Ireland's Wildlife

Plant List

Taxon name	Common name	Sub-list designation		Habitat	Invasive
		ISI Risk assessment	Problematic Plant		
Azolla filiculoides	**Water Fern**	**ISI Most unwanted**	**Problematic Plant**	**Freshwater**	**Invasive**
Carpobrotus edulis	**Hottentot-fig**	**ISI Most unwanted**	**Problematic Plant**	**Terrestrial**	**Invasive**
Crassula helmsii	**New Zealand Pigmyweed**	**ISI Most unwanted**	**Problematic Plant**	**Freshwater**	**Invasive**
Elodea nuttallii	**Nuttall's Waterweed**	**ISI Most unwanted**	**Problematic Plant**	**Freshwater**	**Invasive**
Fallopia japonica	**Japanese Knotweed**	**ISI Most unwanted**	**Problematic Plant**	**Terrestrial**	**Invasive**
Gunnera tinctoria	**Giant-rhubarb**	**ISI Most unwanted**	**Problematic Plant**	**Terrestrial**	**Invasive**
Heracleum mantegazzianum	**Giant Hogweed**	**ISI Most unwanted**	**Problematic Plant**	**Terrestrial**	**Invasive**
Hydrocotyle ranunculoides	**Floating Pennywort**	**ISI Most unwanted**	**Problematic Plant**	**Freshwater**	**Invasive**
Impatiens glandulifera	**Himalayan Balsam**	**ISI Most unwanted**	**Problematic Plant**	**Terrestrial**	**Invasive**
Lagarosiphon major	**Curly Waterweed**	**ISI Most unwanted**	**Problematic Plant**	**Freshwater**	**Invasive**
Myriophyllum aquaticum	**Parrot's Feather**	**ISI Most unwanted**	**Problematic Plant**	**Freshwater**	**Invasive**
Rhododendron ponticum	**Rhododendron**	**ISI Most unwanted**	**Problematic Plant**	**Terrestrial**	**Invasive**
Sargassum muticum	**Wire Weed**	**ISI Most unwanted**	**-**	**Marine**	**Invasive**
Spartina anglica	**Common Cord-grass**	**ISI Most unwanted**	**Problematic Plant**	**Terrestrial**	**Invasive**
Acaena novae-zelandiae	Biddy Biddy/Pirri-pirri-bur	ISI Amber list	Problematic Plant	Terrestrial	
Acaena ovaliflolia	Two-Spined Acaena	ISI Amber list	Problematic Plant	Terrestrial	
Acer pseudoplatanus	Sycamore	ISI Amber list	-	Terrestrial	
Clematis vitalba	Traveller's Joy	ISI Amber list	-	Terrestrial	
Cornus sericea	Red Osier Dogwood	ISI Amber list	-	Terrestrial	
Cotoneaster horizontalis	Wall Cotoneaster	ISI Amber list	-	Terrestrial	
Cotoneaster integrifolius	Entire-leaved Cotoneaster	ISI Amber list	Problematic Plant	Terrestrial	
Crocosmia x crocosmiiflora	Montbretia	ISI Amber list	-	Terrestrial	
Fallopia sachalinensis	Giant Knotweed	ISI Amber list	-	Terrestrial	
Glyceria maxima	Reed Sweet-grass	ISI Amber list	-	Terrestrial	
Hippophae rhamnoides	Sea Buckthorn	ISI Amber list	-	Terrestrial	
Hyacinthoides hispanica	Spanish Bluebell	ISI Amber list	-	Terrestrial	
Hyacinthoides non-scripta x hispanica	none	ISI Amber list	-	Terrestrial	
Juncus planifolius	Broad-leaved Rush	ISI Amber list	Problematic Plant	Terrestrial	
Lagarus ovatus	Hare's-tail	ISI Amber list	Problematic Plant	Terrestrial	
Lemna minuta	Least Duckweed	ISI Amber list	Problematic Plant	Freshwater	
Libertia formosa	Chilean Iris	ISI Amber list	Problematic Plant	Terrestrial	
Lonicera japonica	Japanese Honeysuckle	ISI Amber list	-	Terrestrial	
Lupinus polyphyllus	Garden Lupin	ISI Amber list	-	Terrestrial	
Mycelis muralis	Wall Lettuce	ISI Amber list	-	Terrestrial	
Petasites fragrans	Water Heliotrope	ISI Amber list	-	Terrestrial	
Picea sitchensis	Stika Spruce	ISI Amber list	-	Terrestrial	
Pinus contorta	Lodgepole Pine	ISI Amber list	-	Terrestrial	
Prunus laurocerasus	Cherry-laurel	ISI Amber list	-	Terrestrial	
Rosa rugosa	Japanese Rose	ISI Amber list	-	Terrestrial	
Rubus spectabilis	Salmonberry	ISI Amber list	Problematic Plant	Terrestrial	
Sedum album	White Stonecrop	ISI Amber list	-	Terrestrial	
Stratiotes aloides	Water-soldier	ISI Amber list	Problematic Plant	Terrestrial	
Symphoricarpos albus	Snowberry	ISI Amber list	-	Terrestrial	
Acaena anserinifolia	Bronze Pirri-pirri-bur	-	Problematic Plant	Terrestrial	
Aponogeton distachyos	Cape-pondweed	-	Problematic Plant	Freshwater	
Cyperus eragrostis	Pale Galingale	-	Problematic Plant	Terrestrial	
Egeria densa	South American Waterweed	-	Problematic Plant	Freshwater	
Gaultheria mucronata	Prickly Heath	-	Problematic Plant	Terrestrial	
Gaultheria shallon	Shallon	-	Problematic Plant	Terrestrial	
Hottonia palustris	Water-violet	-	Problematic Plant	Freshwater	
Lysichiton americanus	Yellow Skunk-cabbage	-	Problematic Plant	Freshwater	
Nymphoides peltata	Fringed Water-lily	-	Problematic Plant	Freshwater	
Phormium tenax	New Zealand Flax	-	Problematic Plant	Terrestrial	
Sagittaria rigida	Canadian Arrowhead	-	Problematic Plant	Freshwater	
Sarracenia purpurea	Pitcherplant	-	Problematic Plant	Terrestrial	
Sasa palmata	Broad-leaved Bamboo	-	Problematic Plant	Terrestrial	
Senecio cineraria	Silver Ragwort	-	Problematic Plant	Terrestrial	
Sisyrinchium californicum	Yellow-eyed-grass	-	Problematic Plant	Terrestrial	
Note: *Ceratophyllum submersum* (Soft Hornwort) was included in the original Problematic Plant list but has since been classified as a native species and so is removed from this Priority List.					
http://invasivespecies.biodiversityireland.ie					

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scott cawley

DUNKETTLE INTERCHANGE IMPROVEMENT SCHEME.

LICENSE APPLICATION FOR DEROGATION FOR OTTER FROM BIRDS AND NATURAL HABITAT REGULATIONS 2011, IN ACCORDANCE WITH NPWS CIRCULAR 2/07

SUBMITTED ON BEHALF OF NATIONAL ROADS AUTHORITY

Rev.	Status	Author	Reviewed By	Approved By	Issue Date
00	FINAL	RF	AC	AC	09/07/2012

Scott Cawley, 27 Lower Baggot Street, Dublin 2, Ireland

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National Parks and Wildlife Service,
Main Street,
Ballybay,
Co Monaghan.
[Copied by email to:
-Divisional Ecologist Jervis good Jervis.Good@ahg.gov.ie , &
-District Conservation Officer Cyril Saich Cyril.Saich@ahg.gov.ie[

9th July 2012

Dear Sir/Madam

Scott Cawley Ltd. was appointed by the National Roads Authority to undertake the Ecological Impact Assessment (EcIA) and Appropriate Assessment for the Dunkettle Interchange Improvement Scheme in Cork City (hereafter the proposed development).

Please find attached a licence application for a derogation from Regulation 51 of the Birds and Natural habitat regulations 2011 in relation to an otter holt recorded during surveys for the proposed development.

In accordance with NPWS circular 2/07, this licence application has been made in advance of planning. The application has been included in an appendix of the ECIA.

The Environmental Impact Statement (EIS) for the proposed development including the EcIA will be published on 20th July for subsequent submission of in a planning application to An Bord Pleanala. On behalf of the NRA, we would welcome NPWS comment on the EIS, including this derogation licence application upon EIS submission

It should be noted that at the present time, the scientific agent, and contractor for the proposed development are unknown. However, acting on behalf of the National Roads Authority, Scott Cawley would be please to respond to any queries in relation to the attached license application.

Kind Regards

Robert Fennelly

Ecologist

Derogation Licence Application for Potential Otter Holt

Introduction

This document presents a proposed approach to mitigate the impacts of the proposed Dunkettle Interchange Improvement Scheme (hereafter 'the proposed development') upon Otters. This information supports an application for derogation from the European Communities (Birds and Natural Habitats) Regulations 2011. This derogation application is made in advance of seeking planning permission in accordance with NPWS guidelines '*Guidance on compliance with Regulation 23 of the Habitats Regulations 1997*' (NPWS Circular 2/07).

Otter surveys were undertaken as part of the survey work for the Ecological Impact Assessment for the proposed development in December 2010, and January, February, March and April 2011. This work was undertaken on behalf of the National Roads Authority.

