Appendix A11.1 Legislation, Policy and Guidelines

The following legislation was of relevance to the assessment:

- The European Commission (EC) Habitats Directive 92/43/EEC (as amended).
- The EC Birds Directive 2009/147/EC.
- The European Communities (Birds and Natural Habitats) Regulations 2011-2015 hereafter referred to as the Birds and Habitats Regulations;
- The Roads Act s1993-2015, as amended.
- The Planning & Development Act 2000 & the Planning and Development (Amendment) Act, 2010 (as amended) hereafter referred to as 'the Planning Acts.'
- The Wildlife Act 1976 as amended by the Wildlife (Amendment) Act, 2000 (as amended) hereafter referred to as 'the Wildlife Acts.'
- The Flora (Protection) Order, 2015 S.I. 356/2015.
- The Environment (Miscellaneous Provisions) Act No. 20 of 2011.
- The Fisheries (Consolidation) Acts 1959-1990 (as amended).
- The Local Government (Water Pollution) Act, 1977 (as amended).

A number of land-use plans and strategic policy documents were relevant to the ecological assessment, because they overlapped the potential zones of influence for different ecological features. No Local Area Plans (or draft plans), had been adopted for the lands within the footprint of the proposed development or the various zones of influence radiating beyond it:

- Draft Kildare County Development Plan 2017-2023.
- Kildare County Development Plan 2011-2017.
- The National Biodiversity Plan, 2011-2016.
- County Kildare Biodiversity Plan. Action to Enhance our Living Environment 2009 -2014.

The key guidance relevant to ecology was the full suite of the NRA's planning and construction guidance (NRA 2001-2009), and the Chartered Institute of Ecology and Environmental Management's *Guidelines for Impact Assessment in the United Kingdom and Ireland* (CIEEM. 2016). These are included in the reference section and referenced throughout the assessment. Other guidance included:

- EPA Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002) (and revised and draft guidelines 2015/2017)
- EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a) (and revised advice notes 2015).
- Good Practice Guidelines for Developers. Biodiversity and Development in County Kildare. Kildare Heritage Series 2. An Action of the County Kildare Heritage Plan.
- Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011).
- A Guide to Habitats in Ireland (Fossitt, 2000).

- Bat Mitigation Guidelines for Ireland (National Parks and Wildlife Service, 2006).
- Bat Surveys: Good Practice Guidelines (Bat Conservation Trust, 2016)

Appendix A11.2 Zones of Influence Informing the Assessment

Ecological feature		Protected and/or significant examples	Potential source (s) of effect from proposed development	Potential effect pathways	ZoI (m study area)	Rationale
Habitats and flora	Terrestrial habitats or plant species.	Limestone pavements lowland meadows, Killarney fern *Trichomanes speciosum.*	Vegetation clearance, access routes.	Habitat loss.	0m (i.e. study area)	Only habitat loss in footprint would pose risk of significant effect.
	Surface water dependent habitats or plant species	Estuaries, saltmarsh, mudflats and rivers	Instream works	Habitat loss.	0m (i.e. study area)	Only habitat loss in footprint will pose risk of significant effect.
	Ground-water dependent habitats/species.	Alluvial woodlands, petrifying springs, dune slacks, peatlands, lagoons, whorl snails (three *Vertigo* species), turloughs.	Earthworks, piling, access routes.	Interference with groundwater supply or quality.	250m	Radius within which further survey of groundwater-dependent habitats recommended where foundations or burrow pits proposed (SEPA, 2014).
Mammals	Mammal crossing points.	Otter, badger, hedgehog, stoat.	Earthworks, piling, access routes.	Altered or decreased routes for safe crossing of roads.	100m upstream and downstream of watercourses from works	Radius within which surveys recommended to detect otter crossing points in the UK design Manual for Roads and Bridges (Highways Agency, 2001).
	Underground breeding or resting sites.	Otter holts, badger setts, stoat warrens, pine marten dens.	Vegetation clearance, earthworks, piling, access routes, instream works	Direct disturbance or vibration causing chamber collapse.	150m	Distance to underground otter sites within which disturbing works are likely to require licencing (NRA, 2006b).
	Bats (roosting).	All bats are Annex IV European-protected species in Ireland (Lesser horseshoe is also Annex II and is treated separately below)	Vegetation clearance, tree removal, lighting.	Loss or damage to roosting features in trees or structures. Lighting of roosts	0m for direct impacts (i.e. study area) up to 50m from development to account for indirect light spill impacts	Professional judgement and based on project and types of impacts associated with the project.