Methodology and Results

Otter surveys were undertaken with regard to the following guidelines:

- *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (NRA, 2006).*

Watercourses and intertidal features were surveyed 250 metres either side of the centreline of the proposed development for signs of Otter. Evidence of Otter activity was noted in the form of spraints, prints, holts and couches (resting areas on river banks). Where holts were encountered they were described and their locations mapped.

All main watercourses within the vicinity of the proposed development were considered to have the potential to be used by Otter for foraging and commuting. Table 1 shows the Otter holts, located within 250m of the proposed development, that were recorded during the surveys. Figure: Otter Activity 2010/2011 illustrates the locations of both holts, and other otter activity recorded.

Status	Location, Link and Chainage	GPS Location (Irish National Grid)	Distance from landtake (m)	Description
Potential Holt	North Esk, Link H (Ch. 330)	W739 724	40m (West)	Two entrances have been dug in a hedgebank and treeline surrounded by intertidal mudflat and upper saltmarsh habitat. Holes are separated by c. 5m. Footprints were recorded in nearby muds on several occasions in spring/summer 2012. A dead otter carcass was found floating in nearby mud flats on a rising tide immediately north of the holes here in May 2011. Cause of death is unknown but is likely to have been a road collision, or accidental poisoning. Infrared camera monitoring from 28th May-1st June 2011 & 15th-21st July 2011 failed to confirm use by otter. However otter usage of holts can be very transitory with large numbers of holts in each territory, so a precautionary approach has assumed status as a potential holt.
Confirmed Holt	Glanmire Roundabout (Roundabout AA)	W727 726	210m (West)	A single naturally formed hole is located below the existing roundabout on the western bank of Glashaboy River Mouth, on the southern side of the existing carriageway. The hole is located where the rock armour meets the concrete pier. Confirmed as occupied and active in 2011 by the presence of a large latrine, and a sighting of an Otter cub exiting the hole. This is considered a major historical breeding holt for east Cork (Dr. Tom Kelly, Pers. Comm.), and is one of only 4 known holts in Cork City (Sleeman & Moore, 2005).

Table 1 Otter Holts within 250m of Proposed Development

Proposed Mitigation Strategy

Mitigation measures that the contractor must follow are summarised below; refer to the above NRA guidelines for full details:

- *Pre-construction Otter surveys of the North Esk holt, located within 150m of the proposed development;*
- *Temporary exclusion of the North Esk holt prior to construction, where there may be temporary disturbance from piling, use of tracked machinery or other earthworks ;*
- *Specification of distances within which work will not be undertaken if breeding females or cubs found in North Esk holt during pre-construction surveys;*
- *Specification of distances within which different categories of work will not be undertaken if the North Esk holt is found to be a non-breeding holt (differs for use of wheeled/tracked machinery and hand digging);*
- *Protection (e.g. fencing) of holts and prohibited working areas;*
- *Clear identification (e.g. signing) of holts and prohibited working areas; and*
- *Fencing of relevant areas of the proposed development to prevent Otters from crossing a road at unsafe locations. This will help to guide them to underpass locations were they can cross under the road safely.*

Aside from the temporary exclusion, in relation to watercourse crossings, the mitigation set out in Figure 32102600/EIS/Figure 5.1.9, and specified in the EcIA will be specified in the contractor's method statement. Regard will also be had to the NRA (2005) *Guidelines for the crossing of watercourses during the construction of National Road Schemes*. Please ignore the items of mitigation in 32102600/EIS/Figure 5.1.9 not relating to Otter (Hedgehog and Breeding Bird Nest boxes etc.)

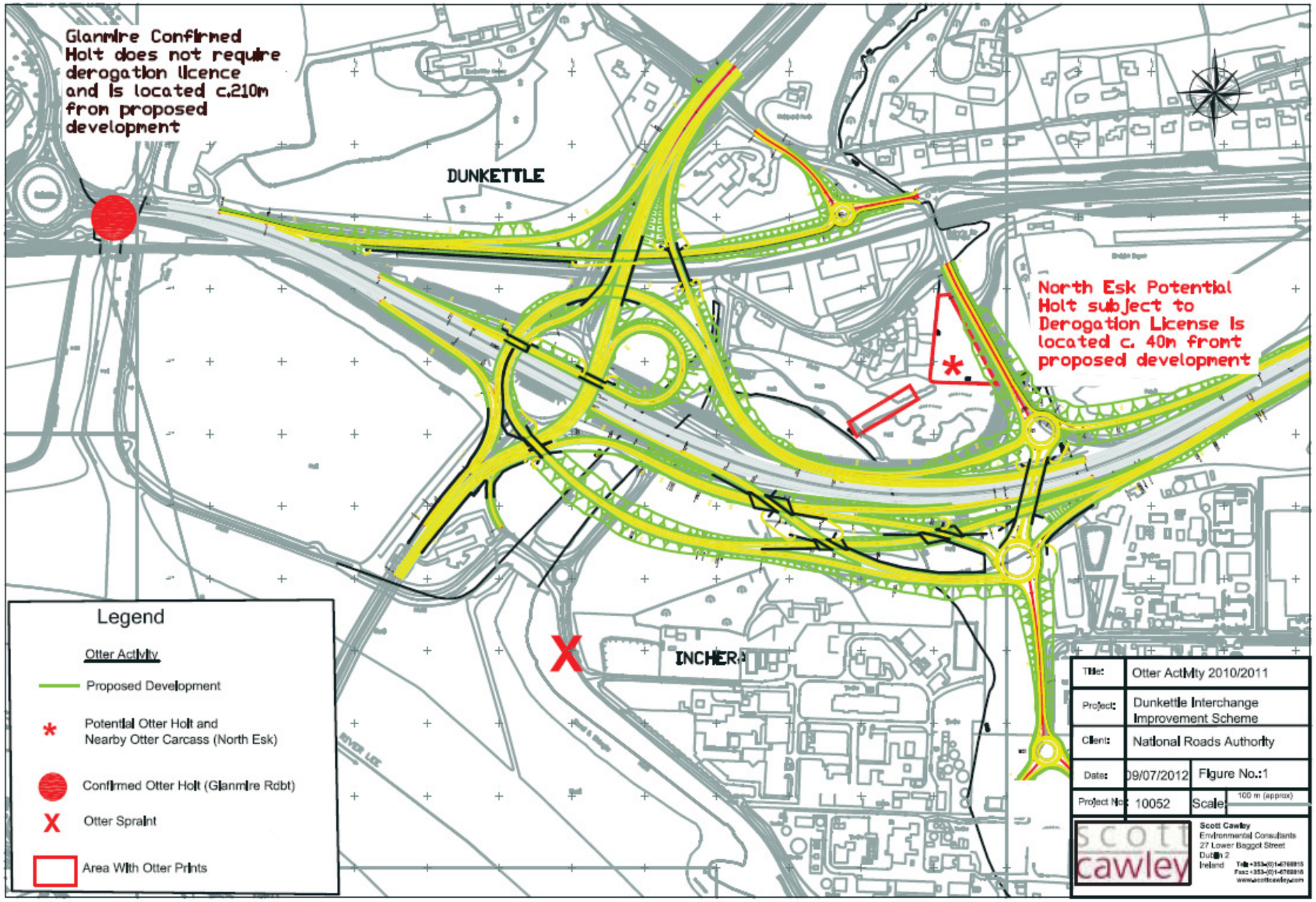
- *Inclusion of dry culverts, suitable for Otter passage at likely mammal crossing points (see Figure 32102600/EIS/Figure 5.1.9).* As set out in the EcIA, the underpass will be constructed in accordance with NRA guidelines (2006a) as follows:
-
    - *At least 600mm wide;*
    - *At least 600mm headroom; and*
    - *At least 150mm above the 1 in 5 year flood event.*

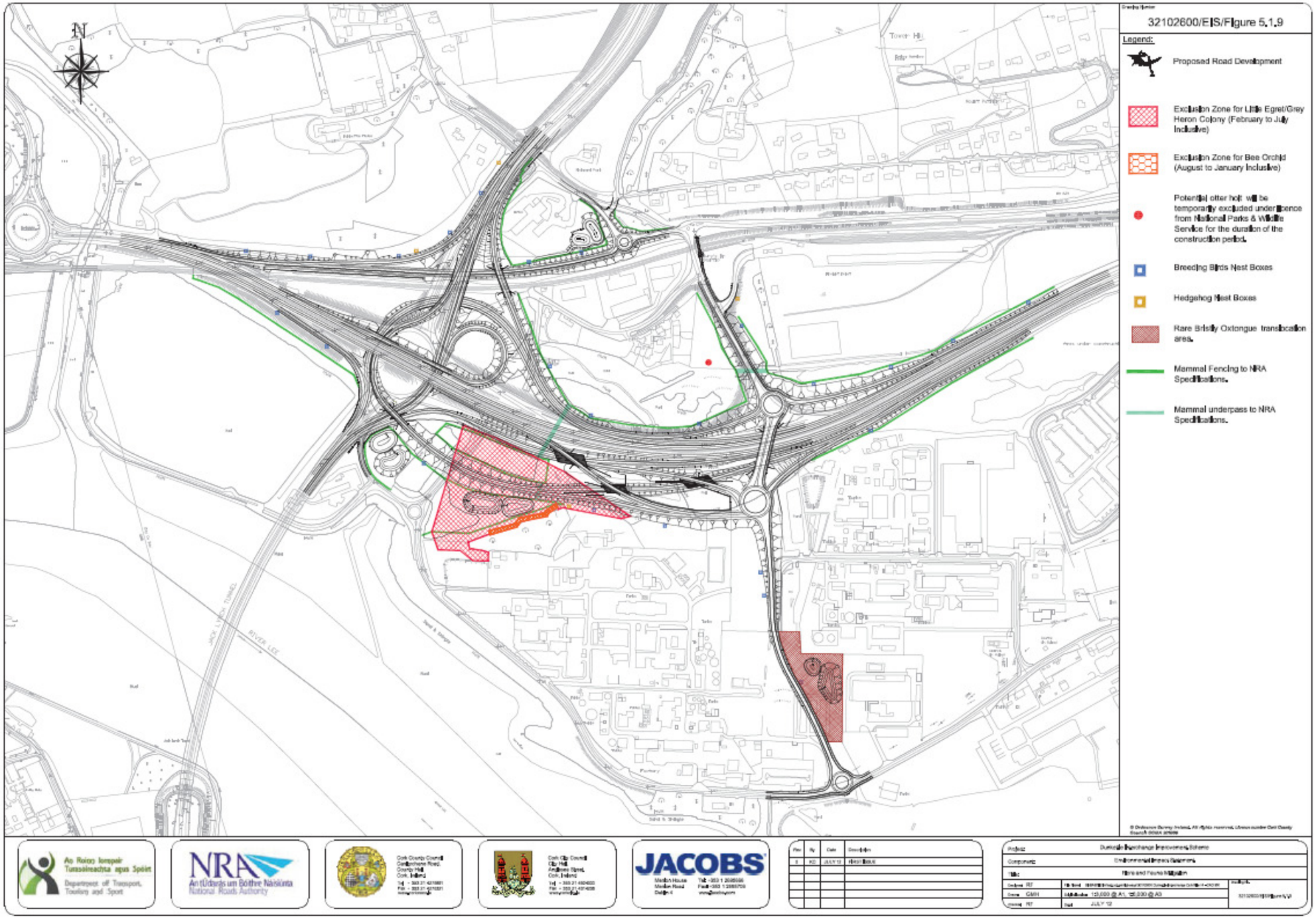
- *Inclusion of ramps for access to ledges or dry culverts, where required (see Figure 32102600/EIS/Figure 5.1.9);*
- *Mammal fencing to guide Otters to dry culverts as specified in Figure 32102600/EIS/Figure 5.1.9; and*
- *Landscape planting to guide Otters to dry culverts as specified in the EcIA.*

Monitoring

Monitoring will be undertaken during the period following construction, prior to road operation, and will ensure that otters and their holts are adequately protected by confirming appropriate design of underpasses, ramps, fencing, and lead-in planting to underpasses (as set out in the EcIA).

Once the licence has been received the licensee will be responsible for implementing all monitoring requirements and for the associated reporting requirements to the NPWS.


Glanmire Confirmed Holt does not require derogation licence and is located c.210m from proposed development
DUNKETTLE
North Esk Potential Holt subject to Derogation License is located c. 40m front proposed development
INCHER
Legend
Otter Activity
Proposed Development
Potential Otter Holt and Nearby Otter Carcass (North Esk)
Confirmed Otter Holt (Glanmire Rdbt)
Otter Spraint
Area With Otter Prints
Title: Otter Activity 2010/2011
Project: Dunkettle Interchange Improvement Scheme
Client: National Roads Authority
Date: 09/07/2012
Figure No.: 1
Project No: 10052
Scale: 100 m (approx)
scott cawley
Scott Cawley
Environmental Consultants
27 Lower Baggot Street
Dublin 2
Ireland


32102600/EIS/Figure 5.1.9
Legend:
Proposed Road Development
Exclusion Zone for Little Egret/Grey Heron Colony (February to July Inclusive)
Exclusion Zone for Bee Orchid (August to January Inclusive)
Potential otter holt will be temporarily excluded under licence from National Parks & Wildlife Service for the duration of the construction period.
Breeding Birds Nest Boxes
Hedgehog Nest Boxes
Rare Bristly Oxtongue translocation area.
Mammal Fencing to NRA Specifications.
Mammal underpass to NRA Specifications.
N
Tower Hill
RIVER LEE
JACOBS
NRA
An Údarás um Bóithre Náisiúnta
National Roads Authority
Department of Transport, Tourism and Sport
Cork County Council
Cork City Council

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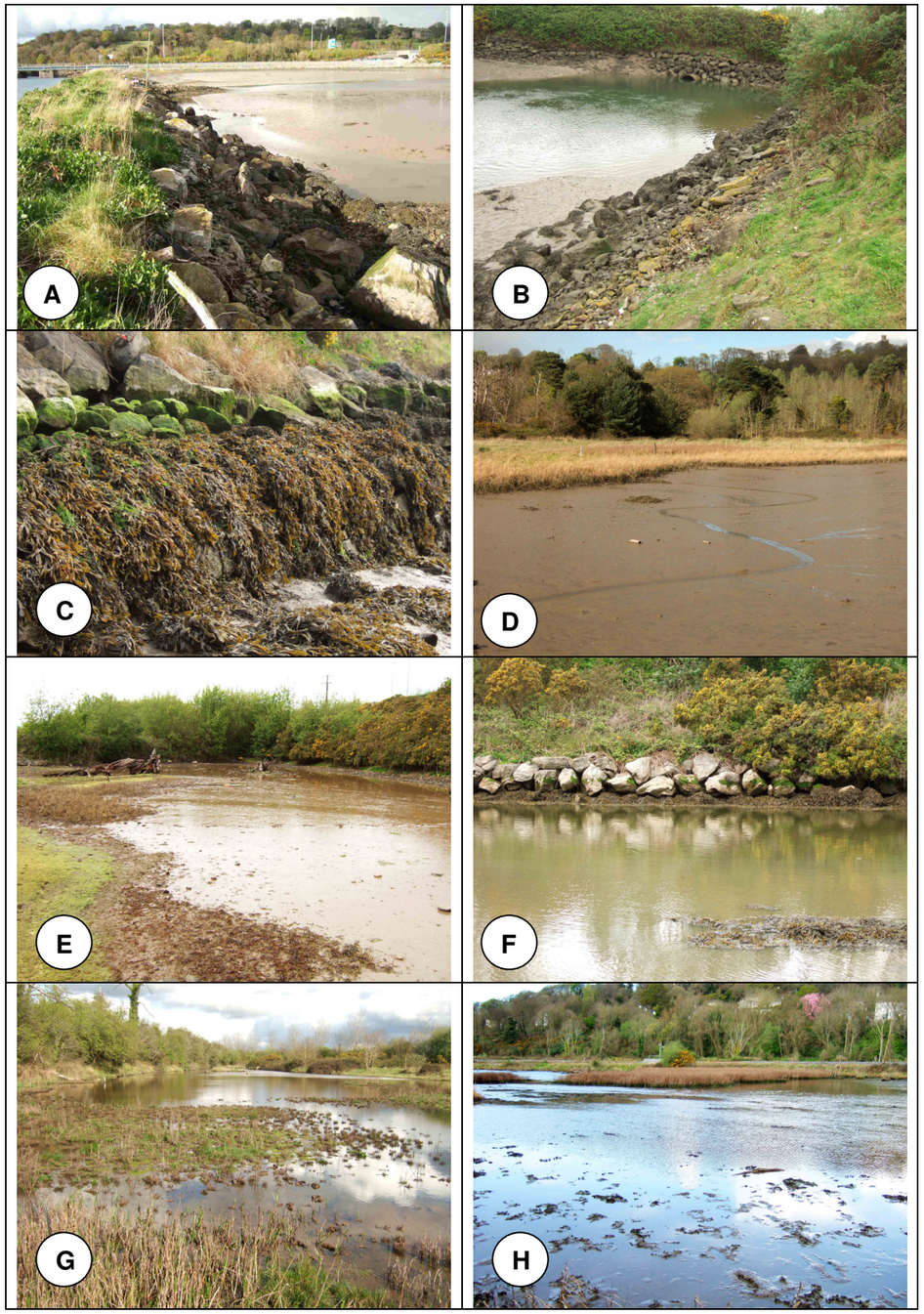

Plate 1 Intertidal Habitats A (WF1-view to of western embankment); B (WF2-view toward outlet culvert from western shore); C, (WF3 – view of northern inlet area dominated by *Fucus ceranoides*); D (WF4 – view to north from south eastern shore); E (WF5 – view toward western end); F (WF6 – view of northern shore); G (WF7-view from western end); H (WF8-general view to NW of mid to eastern end)

Plate 2 Freshwater stream (WF10) flowing into the north Esk intertidal mudflat. This 1st order stream had some habitat for juvenile lampreys but lampreys were not recorded.

Plate 3 Freshwater stream (WF10) approximately 1km upstream of the north Esk mudflats is of little/no value to trout due to its small size.

Plate 4 Shrimp *Crangon* sp. were recorded at most intertidal areas. These macroinvertebrates are an important source of food for predatory fish species including bass and sea trout, species not recorded in the study area.

Plate 5 Flounder *Platichthys flesus* recorded in the Glashaboy Estuary. This Estuary is an important nursery for this species.