Ecological feature		Protected and/or significant examples	Potential source (s) of effect from proposed development	Potential effect pathways	ZoI (m study area)	Rationale
	Bats (foraging)	As above	Vegetation clearance. lighting	Loss or deterioration of foraging habitat.	0m for habitats (i.e. study area) 50m from development to account for indirect light spill impacts	Precautionary based on professional judgement given characteristics of development e.g. majority of the footprint is within existing built development.
Birds	Breeding Birds (highly sensitive species)	European-protected birds of prey, chough	Vegetation clearance, noise and physical human presence	Disturbance to breeding sites	100m up to a maximum of 500m.	Worst-case, upper limit of disturbance to white-tailed sea eagle, from all Irish species study by Whitfield et al., (2008).
	Breeding Birds (kingfisher)	European-protected kingfisher	Vegetation clearance earthworks, piling, visible human presence	Disturbance to breeding sites	150m	Distance within which ground vibration from piling or earthworks may result in collapse of banks potentially containing nest sites (as per NRA, 2009 for underground mammal resting sites).
	Breeding Birds (less sensitive species; often urban/suburban areas)	Nationally-protected passerines, crows, and gulls	Vegetation clearance, and construction works including earthworks and piling.	Noise and human presence causing disturbance to breeding sites	Up to 100m	Precautionary based on professional judgement given characteristics of development
	Wintering birds	European-protected wading birds, gulls, duck, geese, swans	Noise and physical human presence, and machinery in intertidal habitats.	Noise and human presence causing disturbance to feeding and roosting sites	None – scoped out from assessment	No suitable habitat within or surrounding the study area to support these species.
Invertebrates (where not highly dependent on groundwater habitats)	Butterflies, odonatan (dragonflies, damselflies), beetles, bees etc.	Marsh fritillary (Ireland's only European-protected butterfly), nationally protected butterflies and red-listed bees and Odonata	Vegetation clearance, access routes	Direct injury or loss of habitat	None – scoped out from assessment	The works are outside the range for the species

Ecological feature		Protected and/or significant examples	Potential source (s) of effect from proposed development	Potential effect pathways	ZoI (m study area)	Rationale
Aquatic species	In freshwater habitats	Sea and river lamprey, Atlantic salmon, white-clawed crayfish	Instream works	mortality/habitat loss	0m (i.e. proposed works footprint)	Habitat loss or mortality impacts can only occur within the footprint of the works.
	Species sensitive to underwater noise disturbance	Atlantic salmon, marine mammals.	Drilling	Vibrations	0m (i.e. proposed works footprint)	No significant underwater noise will be generated as part of the Proposed Project.

Appendix A11.3 Bat Conservation Ireland Records

Bat Conservation Ireland Ltd., Ulex House, Drumheel, Lisduff, Virginia, County Cavan

Charitable Company Limited by Guarantee No. 494343

www.batconservationireland.org info@batconservationireland.org

25th June 2016

Tom Murphy,
Jacobs

RE: Grid Reference –N9139022090.

Dear Tom,

Thank you for contacting Bat Conservation Ireland in relation your data request. Records for the quoted grid references within 10km radius of the grid reference listed.

The seriousness of the decline of bat population across Europe has led to the establishment of conservation programmes and appropriate legislation to stablise population numbers. The following should be considered in relation to developments or proposals that may impact on bat populations:

a. Bats and their bat roosts are protected by Irish (Wildlife Act 1976 and 2000 Amendment) which make it an offence to willfully interfere with or destroy the breeding or resting place of these species. All species of bats are listed in Schedule 5 of the 1976 Act and therefore are subject to the provisions of Section 23. The Wildlife Amendment Act 2000 improves the conservation of both species and their habitats and gives statutory protection to Natural Heritage Areas (NHAs).
b. Potentially the most important legislation for the protection and conservation of flora and fauna and their natural habitat is the EC Habitats Directive 1992 (EEC 92/43), which lists habitats and species of European conservation importance. This directive seeks to protect rare and vulnerable species, including all species of bats. All ten species of bat are protected with the lesser horseshoe bat listed as an Annex II species while all other bats (commonly known as vesper bats) are listed as Annex IV species.
c. Local Planning Authorities are required to give consideration to nature conservation interests under the guidance of the SEA Directive 2001/42/EC. This directive states that the protected status afforded to bats means that planning authorities must consider their presence in order to reduce the impact of developments through mitigation measures.
d. The National Biodiversity Plan confers general responsibilities on all participants in the development process to take into account of protected species. "*The overall objective is to secure the conservation, and where possible the enhancement, and sustainable use of biological diversity in Ireland and contribute to conservation and sustainable use of biodiversity globally".*

Member States must achieve a favourable conservation status for bat species. This involves measures that will stabilize the population dynamics of the species, so that it maintains itself on a long-term basis as a viable component of the natural habitat. Therefore, each Member State must prevent the natural range of the species from reducing and thus takes measures to ensure suitable habitat remain in the long-term.

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There are total of nine species of bat known to roost in the Republic of Ireland: soprano pipistrelle, common pipistrelle, Nathusius' pipistrelle, Natterer's bat, Daubenton's bat, whiskered bat, lesser horseshoe bat, Leisler's bat and brown long-eared bat. Each bat species have particular ecological requirements in relation to roosting, commuting and foraging habitats. A tenth species of bat, the Brandt's bat, was recorded once in 2001 and is considered a vagrant species. In addition, a single male Greater Horseshoe bat was also recorded once in 2012 and is also considered a vagrant. The NPWS Conservation Assessment for each species can access via www.npws.ie as well as a number of documents listed below.

NPWS Conservation Status Assessment report for each of the species recorded is presented below:

a. Natterer's bat *Myotis nattereri* (Species Code 1322)
This species is given a Favourable Status in Republic of Ireland.
b. Whiskered bat *Myotis mystacinus* (Species Codes 1330)
This species is given a Favourable Status in Republic of Ireland.
c. Leisler's bat *Nyctalus leisleri* (Species Code 1331)
This species is given a Favourable Status in Republic of Ireland. Ireland is the stronghold for this species and is given a status of International Importance.
d. Daubenton's bat *Myotis daubentoni* (Species Code 1314)
This species is given a Favourable Status in Republic of Ireland.
e. Brown long-eared bats *Plecotus auritus* (Species Code 1326)
This species is given a Favourable Status in Republic of Ireland.
f. Common pipistrelle *Pipistrellus pipistrellus* (Species Code 1309)
This species is given a Favourable Status in Republic of Ireland.
g. Nathusius' pipistrelle *Pipistrellus nathusii* (Species Code 1317)
This species is given a Favourable Status in Republic of Ireland.
h. Lesser horseshoe bat *Rhinolophus hipposideros* (Species Code 1303)
This species is given a Favourable Status in Republic of Ireland.
i. Brandt's bat *Myotis brandtii* (Species Code 1320)
This species is given a Favourable Status in Republic of Ireland.
j. Soprano pipistrelle *Pipistrellus pygmaeus* Species Code 1309)
This species is given a Favourable Status in Republic of Ireland.

The principal pressures on Irish bat species are as follows:

- urbanized areas (e.g. light pollution)
- bridge/viaduct repairs
- pesticides usage
- removal of hedges, scrub, forestry
- water pollution
- other pollution and human impacts (e.g. renovation of dwellings with roosts)
- infillings of ditches, dykes, ponds, pools and marshes
- management of aquatic and bank vegetation for drainage purposes
- abandonment of pastoral systems
- spieleology and vandalism
- communication routes: roads
- forestry management

For information on population trends, distribution and threats please consult the Bat Conservation Ireland publication *Irish Bats in the 21st Century* (Roche *et al.,* 2014).

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Bat Conservation Ireland officially came into existence in 2004 and now acts as the national umbrella group for all county bat groups. Bat Conservation Ireland is affiliated with the Irish Wildlife Trust and works closely with many NGOs, The Heritage Council and NPWS Conservation Rangers. Bat Conservation Ireland manages the All Ireland Bat Monitoring Programme in conjunction with Bat Conservation Trust UK and under the funding and assistance of the Heritage Council, NPWS (Department of Environment, Heritage and Local Government), EHS (Department of Environment Northern Ireland) and Waterways Ireland. We provide information on the conservation of bats to all public enquires and will assist the general public in their needs in relation to bats. The group is also involved in providing training in the use of bat detectors through organising bat detector workshops. The erection of bat boxes, field surveys and the collection of data on bat distribution in the country are on-going group projects.

If you have any further queries, please do not hesitate to contact me.

Yours sincerely,

Dr Tina Aughney

_____

Dr Tina Aughney
Bat Conservation Ireland

Bat Conservation Ireland Ltd., Ulex House, Drumheel, Lisduff, Virginia, County Cavan

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www.batconservationireland.org info@batconservationireland.org

Consultation Documents:

Anon (2002) National Biodiversity Plan. Department of Arts, Heritage, Gealtacht and the Islands.

Anon (2008) The status of EU protected habitats and species in Ireland: Conservation status in Ireland of habitats and species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.

Kelleher, C. and Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Limpens, H. J. G. A., Twist, P., & Veenbaas, G. 2005 Bats and road construction. *Brochure about bats and the ways in which practical measures can be taken to observe the legal duty of care for bats in planning, constructing, reconstructing and managing roads.* Rijkwaterstaat, Dienst Weg-en Waterbouwkunde, Delft, the Netherlands and the Vereniging voor Zoogdierkunde en Zoogdierbescherming, Arnhem, The Netherlands. 24 pages. DWW-2005-033.

McAney, K. (2006) A conservation plan for Irish vesper bats. Irish Wildlife Manuals, No. 20. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

National Roads Authority (2004 & 2009) *Guidelines for assessment of ecological impacts of National road schemes.* NRA, Dublin.