Plate 6 Adult Thick-lipped Grey Mullet *Chelon labrosus* seen here in the channel (WF11) draining the Pfizer intertidal mudflat to the north of the Pfizer plant. Adults feed on algae, vegetal detritus and sediment. Thick-lipped Mullet are extremely hardy and pollution tolerant.

Plate 7 Juvenile Thick-lipped grey Mullet were recorded in the Glashaboy Estuary. This species spawns in coastal areas. Young fish migrate to coastal lagoons and estuaries in April-June, feeding on zooplankton.

Plate 8 Common Goby *Pomatoschistus microps* was recorded in the channel (WF12) linking the Iarnrod Eireann intertidal mudflat to Lough Mahon. Common Goby is listed as a protected fauna species under Appendix III of the Bern Convention and has been assessed as 'Least Concern' by the IUCN. This species is locally abundant in estuaries around the Irish coast. There are no known major threats to this species at present.

Plate 9 Bristly Oxtongue on margin of WF15 BASF Watercourse (W7403 720).Nationally Rare plant of county importance

Plate 10 Nationally Rare Sweet Briar Plant located in woodland plantation atop the Jack Lynch Tunnel (W732 723)

Plate 11 Confirmed Otter Holt below bridge at Dunkettle Roundabout to the west of the proposed development.

Plate 12 Infrared camera setup adjacent to potential Otter Holt in earth bank at North Esk (W739 724). Both holes screened by grass in photo.

Plate 13 One of two holes at North Esk potential holt.

Plate 14 Dead otter beside potential holt at North Esk.

Plate 15 View south near existing N25 of Dunkettle Shore pNHA Wood. Approximate location of Little Egret/Grey Heron colony shown by white line.

Plate 15 Close-up of Holm Oak containing several nests.

Plate 16 View from west of Soprano Pipistrelle Roost (BR1) near N8 in Dunkettle Estate

Appendix 6.1 Baseline Water Quality Sampling Results Summary

Analyte	Units	EC Env Obj (Surface Waters) Reg 2009	WF13 Pond Pond	WF10 WC1	WF12 Low WC2 Low	WF12 Mid WC2 Mid	WF12 High WC2 High	WF11 Low WC3 Low	WF11 Mid WC3 MID	WF11 High WC3 High	WF0 Low Site 0 Low	WF0 Mid Site 0 Mid	WF0 High Site 0 High
pH	*	See Note 2	8.664	7.601	8.032	8.226	8.46	NSP	7.959	7.887	8.895	8.006	8.692
DO	mg/l	See Note 3	9.37	9.13	6.72	5.62	7.72	NSP	7.22	7.43	7.35	5.81	7.94
Conductivity in field	ms/cm	See Note 1	3.14	35.9	13.83	29.5	25	NSP	25.4	11.44	34.8	40	31.4
Temperature	degreesC	See Note 4	13.1	11	11.4	10.6	14	NSP	12.5	14.1	11.7	10.2	13.9
Copper, Filtered as Cu	mg/l	0.005	<0.009	<0.009	<0.009	<0.009	<0.009	NSP	<0.009	<0.009	<0.009	<0.009	<0.009
Zinc, Total as Zn	mg/l	0.04	<0.018	<0.018	<0.018	<0.018	<0.018	NSP	<0.018	<0.018	<0.018	<0.018	<0.018
Total Hardness as CaCO3	mg/l	See Note 1	391	187	1720	3820	4020	NSP	3460	4650	4510	5570	4000
Ammoniacal Nitrogen as N	mg/l	See Note 1	<0.27	<0.27	<0.27	<0.27	<0.27	NSP	<0.27	<0.27	<0.27	<0.27	<0.27
Nitrate as N	mg/l	See Note 1	1.4	7.1	0.8	<0.4	<0.4	NSP	<0.4	<0.4	<0.4	<0.4	<0.4
Phosphate, Ortho as P	mg/l	<0.06	<1.2	1.3	<1.2	<1.2	<1.2	NSP	<1.2	<1.2	<1.2	<1.2	<1.2
Suspended Solids	mg/l	See Note 1	16	5	17	34	29	NSP	21	31	26	54	28
BOD + ATU (5 day)	mg/l	≤ 4.0 mg/l (95%ile)	6	<1	2	3	<1	NSP	<1	1	<1	<1	<1
TPH (EH >C6 - C40)	ug/l	See Note 1	<10	<10	<20	<10	<10	NSP	<10	<10	<10	<10	<10
EH >C6 - C8	ug/l	See Note 1	<10	<10	<20	<10	<10	NSP	<10	<10	<10	<10	<10
EH >C8 - C10	ug/l	See Note 1	<10	<10	<20	<10	<10	NSP	<10	<10	<10	<10	<10
EH >C16 - C24	ug/l	See Note 1	<10	<10	<20	<10	<10	NSP	<10	<10	<10	<10	<10
EH >C10 - C16	ug/l	See Note 1	<10	<10	<20	<10	<10	NSP	<10	<10	<10	<10	<10
EH >C24 - C40	ug/l	See Note 1	<10	<10	<20	<10	<10	NSP	<10	<10	<10	<10	<10

Analyte	Units	EC Env Obj (Surface Waters) Reg 2009	WF1 Low Site 1 Low	WF1 Mid Site 1 Med	WF1 High Site 1 High	WF2 Low Site 2 Low	WF2 Mid Site 2 Med	WF2 High Site 2 High	WF3 Low Site 3 Low	WF3 Mid Site 3 Mid	WF3 High Site 3 High
pH	*	See Note 2	8.598	8.105	8.325	8.762	8.45	8.739	8.385	8.198	8.493
DO	mg/l	See Note 3	8.14	6.44	5.54	7.5	6.07	8.92	7.47	6.89	8.16
Conductivity in field	ms/cm	See Note 1	30.5	32	33.3	33.1	37.8	37.1	16.08	29.3	37.1
Temperature	degreesC	See Note 4	10.6	9.7	12.3	12	10.4	12.8	11	10.9	12.1
Copper, Filtered as Cu	mg/l	0.005	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Zinc, Total as Zn	mg/l	0.04	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
Total Hardness as CaCO3	mg/l	See Note 1	4830	4050	5750	4690	5120	6110	2140	3840	6040
Ammoniacal Nitrogen as N	mg/l	See Note 1	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27	<0.27
Nitrate as N	mg/l	See Note 1	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Phosphate, Ortho as P	mg/l	<0.06	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
Suspended Solids	mg/l	See Note 1	31	15	33	18	26	33	19	36	39
BOD + ATU (5 day)	mg/l	≤ 4.0 mg/l (95%ile)	<1	<1	<1	<1	<1	<1	<1	<1	<1
TPH (EH >C6 - C40)	ug/l	See Note 1	<10	<10	<10	<10	<10	<10	30	<10	<10
EH >C6 - C8	ug/l	See Note 1	<10	<10	<10	<10	<10	<10	<10	<10	<10
EH >C8 - C10	ug/l	See Note 1	<10	<10	<10	<10	<10	<10	<10	<10	<10
EH >C16 - C24	ug/l	See Note 1	<10	<10	<10	<10	<10	<10	<10	<10	<10
EH >C10 - C16	ug/l	See Note 1	<10	<10	<10	<10	<10	<10	<10	<10	<10
EH >C24 - C40	ug/l	See Note 1	<10	<10	<10	<10	<10	<10	30	<10	<10

Notes

NSP No Sample Possible due to low water
1 No standard
2 No standard for transistional waters
3 (0 psu) 95%ile > 70% saturation
(35 psu) 95%ile > 80% saturation
4 Not greater than a 1.5°C rise in ambi

Analyte	Units	EC Env Obj (Surface Waters) Reg 2009	Low Site 4 Low	WF4 Mid Site 4 Mod	High Site 4 High	Low Site 5 Low	WF5 Mid Site 5 Mod	High Site 5 High	Low Site 6 Low	WF6 Mid Site 6 Mod	High Site 6 High
pH	*	See Note 2	NSP	NSP	8.371	NSP	NSP	8.352	NSP	NSP	8.167
DO	mg/l	See Note 3	NSP	NSP	7.63	NSP	NSP	9.28	NSP	NSP	7.8
Conductivity in field	ms/cm	See Note 1	NSP	NSP	35.3	NSP	NSP	36.4	NSP	NSP	28.4
Temperature	degreesC	See Note 4	NSP	NSP	13	NSP	NSP	12.6	NSP	NSP	13.5
Copper, Filtered as Cu	mg/l	0.005	NSP	NSP	<0.009	NSP	NSP	<0.009	NSP	NSP	<0.009
Zinc, Total as Zn	mg/l	0.04	NSP	NSP	<0.018	NSP	NSP	<0.018	NSP	NSP	<0.018
Total Hardness as CaCO3	mg/l	See Note 1	NSP	NSP	5290	NSP	NSP	5360	NSP	NSP	3390
Ammoniacal Nitrogen as N	mg/l	See Note 1	NSP	NSP	<0.27	NSP	NSP	0.41	NSP	NSP	0.27
Nitrate as N	mg/l	See Note 1	NSP	NSP	<0.4	NSP	NSP	<0.4	NSP	NSP	<0.4
Phosphate, Ortho as P	mg/l	<0.06	NSP	NSP	<1.2	NSP	NSP	<1.2	NSP	NSP	<1.2
Suspended Solids	mg/l	See Note 1	NSP	NSP	31	NSP	NSP	24	NSP	NSP	20
BOD + ATU (5 day)	mg/l	≤ 4.0 mg/l (95%ile)	NSP	NSP	<1	NSP	NSP	<1	NSP	NSP	<1
TPH (EH >C6 - C40)	ug/l	See Note 1	NSP	NSP	<10	NSP	NSP	<10	NSP	NSP	<10
EH >C6 - C8	ug/l	See Note 1	NSP	NSP	<10	NSP	NSP	<10	NSP	NSP	<10
EH >C8 - C10	ug/l	See Note 1	NSP	NSP	<10	NSP	NSP	<10	NSP	NSP	<10
EH >C16 - C24	ug/l	See Note 1	NSP	NSP	<10	NSP	NSP	<10	NSP	NSP	<10
EH >C10 - C16	ug/l	See Note 1	NSP	NSP	<10	NSP	NSP	<10	NSP	NSP	<10
EH >C24 - C40	ug/l	See Note 1	NSP	NSP	<10	NSP	NSP	<10	NSP	NSP	<10