National Roads Authority (2006) Best Practice *Guidelines for the Conservation of Bats in the planning of National Road Schemes.* NRA, Dublin.

National Roads Authority (2006) G*uidelines for the Treatment of Bats during the construction of National Road Schemes.* NRA, Dublin.

NPWS (2009) Threat Response Plan: Vesper Bats (2009-2011). National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland

Roche, N., Aughney, T., Marnell, F. and Lundy, M. (2014) *Irish Bats in the 21st Century*. Cavan: Bat Conservation Ireland.

Whilde, A. 1993 *Threatened mammals, birds, amphibians and fish in Ireland. Irish Red Data Book 2: Vertebrates.* Belfast: HMSO.

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10km Radius

ROOSTS (22)

Name	Grid reference	Address	Species
Private	O0125	Rathcoole, County Dublin	Unidentified bat
Private	N9030	Castletown Estate,Leixlip Kildare	Pipistrellus pygmaeus
Private	N9814	Blessington, County Wicklow	Pipistrellus pygmaeus
Private	N9921	Kilteel, County Kildare	Pipistrellus spp. (45kHz/55kHz)
Private	O0119	Manor Kilbride, Co. Wicklow	Pipistrellus pygmaeus
Private	N9714	Naas Road, Blessington	Pipistrellus pipistrellus (45kHz)
Private	N9814	Cragmore, Belssington, County Wicklow	Pipistrellus spp. (45kHz/55kHz)
Private	N9721	Rathmore, Naas, County Kildare	Unidentified bat
Private	N8716	Newlands, Naas, County Kildare	Unidentified bat
Private	N8824	Sallins, County Kildare	Pipistrellus spp. (45kHz/55kHz), Plecotus auritus
Private	N9415	Newtown Great, Naas, Co. Kildare.	Unidentified bat
Private	N8721	Osberstown, Naas, County Kildare	Pipistrellus pipistrellus (45kHz), Unidentified bat
Private	N9222	Palmerstown Demesne, Naas, Co. Kildare	Pipistrellus spp. (45kHz/55kHz)
Private	N9631	Templemills, Cellbridge, County Kildare	Pipistrellus pygmaeus
Private	N9815	Blessington, County Wicklow	Pipistrellus pipistrellus (45kHz)
Private	N8729	Clane, County Kildare	Pipistrellus pipistrellus (45kHz)
Private	N9030	Cellbridge, County Kildare	Unidentified bat
Private	N8725	Millicent, Clane, County Kildare	Plecotus auritus
Private	N9122	Palmerstown Demesne, Naas, Co. Kildare	Plecotus auritus
Private	O0028	Newcastle Lyons, Newcastle, Co. Dublin.	Pipistrellus spp. (45kHz/55kHz)
Private	N9713	Blessington, County Wicklow	
Private	N9928	Newcastle, County Dublin	Pipistrellus pygmaeus, Unidentified bat

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TRANSECTS (9)

Name	Grid reference start	Species
Ayimer Bridge Transect	N9730029500	Myotis daubentonii, Nyctalus leisleri, Pipistrellus spp. (45kHz/55kHz), Unidentified bat
Hazelhatch Bridge Transect	N9880030700	Myotis daubentonii, Unidentified bat
Henry Bridge Transect	N9565028250	Myotis daubentonii, Unidentified bat
Liffer Park Clane Transect	N8790027050	Myotis daubentonii, Unidentified bat
Limerick Bridge Transect	N8730018700	Myotis daubentonii, Unidentified bat
Newcastle Lyons	O0000028000	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)
Oberstown M7 Bridge Transect	N8862121718	Myotis daubentonii, Unidentified bat
Ponsonby Bridge Transect	N9370026600	Myotis daubentonii, Unidentified bat
Sallins Village Transect	N8940022800	Myotis daubentonii, Unidentified bat

AD-HOC OBSERVATIONS (16)

Survey	Grid reference	Date	Species
BATLAS 2010	N8634324123	2008-07-26	Myotis daubentonii, Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus
BATLAS 2010	N998142	2008-08-30	Myotis daubentonii, Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)
EIA survey	N888220	2008-06-11	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus
EIA survey	N998287	2010-05-10	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Unidentified bat
EIA survey	N876297	2008-07-30	Myotis daubentonii, Nyctalus leisleri, Pipistrellus pygmaeus
EIA survey	N8800016000	2005-09-19	Myotis mystacinus/brandtii, Myotis natterreri, Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus
EIA survey	N8900016000	2005-09-19	Myotis mystacinus/brandtii, Myotis natterreri, Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus
EIA survey	N9965028800	2006-01-20	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)
EIA survey	N9380015500	2007-11-16	Pipistrellus spp. (45kHz/55kHz)
EIA survey	N868186	2004-06-02	Nyctalus leisleri
EIA survey	N867185	2004-06-02	Pipistrellus pipistrellus (45kHz)

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EIA survey	N869184	2004-06-02	Myotis spp.
EIA survey	O007279	2011-07-12	Nyctalus leisleri, Pipistrellus pygmaeus
EIA survey	O007279	2012-06-29	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus
EIA survey	N9122	2007-06-00	Myotis daubentonii, Myotis spp., Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus
NPWS Calls	N967121	2008-04-29	Plecotus auritus

Appendix A11.4 Photos

Photos 11.1 – 11.4	
	
Photo 11.1: Building (shed) with cracks in brick work and dense ivy cover. Point A on Figure 12.2.	Photo 11.2: Semi-mature trees along boundary with dense ivy cover. Point C on Figure 12.2.
	
Photo 11.3: Large rot hole in mature ash tree (confirmed roost). Point B on Figure 12.2.	Photo 11.4: Large rot hole in mature ash tree. Point D on Figure 12.2.

Photos 11.5 – 11.8

Photo 11.5: Proposed location of new outfall will be install on roadside bank, far bank will remain untouched.

Photo 11.6: Just upstream of proposed outfall location. Existing bank is modified with rock amour.

Photos 11.5 – 11.8

Photo 11.7: Artificial reptile hibernacula. Vegetation cleared from other parts of the site (scrub, grassland, log piles) could be used to create other log/brash piles within newly created habitats.

Photo 11.8: Artificial sand martin bank.

Appendix A11.5 Flora Species List

FL8 Other artificial lakes and ponds	
Common name	**Scientific name**
Bulrush	*Typha latifolia*
Marsh foxtail	*Alopecurus geniculatus*
Silverweed	*Potentilla anserina*
Water-starwort	*Callitriche sp.*

FW4 Drainage ditches	
Common name	**Scientific name**
Filamentous algae	N/A

GA1 Improved Agricultural Grassland	
Common name	**Scientific name**
Clover	*Trifolium sp.*
Perennial rye-grass	*Lolium perenne*
Yorkshire-fog	*Holcus lanatus*

GS2 Dry Meadows and grassy verges	
Common name	**Scientific name**
Black medick	*Medicago lupulina*
Bramble	*Rubus fruticosus*
Broad-leaved dock	*Rumex obtusifolius*
Butterfly bush	*Buddleja davidii*
Caper spurge	*Euphorbia lathyris*
Cat's-ear	*Hypochaeris radicata*
Cock's-foot	*Dactylis glomerata*
Common bent	*Agrostis capillaris*
Common centaury	*Centaurium erythraea*
Common couch	*Elytrigia repens*
Common evening primrose	*Oenothera biennis*
Common feather-moss	*Kindbergia praelonga*
Common sedge	*Carex nigra*
Common spotted-orchid	*Dactylorhiza fuchsii*
Creeping bent	*Agrostis stolonifera*
Creeping buttercup	*Ranunculus repens*
Creeping cinquefoil	*Potentilla reptans*
Creeping thistle	*Cirsium arvense*
Dove's-foot crane's-bill	*Geranium molle*
False oat-grass	*Arrhenatherum elatius*
Fennel	*Foeniculum vulgare*
Fool's-water-cress	*Apium nodiflorum*
Glaucous sedge	*Carex flacca*
Goldenrod	*Solidago virgaurea*
Great willowherb	*Epilobium hirsutum*
Grey alder	*Alnus incana*
Hard rush	*Juncus inflexus*
Hemp-agrimony	*Eupatorium cannabinum*
Hoary ragwort	*Senecio erucifolius*
Japanese knotweed	*Fallopia japonica*

GS2 Dry Meadows and grassy verges	
Michaelmas daisy	*Aster sp.*
Mugwort	*Artemisia vulgaris*
Musk-mallow	*Malva moschata*
Pendulous sedge	*Carex pendula*
Perennial rye-grass	*Lolium perenne*
Perforate St John's- wort	*Hypericum perforatum*
Pointed spear-moss	*Calliergonella cuspidata*
Poplar	*Populus sp.*
Pyramidal orchid	*Anacamptis pyramidalis*
Red bartsia	*Odontites vernus*
Red fescue	*Festuca rubra*
Reed canary-grass	*Phalaris arundinacea*
Ribwort plantain	*Plantago lanceolata*
Rosebay willowherb	*Chamerion angustifolium*
Sea barley	*Hordeum marinum*
Smooth hawk's-beard	*Crepis capillaris*
Spiked sedge	*Carex spicata**
Springy turf-moss	*Rhytidiadelphus squarrosus*
Sweet vernal-grass	*Anthoxanthum odoratum*
Tall melilot	*Melilotus altissimus*
Timothy	*Phleum pratense*
White clover	*Trifolium repens*
Wild marjoram	*Origanum vulgare*
Yellow clematis	*Clematis sp.*