Notes

Analyte	Units	EC Env Obj (Surface Waters) Reg 2009	Low Site 7 Low	WF7 Mid Site 7 Mid	High Site 7 High	Low Site 8 Low	WF8 Mid Site 8 Mod	High Site 8 High
pH	*	See Note 2	8.726	8.524	8.435	NSP	NSP	NSP
DO	mg/l	See Note 3	7.75	5.82	7.04	NSP	NSP	NSP
Conductivity in field	ms/cm	See Note 1	34.2	38.1	35.7	NSP	NSP	NSP
Temperature	degreesC	See Note 4	13.1	10.6	14.7	NSP	NSP	NSP
Copper, Filtered as Cu	mg/l	0.005	<0.009	<0.009	<0.009	NSP	NSP	<0.009
Zinc, Total as Zn	mg/l	0.04	<0.018	<0.018	<0.018	NSP	NSP	<0.018
Total Hardness as CaCO3	mg/l	See Note 1	4380	5170	4110	NSP	NSP	2720
Ammoniacal Nitrogen as N	mg/l	See Note 1	0.31	0.35	<0.27	NSP	NSP	<0.27
Nitrate as N	mg/l	See Note 1	<0.4	<0.5	<0.4	NSP	NSP	<0.4
Phosphate, Ortho as P	mg/l	<0.06	<1.2	<1.3	<1.2	NSP	NSP	<1.2
Suspended Solids	mg/l	See Note 1	20	28	29	NSP	NSP	18
BOD + ATU (5 day)	mg/l	≤ 4.0 mg/l (95%ile)	<1	<1	<1	NSP	NSP	1
TPH (EH >C6 - C40)	ug/l	See Note 1	<10	16	<10	NSP	NSP	<10
EH >C6 - C8	ug/l	See Note 1	<10	<10	<10	NSP	NSP	<10
EH >C8 - C10	ug/l	See Note 1	<10	<10	<10	NSP	NSP	<10
EH >C16 - C24	ug/l	See Note 1	<10	<10	<10	NSP	NSP	<10
EH >C10 - C16	ug/l	See Note 1	<10	<10	<10	NSP	NSP	<10
EH >C24 - C40	ug/l	See Note 1	<10	16	<10	NSP	NSP	<10

Notes

NSP No Sample Possible due to low water
1 No standard
2 No standard for transistional waters
3 (0 psu) 95%ile > 70% saturation
(35 psu) 95%ile > 80% saturation
4 Not greater than a 1.5°C rise in ambi

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Analytical Services
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Ms Kiernan
Jacobs
Merrion House
Merrion Road
Dublin DUBLIN 4

13 April 2012

Test Report: COV/848151/2012

Dear Ms Kiernan

Analysis of your sample(s) submitted on 23 March 2012 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out is included with this report.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using Severn Trent Services and we look forward to receiving your next samples.

Yours Sincerely,

Signed:

Name: J. Fell

Title: Chemistry Operations Manager

Report Summary

SEVERN TRENT SERVICES

Ms Sarah Kiernan
Jacobs
Merrion House
Merrion Road
Dublin
DUBLIN 4

Date of Issue: **13 April 2012**

Report Number: COV/848151/2012 Issue **1**

Job Description: Surface Water: Cork

Job Location: Dunkettle

Number of Samples included in this report **5**

Job Received: **23 March 2012**

Number of Test Results included in this report **80**

Analysis Commenced: **23 March 2012**

Signed:

Name: **J. Fell** Date: **13 April 2012**

Title: **Chemistry Operations Manager**

Severn Trent Services
Analytical Services, Torrington Avenue, Coventry, CV4 9GU
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Page 1 of 6

Certificate of Analysis

SEVERN TRENT SERVICES

Report Number: COV/848151/2012
Laboratory Number: 12921462

Issue 1
Sample 1 of 5

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: WC1
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.4	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	354	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	187	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	7.1	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	1.3	mg/l	Y	Cov	WAS036
Suspended Solids	5	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921462: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised. Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, Sl = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected. For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell
Name: J. Fell
Date: 13 April 2012
Title: Chemistry Operations Manager

Severn Trent Services
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Certificate of Analysis

SEVERN TRENT SERVICES

Report Number: COV/848151/2012
Laboratory Number: 12921463

Issue 1
Sample 2 of 5

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 2 Low
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	29700	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	4690	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	18	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921463: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, Sl = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected. For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell
Name: J. Fell
Date: 13 April 2012
Title: Chemistry Operations Manager

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Certificate of Analysis

SEVERN TRENT SERVICES

Report Number: COV/848151/2012
Laboratory Number: 12921464

Issue 1
Sample 3 of 5

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 1 Low
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.1	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	31900	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	4830	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	31	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921464: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, Sl = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected. For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
IS=Insufficient sample

Signed: JFell
Name: J. Fell
Date: 13 April 2012
Title: Chemistry Operations Manager

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Certificate of Analysis

SEVERN TRENT SERVICES

Report Number: COV/848151/2012
Laboratory Number: 12921465

Issue 1
Sample 4 of 5

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 0 Low
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	29700	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	4510	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	26	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921465: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, Sl = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected. For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
IS=Insufficient sample

Signed: JFell
Name: J. Fell
Date: 13 April 2012
Title: Chemistry Operations Manager

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Certificate of Analysis

SEVERN TRENT SERVICES

UKAS 1314 1229 0897 4409

Report Number: COV/848151/2012
Laboratory Number: 12921466

Issue 1
Sample 5 of 5

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 8 High
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	7.9	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	19900	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	2720	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	18	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921466: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell

Name: J. Fell
Date: 13 April 2012
Title: Chemistry Operations Manager

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Analytical Services
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www.stsanalytical.com

Ms Kiernan
Jacobs
Merrion House
Merrion Road
Dublin DUBLIN 4

12 April 2012

Test Report: COV/848152/2012

Dear Ms Kiernan

Analysis of your sample(s) submitted on 23 March 2012 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using Severn Trent Services and we look forward to receiving your next samples.

Yours Sincerely,

Signed: JFell

Name: J. Fell

Title: Chemistry Operations Manager

Report Summary

UKAS 1314 1229 0897 4409

SEVERN TRENT SERVICES

Ms Sarah Kiernan
Jacobs
Merrion House
Merrion Road
Dublin
DUBLIN 4

Date of Issue: **12 April 2012**

Report Number: **COV/848152/2012** Issue **1**

Job Description: Surface Water: Cork

Job Location: Dunkettle

Number of Samples included in this report **4**

Job Received: **23 March 2012**

Number of Test Results included in this report **64**

Analysis Commenced: **23 March 2012**

Signed: JFell

Name: **J. Fell** Date: **12 April 2012**

Title: **Chemistry Operations Manager**

Severn Trent Services was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. The results relate only to the items tested.
Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

Severn Trent Services
Analytical Services, Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

Certificate of Analysis

UKAS 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848152/2012 Issue 1
Laboratory Number: 12921467 Sample 1 of 4

Sample Source: **Jacobs**
Sample Point Description: **Jacobs**
Sample Description: **WC2 High**
Sample Matrix: **Surface waters**
Sample Date/Time: **22 March 2012**
Sample Received: **23 March 2012**
Analysis Complete: **12 April 2012**

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	7.9	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	27100	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	4020	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	29	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921467: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell

Name: **J. Fell** Date: **12 April 2012**

Title: **Chemistry Operations Manager**

Severn Trent Services
Analytical Services, Torrington Avenue, Coventry, CV4 9GU
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Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848152/2012 Issue 1
Laboratory Number: 12921468 Sample 2 of 4

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Pond
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 12 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	2070	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	391	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	1.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	16	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	6	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921468: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 12 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848152/2012 Issue 1
Laboratory Number: 12921469 Sample 3 of 4

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: WC3 High
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 12 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	7.9	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	29600	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	4650	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	31	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921469: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 12 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848152/2012
Laboratory Number: 12921470

Issue 1
Sample 4 of 4

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 7 High
Sample Matrix: Surface waters
Sample Date/Time: 22 March 2012
Sample Received: 23 March 2012
Analysis Complete: 12 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	7.9	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	26800	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	4110	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	29	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921470: This sample has been analysed for Nitrate as N outside recommended stability times. It is therefore possible that the results provided may be compromised.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell

Name: J. Fell Date: 12 April 2012
Title: Chemistry Operations Manager

Severn Trent Services
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Analytical Services
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www.stsanalytical.com

Ms Kiernan
Jacobs
Merrion House
Merrion Road
Dublin DUBLIN 4

13 April 2012

Test Report: COV/848153/2012

Dear Ms Kiernan

Analysis of your sample(s) submitted on 23 March 2012 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out is included with this report.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using Severn Trent Services and we look forward to receiving your next samples.