GS4 wet grassland	
Common name	**Scientific name**
Broad-leaved willowherb	*Epilobium montanum*
Creeping bent	*Agrostis stolonifera*
Cut-leaved crane's- bill	*Geranium dissectum*
Hard rush	*Juncus inflexus*
Red fescue	*Festuca rubra*
Silverweed	*Potentilla anserina*
Yorkshire-fog	*Holcus lanatus*
	Pseudoscleropodium purum

WS1 Scrub	
Common name	**Scientific name**
Bittersweet	*Solanum dulcamara*
Black nightshade	*Solanum nigrum agg.*
Bramble	*Rubus fruticosus*
Butterfly bush	*Buddleja davidii*
Caper spurge	*Euphorbia lathyris*
Dogwood	*Cornus sanguinea*
Field rose	*Rosa arvensis*
Great horsetail	*Equisetum telmateia*
	Salix cinerea
Japanese rose	*Rosa rugosa*
Large bindweed	*Calystegia silvatica*
Osier	*Salix viminalis*
Rosebay willowherb	*Chamerion angustifolium*
Sherard's downy-rose	*Rosa sherardii*
Wild raspberry	*Rubus idaeus*
Winter heliotrope	*Petasites fragrans*

WS1 Scrub	
Yarrow	*Achillea millefolium*
Dog-rose	*Rosa canina*

**This species was not recorded during the 2016 survey*

WL1 Hedgerow	
Common name	**Scientific name**
Ash	*Fraxinus excelsior*
Beech	*Fagus sylvatica*
Blackthorn	*Prunus spinosa*
Cotoneaster	*Cotoneaster sp.*
Elder	*Sambucus nigra*
Hawthorn	*Crataegus monogyna*
Leyland cypress	*Cuprocyparis leylandii*
Rowan	*Sorbus aucuparia*

WL2 Treeline	
Common name	**Scientific name**
Ash	*Fraxinus excelsior*
Dog-rose	*Rosa canina*
Elder	*Sambucus nigra*
Hawthorn	*Crataegus monogyna*
Herb-robert	*Geranium robertianum*
Hogweed	*Heracleum sphondylium*
Ivy	*Hedera helix*
	Salix cinerea
Nettle	*Urtica dioica*
Oak	*Quercus sp.*
Sycamore	*Acer pseudoplatanus*
Wood avens	*Geum urbanum*

WD1 Oak-birch-holly woodland	
Common name	**Scientific name**
Ash	*Fraxinus excelsior*
Dock	*Rumex sanguineus*
Dog-rose	*Rosa canina*
Elder	*Sambucus nigra*
Hawthorn	*Crataegus monogyna*
Herb-robert	*Geranium robertianum*
Hogweed	*Heracleum sphondylium*
Ivy	*Hedera helix*
N/A	*Salix cinerea*
Nettle	*Urtica dioica*
Oak	*Quercus sp.*
Sycamore	*Acer pseudoplatanus*
Wood avens	*Geum urbanum*

ED Species of disturbed ground	
Common name	**Scientific name**
Annual mercury	*Mercurialis annua*
Apple-of-Peru	*Nicandra physalodes*
Argentinian vervain	*Verbena bonariensis*
Bastard cabbage	*Rapistrum rugosum*
Bilbao fleabane	*Conyza floribunda*
Black-bindweed	*Fallopia convolvulus*
Borage	*Borago officinalis*
Buckwheat	*Fagopyrum esculentum*

ED Species of disturbed ground	
Canary grass	*Phalaris canariensis*
Charlock	*Sinapis arvensis*
Chickweed	*Stellaria media*
Cockspur	*Echinochloa crus-galli*
Common orache	*Atriplex patula*
Common poppy	*Papaver rhoeas*
Common ramping-fumitory	*Fumaria muralis*
Fat-hen	*Chenopodium album*
Garden dahlia	*Dahlia pinnata*
Giant viper's-bugloss	*Echium pininana*
Great millet	*Sorghum bicolor*
Hollyhock	*Alcea rosea*
Kangaroo-apple	*Solanum laciniatum*
Large bindweed	*Calystegia silvatica*
Lesser swine-cress	*Coronopus didymus*
Nasturtium	*Tropaeolum majus*
Nettle	*Urtica dioica*
Nipplewort	*Lapsana communis*
Opium poppy	*Papaver somniferum*
Pot marigold	*Calendula officinalis*
Potato	*Solanum tuberosum*
Prickly lettuce	*Lactuca serriola*
Purple spurge	*Euphorbia peplis*
Purple toadflax	*Linaria purpurea*
Ragwort	*Senecio jacobaea*
Red goosefoot	*Chenopodium rubrum*
Redshank	*Persicaria maculosa*
Scentless mayweed	*Tripleurospermum inodorum*
Smooth sow-thistle	*Sonchus oleraceus*
Snapdragon	*Antirrhinum majus*
Spear-leaved orache	*Atriplex prostrata*
Sunflower	*Helianthus annuus*
Tall rocket	*Sisymbrium altissimum*
Tomato	*Lycopersicon esculentum*
Twiggy mullein	*Verbascum virgatum*
Wall barley	*Hordeum murinum*
Water figwort	*Scrophularia auriculata*