Yours Sincerely,

Signed: JFell

Name: J. Fell

Title: Chemistry Operations Manager

Report Summary

UKAS 1314 1229 0897 4409

SEVERN TRENT SERVICES

Ms Sarah Kiernan
Jacobs
Merrion House
Merrion Road
Dublin
DUBLIN 4

Date of Issue: **13 April 2012**

Report Number: **COV/848153/2012** Issue **1**

Job Description: Surface Water: Cork

Job Location: Dunkettle

Number of Samples included in this report **7**

Job Received: **23 March 2012**

Number of Test Results included in this report **112**

Analysis Commenced: **23 March 2012**

Signed: JFell

Name: **J. Fell** Date: **13 April 2012**

Title: **Chemistry Operations Manager**

Severn Trent Services was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. The results relate only to the items tested.
Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

Severn Trent Services
Analytical Services, Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

Certificate of Analysis

UKAS 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848153/2012 Issue 1
Laboratory Number: 12921471 Sample 1 of 7

Sample Source: **Jacobs**
Sample Point Description: **Jacobs**
Sample Description: **Site 0 High**
Sample Matrix: **Surface waters**
Sample Date/Time: **21 March 2012**
Sample Received: **23 March 2012**
Analysis Complete: **13 April 2012**

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.1	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	25800	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	4000	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	28	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921471: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell

Name: **J. Fell** Date: **13 April 2012**

Title: **Chemistry Operations Manager**

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SEVERN TRENT SERVICES

Report Number: COV/848153/2012 Issue 1
Laboratory Number: 12921472 Sample 2 of 7

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 1 High
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.1	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	34500	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	5750	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	33	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921472: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

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Certificate of Analysis

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SEVERN TRENT SERVICES

Report Number: COV/848153/2012 Issue 1
Laboratory Number: 12921473 Sample 3 of 7

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 2 High
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	35900	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	6110	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	33	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921473: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

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SEVERN TRENT SERVICES

Report Number: COV/848153/2012 Issue 1
Laboratory Number: 12921474 Sample 4 of 7

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 3 High
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	35900	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	6040	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	39	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921474: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Severn Trent Services
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Certificate of Analysis

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SEVERN TRENT SERVICES

Report Number: COV/848153/2012 Issue 1
Laboratory Number: 12921475 Sample 5 of 7

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 4 High
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	31900	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	5290	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	31	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921475: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Severn Trent Services
Analytical Services, Torrington Avenue, Coventry, CV4 9GU
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Certificate of Analysis

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SEVERN TRENT SERVICES

Report Number: COV/848153/2012
Laboratory Number: 12921476

Issue 1
Sample 6 of 7

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 5 High
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	33600	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	5360	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	0.41	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	24	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921476: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell

Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Severn Trent Services
Analytical Services, Torrington Avenue, Coventry, CV4 9GU
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Certificate of Analysis

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SEVERN TRENT SERVICES

Report Number: COV/848153/2012
Laboratory Number: 12921477

Issue 1
Sample 7 of 7

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 6 High
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
pH	8.0	pH units	Y	Cov	WAS039
Conductivity- Electrical 20C	23800	uS/cm	Y	Cov	WAS039
Total Hardness as CaCO3	3390	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	20	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921477: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell

Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Severn Trent Services
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www.stsanalytical.com

Ms Kiernan
Jacobs
Merrion House
Merrion Road
Dublin DUBLIN 4

13 April 2012

Test Report: COV/848154/2012

Dear Ms Kiernan

Analysis of your sample(s) submitted on 23 March 2012 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using Severn Trent Services and we look forward to receiving your next samples.

Yours Sincerely,

Signed:

Name: J. Fell

Title: Chemistry Operations Manager

Report Summary

UKAS 1314 1229 0897 4409

SEVERN TRENT SERVICES

Ms Sarah Kiernan
Jacobs
Merrion House
Merrion Road
Dublin
DUBLIN 4

Date of Issue: **13 April 2012**

Report Number: **COV/848154/2012** Issue **1**

Job Description: Surface Water: Cork

Job Location: Dunkettle

Number of Samples included in this report **9**

Job Received: **23 March 2012**

Number of Test Results included in this report **126**

Analysis Commenced: **23 March 2012**

Signed:

Name: **J. Fell** Date: **13 April 2012**

Title: **Chemistry Operations Manager**

Severn Trent Services was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation.

Information on the methods of analysis and performance characteristics are available on request.
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. The results relate only to the items tested.
Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory.

Severn Trent Services
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Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921478 Sample 1 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: WC2 Low
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	1720	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	0.8	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	17	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	2	mg/l	Y	Cov	WAS001
EH >C6 - C40	<20	ug/l	Y	Cov	GEO35
EH >C6 - C8	<20	ug/l	N	Cov	GEO35
EH >C8 - C10	<20	ug/l	N	Cov	GEO35
EH >C16 - C24	<20	ug/l	N	Cov	GEO35
EH >C24 - C40	<20	ug/l	N	Cov	GEO35
EH >C10 - C16	<20	ug/l	N	Cov	GEO35

Analyst Comments for 12921478: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.Reporting limits raised for EH analysis due to insufficient sample.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921479 Sample 2 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: WC2 Mid
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	3820	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	34	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	3	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921479: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

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SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921480 Sample 3 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 3 Low
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	2140	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	19	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	30	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	30	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921480: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921481 Sample 4 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 3 Mid
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	3840	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	36	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921481: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921482 Sample 5 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 0 Mid
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	5570	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	54	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921482: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921483 Sample 6 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 1 Mid
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	4050	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	15	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921483: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921484 Sample 7 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 2 Mid
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	5120	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	<0.27	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	26	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921484: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012 Issue 1
Laboratory Number: 12921485 Sample 8 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 7 Low
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	4380	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	0.31	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	20	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	<10	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	<10	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921485: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Certificate of Analysis

UKAS TESTING 1314 1229 0897 4409

SEVERN TRENT SERVICES

Report Number: COV/848154/2012
Laboratory Number: 12921486

Issue 1
Sample 9 of 9

Sample Source: Jacobs
Sample Point Description: Jacobs
Sample Description: Site 7 Mid
Sample Matrix: Surface waters
Sample Date/Time: 21 March 2012
Sample Received: 23 March 2012
Analysis Complete: 13 April 2012

Test Description	Result	Units	Accreditation		Method
Copper, Filtered as Cu	<0.009	mg/l	Y	Cov	WAS049
Zinc, Total as Zn	<0.018	mg/l	Y	Cov	WAS049
Total Hardness as CaCO3	5170	mg/l	Y	Cov	WAS049
Ammoniacal Nitrogen as N	0.35	mg/l	Y	Cov	WAS036
Nitrate as N	<0.4	mg/l	Y	Cov	WAS036
Phosphate, Ortho as P	<1.2	mg/l	Y	Cov	WAS036
Suspended Solids	28	mg/l	Y	Cov	WAS006
BOD + ATU (5 day)	<1	mg/l	Y	Cov	WAS001
EH >C6 - C40	16	ug/l	Y	Cov	GEO35
EH >C6 - C8	<10	ug/l	N	Cov	GEO35
EH >C8 - C10	<10	ug/l	N	Cov	GEO35
EH >C16 - C24	<10	ug/l	N	Cov	GEO35
EH >C24 - C40	16	ug/l	N	Cov	GEO35
EH >C10 - C16	<10	ug/l	N	Cov	GEO35

Analyst Comments for 12921486: Sub sample taken from PET container for EH due to quality control failure on the original sample taken from the glass container.

Accreditation Codes: Y = UKAS Accredited, N = Not UKAS Accredited, M = MCERTS.
Analysed at: Brd = Bridgend, Cov = Coventry, Rea = Reading, Run = Runcorn, S = Subcontracted, Wak = Wakefield.
For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis will increase where the volume analysed is <1000g (1g is approximately equivalent to 1ml for sample volume analysed).
I/S=Insufficient sample

Signed: JFell

Name: J. Fell Date: 13 April 2012
Title: Chemistry Operations Manager

Severn Trent Services
Analytical Services, Torrington Avenue, Coventry, CV4 9GU
Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7685 6575

D 848200 Jacobs:

STS Laboratory Number			**12921785**
Customer Sample Ref.			**WC3 MID**
Sample Matrix			**Surface waters**
Analyte	**Method**	**Units**	
Copper, Filtered as Cu	WAS049	mg/l	<0.009
Zinc, Total as Zn	WAS049	mg/l	<0.018
pH	WAS039	pH units	7.5
Conductivity- Electrical 20C	WAS039	uS/cm	23500
Total Hardness as CaCO3	WAS049	mg/l	3460
Ammoniacal Nitrogen as N	WAS036	mg/l	<0.27
Nitrate as N	WAS036	mg/l	<0.4
Phosphate, Ortho as P	WAS036	mg/l	<1.2
Suspended Solids	WAS006	mg/l	21
BOD + ATU (5 day)	WAS001	mg/l	<1
EH >C6 - C40	GEO35	ug/l	<10
EH >C6 - C8	GEO35	ug/l	<10
EH >C8 - C10	GEO35	ug/l	<10
EH >C16 - C24	GEO35	ug/l	<10
EH >C24 - C40	GEO35	ug/l	<10
EH >C10 - C16	GEO35	ug/l	<10