Appendix A11.6 Bat Survey Results

SE Corner of Building- 14th June 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dusk emergency								
Weather					Temp 13º	Wind[1] 0	Cloud cover[2] - 8	Rain[3] - 0
Start: 21:40 Finish: 23:25 Sunset: 21:55								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	22:33	Pip 45	1		Brief pass		Relatively low activity	
2	22:42	Pip 55	1		Brief pass			
3	22:47	Pip 55	1		Brief pass			
4	22:50	Pip 45	1		Brief pass			
5	22:54	Pip 55	1		Brief pass			
6	22:57	Pip 55	1		Brief pass			
7	23:03	Leisler	1		Brief pass		Rain at 23:25	
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.								

NW Corner of Building- 14th June 2016- Surveyor: Stephen Hancock Detector/Recording Device Type: Anabat SD2							
Type of Survey: Dusk emergency							
Weather					Temp 13°	Wind[1] 0	Cloud cover[2] - 8	Rain[3] - 0
Start: 21:40 Finish: 23:25 Sunset: 21:55							
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**
1	22:33	Pip 55	1	S	C	W->E and then N	Commuting from west of site (beyond western boundary) onto site, then heading north.
2	22:50	Pip 55	2	S	C	S->N	Commuting S-> N over entrance gate from road into site and then over west site of boundary.
3	22:55	Pip 55	1	S	C/F	S->N and then N->S	Commuting/foraging S->N from near gateway up to shed and N->S back into trees near gateway. Brief single loop.
4	23:01	Pip 45	1	S	Bat pass	S->N and then N->S	S->N and N->S along track. Brief pass.
5	23:04	Leisler	1	NS	Bat pass		Brief pass overhead.
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale							
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.							
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.							

Mature Ash- 15th June 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dawn re-entry								
Weather					Temp 9-10°	Wind[1] 0	Cloud cover[2] - 4	Rain[3] - 0
Start: 03:30 Finish: 05:00 Sunrise: 05:00								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent; R = Returning to roost; F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	03:47	Leisler	1	NS	Pass		Brief pass overhead	
2	03:53	Leisler	1	NS	Pass		Brief pass overhead	
3	04:03	Pip 45	1	S	C	E->W	Flying E->W over treeline along commuting bank across open grassland to treeline west.	
4	04:03	Leisler	1	S	C			
5	04:08	Pip 45	1	S	C			
6	04:09	Leisler	1	NS	C			
7	04:14	Pip 45	1	S	F		Foraging in scrubby valley	
8	04:16	Leisler	1	NS	C		Flying overhead	
9	04:18	Leisler	1	NS	C		Flying overhead	
10	04:20	Leisler	1	NS	C		Flying overhead	
11	04:21	Leisler	1	S	C	E->S	Foraging in scrubby valley	
12	04:24	Leisler	1	NS	C			
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.								

Trees North of Site- 15th June 2016- Surveyor: Stephen Hancock Detector/Recording Device Type: Anabat SD2							
Type of Survey: Dawn re-entry							
Weather					Temp 9-10°	Wind[1] 0	Cloud cover[2] - 4
Start: 03:30 Finish: 05:00 Sunrise: 05:00							
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**
1	03:39	Pip 45	1	NS	C		Very weak, brief call- likely bat was beyond site boundary and commuting past.
2	03:51	Leisler	1	NS	C		Very brief and weak call as bat counted high overhead.
3	03:55	Leisler	1	NS	C		Very brief and weak call as bat counted high overhead.
4	04:01	Leisler	1	NS	C		Very brief and weak call as bat counted high overhead.
5	04:06	Leisler	1	NS	C		Very brief and weak call as bat counted high overhead.
6	04:09	Leisler	1	NS	C		Very brief and weak call as bat counted high overhead.
7	04:13	Leisler	1	NS	C		Very brief and weak call as bat counted high overhead.
8	04:17	Leisler	1	NS	C		Very brief and weak call as bat counted high overhead.
9	04:19	Leisler	1	NS	C		Stronger call, repeated several times. Potentially bat located outside of tree line.
10	04:21	Leisler	1	NS	C		Stronger call, repeated several times. Potentially bat located outside of tree line.
11	04:25	Leisler	1	NS	C		Brief, weak call
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale							
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.							
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.							