Key
N/S - Not Scheduled
I/S - Insufficient Sample
To Follow - analysis incomplete (interim reports only)

Summary of predictions

Prediction of impact	Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact: Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Step1										
Step2										
Step3										

DETAILED RESULTS

In Runoff

Step 1

	Copper	Zinc
RST24		
Allowable Exceedances/year	1	1
No. of exceedances/year	76.30	90.00
No. of exceedances/worst year	98	93
RST6		
Allowable Exceedances/year	1	1
No. of exceedances/year	42.00	57.30
No. of exceedances/worst year	55	67
	(ug/l)	(ug/l)
Thresholds RST24	21	395
Thresholds RST6	42	770
Event Statistics Mean	48.89	212.72
90%ile	94.96	446.01
95%ile	120.30	568.52
99%ile	102.87	1214.61

Step 1

	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Allowable Exceedances/year	1	1	1	1	1	1	1	1
No. of exceedances/year	91.90	91.70	4.30	30.30	72.50	30.30	14.40	59.40
No. of exceedances/worst year	95	103	9	37	81	37	21	66
	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245	515
Mean	687	2604	1	15615	2701	2592	166	731
90%ile	1409	5498	3	35481	6138	5890	376	1661
95%ile	1711	7266	3	35481	6138	5890	376	1661
99%ile	2285	11654	5	89125	15419	14795	945	4171

In River (no mitigation)

Step 2

	Copper	Zinc
RST24		
Allowable Exceedances/year	1	1
No. of exceedances/year	0	0
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
RST6		
Allowable Exceedances/year	0.5	0.5
No. of exceedances/year	0	0
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.00	0.03
	(ug/l)	(ug/l)
Thresholds RST24	21	395

Step 2

Velocity	0.00	m/s
DI	0.98	
% settlement needed	0	%

Tier 1 is used for the calculation

HAWRAT Outfall 2 & 3 Lough Mahon

Thresholds	RST6	42	770
Event Statistics Mean		0.03	0.12
90%ile		0.06	0.24
95%ile		0.09	0.40
99%ile		0.26	1.50

In River (with mitigation)

Step 3

	Copper	Zinc
	RST24	
Allowable Exceedances/year	1	1
No. of exceedances/year	-	-
No. of exceedances/worst year	-	-
No. of exceedances/summer	-	-
No. of exceedances/worst summer	-	-
	RST6	
Allowable Exceedances/year	0.5	0.5
No. of exceedances/year	-	-
No. of exceedances/worst year	-	-
No. of exceedances/summer	-	-
No. of exceedances/worst summer	-	-
Annual average concentration (ug/l)	-	-
	(ug/l)	(ug/l)
Thresholds hresholds	RST24 21	395
Thresholds	RST6 42	770
Event Statistics Mean	-	-
90%ile	-	-
95%ile	-	-
99%ile	-	-

DI -

Details of the chosen rainfall sip	
SAAR (mm)	1000
Altitude (m)	200
Easting	4060
Northing	4410
Coastal distance (km)	70

User parameters

Location Details

Road Number	Dunkettle Interchange		**Assessment type**	Non-cumulative assessment (single outfall)
HA Area/DBFO number				
OS grid reference of assessment point (m)	**Easting**		**Receiving watercourse**	Lough Mahon
	Northing		**EA receiving water Detailed River Network ID**	EPA - lough Mahon SW 060 0750
OS grid reference of outfall structure (m)	**Easting**		**Assessor and affiliation**	Oonagh Duffy - Jacobs
	Northing		**Date of assessment**	21/05/2012
Outfall number	Outfall 2 & 3		**Version of assessment**	1
List of outfalls in cumulative assessment				
Notes	Outfalls 2 and 3 discharge to the same location and are assessed as one outfall for the purpose of this assessment			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
Runoff Risk Assessments				
AADT	vpd	>10,000 and <50,000	***>=100,000***	
Climatic Region	-	Warm Dry	***Colder Wet***	
Rainfall Site	-	Ashford (SAAR 710mm)	***Keighley (SAAR 1000mm)***	
95%ile River flow	m3/s	0	***3***	
Baseflow Index	-	0.5	***0.5***	
Impermeable road area drained	ha	1	***6.065***	
Permeable area draining to outfall	ha	1	***0***	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	***Yes***	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	***No***	
Hardness	-	Low = <50mg CaCO3/l	***High = >200mg CaCO3/l***	
Use Tier 1	-	TRUE	***TRUE***	
Use Tier 2	-	FALSE	***FALSE***	
Tier 1 Estimated river width at Q95	0	5	***200***	
Tier2 Bed width	m	3	***3***	
Tier2 Side slope	m/m	0.5	***0.5***	
Tier2 Long slope	m/m	0.0001	***0.0001***	
Tier2 Mannings' n	-	0.07	***0.07***	
Existing treatment for solubles	%	0	***0***	***description for existing measures***
Existing attenuation -restricted discharge rate	l/s	Unlimited	***Unlimited***	
Existing settlement of sediments	%	0	***0***	
Proposed treatment for solubles	%	0	***0***	***description for proposed measures***
Proposed attenuation -restricted discharge rate	l/s	Unlimited	***Unlimited***	
Proposed settlement of sediments	%	0	***0***	

Summary of predictions

Prediction of impact	Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc
Step1		
Step2		
Step3		

Sediment - Chronic Impact	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

DETAILED RESULTS

In Runoff

Step 1

	Copper	Zinc
RST24		
Allowable Exceedances/year	1	1
No. of exceedances/year	**76.30**	**80.00**
No. of exceedances/worst year	88	93
RST6		
Allowable Exceedances/year	1	1
No. of exceedances/year	**42.00**	**57.30**
No. of exceedances/worst year	55	67
	(ug/l)	(ug/l)
Thresholds RST24	21	385
Thresholds RST6	42	770
Event Statistics Mean	48.89	212.72
90%ile	94.96	446.01
95%ile	120.30	568.52
99%ile	192.87	1214.61

Step 1

	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold	1	1	1	1	1	1	1	1
	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity Threshold	197	315	3.5	16770	875	2355	245	515

In River (no mitigation)

Step 2

	Copper	Zinc
RST24		
Allowable Exceedances/year	1	1
No. of exceedances/year	**0**	**0**
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
RST6		
Allowable Exceedances/year	0.5	0.5
No. of exceedances/year	**0**	**0**
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.01	0.04
	(ug/l)	(ug/l)
Thresholds RST24	21	385

Step 2

Velocity [ ] m/s

DI [ ]

% settlement needed [ ] %

Tier 1 is used for the calculation

HAWRAT Outfall 1 - 4 Lough Mahon

Thresholds	*RST6*	42	770
Event Statistics Mean		0.04	0.18
90%ile		0.08	0.36
95%ile		0.14	0.73
99%ile		0.39	2.22

In River (with mitigation)

Step 3

	Copper	Zinc
	RST24	
Allowable Exceedances/year	1	1
No. of exceedances/year	-	-
No. of exceedances/worst year	-	-
No. of exceedances/summer	-	-
No. of exceedances/worst summer	-	-
	RST6	
Allowable Exceedances/year	0.5	0.5
No. of exceedances/year	-	-
No. of exceedances/worst year	-	-
No. of exceedances/summer	-	-
No. of exceedances/worst summer	-	-
Annual average concentration (ug/l)	-	-
	(ug/l)	(ug/l)
Thresholds hresholds *RST24*	21	385
Thresholds *RST6*	42	770
Event Statistics Mean	-	-
90%ile	-	-
95%ile	-	-
99%ile	-	-

DI

Details of the chosen rainfall site	
SAAR (mm)	1000
Altitude (m)	200
Easting	4060
Northing	4410
Coastal distance (km)	70

User parameters

Location Details

Road Number	Dunkettle Interchange		**Assessment type**	Cumulative assessment excluding sediments (outfalls between 100m and 1km apart)
HA Area/DBFO number				
OS grid reference of assessment point (m)	**Easting**		**Receiving watercourse**	Lough Mahon
	Northing		**EA receiving water Detailed River Network ID**	EPA Lough Mahon SW 060 0750
OS grid reference of outfall structure (m)	**Easting**		**Assessor and affiliation**	Oonagh Duffy - Jacobs
	Northing		**Date of assessment**	
Outfall number	Outfall 1, 2, 3 and 4		**Version of assessment**	1
List of outfalls in cumulative assessment				
Notes	Used to Asses the impact on Lough Mahon from all outfalls			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
Runoff Risk Assessments				
AADT	vpd	>10,000 and <50,000	***>=100,000***	
Climatic Region	-	Warm Dry	***Colder Wet***	
Rainfall Site	-	Ashford (SAAR 710mm)	***Keighley (SAAR 1000mm)***	
95%ile River flow	m3/s	0	***3***	
Baseflow Index	-	0.5	***0.5***	
Impermeable road area drained	ha	1	***9***	
Permeable area draining to outfall	ha	1	***0***	
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	***Yes***	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	***No***	
Hardness	-	Low = <50mg CaCO3/l	***High = >200mg CaCO3/l***	
Use Tier 1	-	TRUE	***TRUE***	
Use Tier 2	-	FALSE	***FALSE***	
Tier 1 Estimated river width at Q95	0	5	***5***	
Tier2 Bed width	m	3	***3***	
Tier2 Side slope	m/m	0.5	***0.5***	
Tier2 Long slope	m/m	0.0001	***0.0001***	
Tier2 Mannings' n	-	0.07	***0.07***	
Existing treatment for solubles	%	0	***0***	***description for existing measures***
Existing attenuation -restricted discharge rate	l/s	Unlimited	***Unlimited***	
Existing settlement of sediments	%	0	***0***	
Proposed treatment for solubles	%	0	***0***	***description for proposed measures***
Proposed attenuation -restricted discharge rate	l/s	Unlimited	***Unlimited***	
Proposed settlement of sediments	%	0	***0***	

Dunkettle Interchange Proposed Development HA Assessment of Pollution Impacts from Spillage													
		Chainage							Design Year 2031				
Network	Outfall	from	to	Link Description	Receiving Watercourse	RL length (km)	SS	Response time < 1 hour	AADT	% HGVs	Probability of accident (Pspl) - Note 1	Probability / year (Pinc/year) Note 2	1 in years
Link A	2	50	650	N40 N/B (JLT) to N25 E/B	Lough Mahon	0.60	0.36	0.45	19998	5	0.00008	0.00004	26594
Link A	3	650	1123	N40 N/B (JLT) to N25 E/B	Lough Mahon	0.47	0.36	0.45	19998	5	0.00007	0.00003	33734
Link B	2	40	299	N40 N/B (JLT) to N8 W/B merge slip road	Lough Mahon	0.26	0.36	0.45	6957	7	0.00002	0.00001	144397
Link C	1	1425	1492	N25 W/B to M8 N/B	Lough Mahon	0.06	0.36	0.45	2658	8	0.00000	0.00000	1395315
Link C	2	950	1425	N25 W/B to M8 N/B	Lough Mahon	0.48	0.36	0.45	2658	8	0.00001	0.00001	167438
Link C	3	0	950	N25 W/B to M8 N/B	Lough Mahon	0.95	0.36	0.45	2658	8	0.00003	0.00001	83719
Link D	1	0	295	M8 S/B to N40 S/B (JLT)	North Esk	0.30	0.36	0.45	12365	10	0.00005	0.00002	44580
Link D	1	0	295	N40 N/B (JLT) to M8 N/B	North Esk	0.30	0.36	0.45	12365	10	0.00005	0.00002	44580
Link E	1	195	470	M8 S/B to Link A	Lough Mahon	0.28	0.36	0.45	3017	5	0.00001	0.00000	377477
Link E	2	195	470	M8 S/B to Link A	Lough Mahon	0.28	0.36	0.45	3017	5	0.00001	0.00000	377477
Link F	2	0	710	N8 E/B to N40 S/B (JLT)	Lough Mahon	0.71	0.36	0.45	5513	5	0.00003	0.00001	86412
Link G	3	0	338	Link A to North Dumbbell Roundabout	Lough Mahon	0.34	0.36	0.45	5885	4	0.00001	0.00000	242919
Link H	3	130	239	R623 to North Dumbbell Roundabout	Lough Mahon	0.11	0.36	0.45	11717	5	0.00001	0.00000	249847
Link I	3	0	558	North Dumbbell Roundabout to N25 E/B merge slip road	Lough Mahon	0.56	0.36	0.45	858	2	0.00000	0.00000	1471836
Link J	3	0	576	N25 W/B Diverge Slip Road to South Dumbbell Roundabout	Lough Mahon	0.58	0.36	0.45	861	5	0.00000	0.00000	695938
Link K	2	665	825	N25 W/B Diverge Slip Road to N40 S/B (JLT)	Lough Mahon	0.16	0.36	0.45	17023	5	0.00002	0.00001	124184
Link K	3	0	665	N25 W/B Diverge Slip Road to N40 S/B (JLT)	Lough Mahon	0.67	0.36	0.45	17023	5	0.00007	0.00003	29879
Link L	3	0	532	South Dumbbell Roundabout to Link K (N40 S/B JLT)	Lough Mahon	0.53	0.36	0.45	5134	3	0.00001	0.00001	199739
Link M	3	0	630	South Dumbbell Roundabout to N8 W/B Merge	Lough Mahon	0.63	0.36	0.45	4053	10	0.00003	0.00002	64934
Link Q	4	0	503	R623	Pfizer	0.50	0.36	0.45	11519	6	0.00004	0.00002	49472
Link R	3	65	129	Dumb-bell Link Road	Pfizer	0.06	0.36	0.45	12283	4	0.00000	0.00000	537833
Link R	4	0	65	Dumb-bell Link Road	Lough Mahon	0.07	0.36	0.45	12283	4	0.00000	0.00000	529559
Link T	1	0	875	N8 E/B to Roundabout with Dunkettle Road	North Esk	0.88	0.36	0.45	2861	7	0.00002	0.00001	92543
Link U	1	0	584	Link T (N8 E/B) to M8 N/B	North Esk	0.58	0.36	0.45	3842	7	0.00002	0.00001	104686
				Total Mainline	Lough Mahon	10.32	0.36	0.45			0.00060	0.00027	3690

Spillage Rate (SS) 0.36 Urban Trunk Road

Ppol 0.45 Urban (Response time to site < 20 mins)

Note 1

$$P_{SPL} = RL \times SS \times (AADT \times 365 \times 10^{-9}) \times (\%HGV/100)$$

Note 2

$$P_{INC} = P_{SPL} \times P_{POL}$$

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Appendix 6.5 Inter Tidal Areas at Low and High Tide

Plate 1: Jack Lynch Tunnel Tidal inlet (WF 0) at High Tide

Plate 1: Jack Lynch Tunnel Tidal inlet (WF 0) at mid Tide

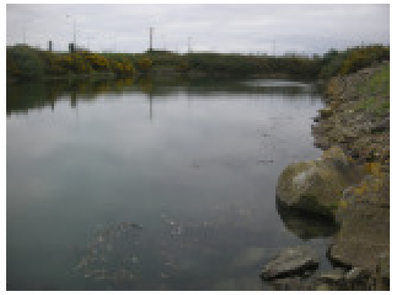

Plate 5: Jack Lynch Tunnel Intertidal Mudflat (WF 2) at High Tide

Plate 6: Jack Lynch Tunnel Intertidal Mudflat (WF 2) at Low Tide

Plate 3: Jack Lynch Tidal Polder (WF1) at High Tide

Plate 4: Jack Lynch Tidal Polder (WF1) at Low Tide

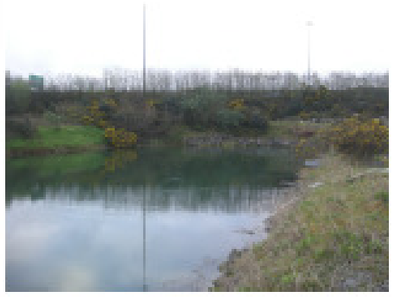

Plate 7: North Esk Intertidal Mudflat East (WF 3) at High Tide

Plate 8: North Esk Intertidal Mudflat East (WF 3) at low Tide

Plate 9: North Esk Intertidal Mudflat West (WF4) at High Tide

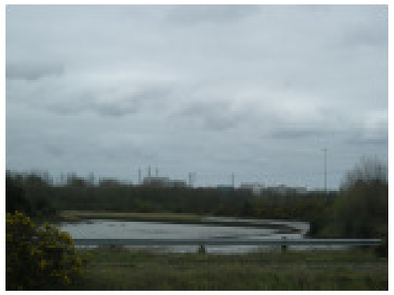

Plate 10: North Esk Intertidal Mudflat West (WF4) at Low Tide

Plate 11: Pfizer Intertidal Mudflat East (WF6) at High Tide

Plate 13: Pfizer Intertidal Mudflat East (WF6) at Low Tide

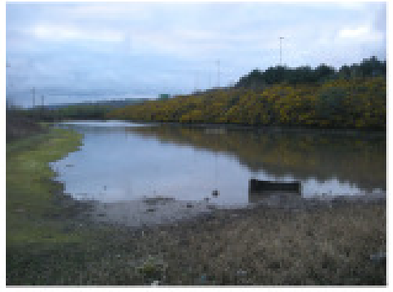

Plate 11: Pfizer Intertidal Mudflat West (WF5) at High Tide

Plate 11: Pfizer Intertidal Mudflat West (WF5) at Low Tide

Plate 14: Iarnrod Éireann Intertidal Mudflat Small (WF7) at High Tide

Plate 14: Iarnrod Éireann Intertidal Mudflat Small (WF7) at Low Tide

Plate 15: Iarnrod Éireann Intertidal Mudflat Large (WF8) at High Tide

Plate 16: Iarnrod Éireann Intertidal Mudflat Large (WF8) at Low Tide

Plate 19: Iarnrod Éireann Intertidal Mudflat Channel (WF12) at High Tide

Plate 20: Iarnrod Éireann Intertidal Mudflat Channel (WF12) at Low Tide

Plate 17: Watercourse 1 (WF10)

Plate 18: Eastgate Pond (WF13)

Plate 21: Eastgate Tidal Channel (WF11) at High Tide

Plate 22: Eastgate Tidal Channel (WF11) at Low Tide

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