Mature Ash- 15th June 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dusk emergency								
Weather					Temp 15°	Wind[1] 0	Cloud cover[2] - 0	Rain[3] - 0
Start: 21:40 Finish: 23:25 Sunset: 21:55								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	22:00	Leisler	1	NS			Very early recording, potential roost close by.	
2	22:03	Leisler	1	NS			Distant calls	
3	22:22	Pip 55	1	S	F		Foraging just above bank towards ash trees	
4	22:27	Pip 55	1	S	C/F	N	Foraging/commuting over open grass	
5	22:28	Pip 55	1	S	C/F	N	Foraging/commuting over open grass	
6	22:28	Pip 55	1	S	C/F	N and W	Foraging/commuting over open grass, all coming from Kerdiffstown house over bank.	
7	22:32	Pip 45	1	S	F	S->N	Foraging along scrubby valley	
8	22:34	?	1	S	F		Foraging along scrubby valley, not heard	
9	22:36	?	1	S	F		Foraging along scrubby valley, not heard	
10	23:36	Leisler	1	S	F	S->N	Foraging over scrubby valley	
12	22:37	?	1	S		E->S	Foraging over scrubby valley	
13	22:40	Pip 45	1	S	F	W->E	Foraging over bank	
14	22:43	Pip 55	1	S	F	W->E	Foraging over bank	
15	22:47	Pip 45	1	S	F	E->S	Foraging over bank/treeline	
16	22:50	Leisler	1	NS	F/C		Overhead	
17	22:53	Pip 55	1	S	F/C	S->N	Overhead	
18	22:53	Pip 55	1	S	F/C		Same bat foraging along bank edge	

Mature Ash- 15th June 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2							
Type of Survey: Dusk emergency							
Weather				Temp 15°	Wind[1] 0	Cloud cover[2] - 0	Rain[3] - 0
Start: 21:40 Finish: 23:25 Sunset: 21:55							
19	23:00	Pip 55	1	NS	F		
20	23:06	CHECK	1	NS			32 frequency
21	23:06	Leisler	1	NS	C		Pass overhead
22	23:08	Pip sp.	1	NS	F/C		
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale							
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.							
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.							

Trees North of Site- 15th June 2016- Surveyor: Stephen Hancock Detector/Recording Device Type: Anabat SD2							
Type of Survey: Dusk emergency							
Weather					Temp 14°	Wind[1] 0	Cloud cover[2] - 1 Rain[3] - 0
Start: 21:40 Finish: 23:25 Sunset: 21:55							
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**
1	22:03	Leisler	1	S	C	NE->SW	Single bat flying high above trees
2	22:12	Leisler	1	S	C	E->W	Flying high above trees
3	22:33	Pip 55	1	S	C	SW->NE	
4	22:52	Pip 45	1	S	F		Foraging over canopy of trees on the NW boundary of site
5	22:56	Pip 45	1	S	F		Foraging over canopy of trees on the NW boundary of site
6	23:05	Pip 45	1	NS	Brief pass		Brief pass
7	23:07	Pip sp.	2	S			Two bats chasing each other through canopy of trees on northern tip of site before leaving site.
8	23:14	29Khz	1	S	C	SE->N	Bat commuting. Brief pass. Left site via northern boundary.
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale							
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.							
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.							

Building (2nd Survey)- 16th June 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dawn re-entry								
Weather					Temp 10°-11°	Wind[1] 0	Cloud cover[2] - 0	Rain[3] - 0
Start: 03:30 Finish: 05:00 Sunrise: 05:00								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	03:49	Pip 45	1	NS	Pass		Brief pass	
2	03:50	Leisler	1	NS	Pass		Brief pass	
3	03:52	Pip 55	1	NS	Pass		Brief pass	
4	04:02	Pip 45	1	NS	Pass		Brief pass	
5	04:08	Pip 45	1	NS	Pass		Brief pass	
6	04:09	Pip 45	1	NS	Pass		Brief pass	
7	04:09	Leisler	1	NS	Pass		Brief pass	
8	04:11	Pip 55	1	S	C	E->S	Overhead	
9	04:13	Pip 55	1	NS	Pass		Brief pass	
10	04:27	Leisler	1	NS	Pass		Brief pass	
11	04:41	Leisler	1	NS	Pass		Brief pass overhead	
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.								

Building (2nd Survey)- 16th June 2016- Surveyor: Stephen Hancock Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dawn re-entry								
Weather					Temp 9.5°C-11°C	Wind[1] 0	Cloud cover[2] - 8	Rain[3] - 0
Start: 03:30 Finish: 05:00 Sunrise: 05:00								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	03:45	Pip 45	1	S	F/C	N	Single bat appeared from over W boundary, foraging briefly along shrubs opposite shed (1 minute) and flew north across site.	
2	03:52	Leisler	1	NS	C		Brief pass	
3	03:58	Pip sp.	1	NS	F		Foraging along shrubs on edge of track opposite shed. Very brief.	
4	04:02	Pip 55	1	S	C	SW	Commuting SW along edge of track and out of site over gates.	
5	04:29	Leisler	1	NS	C		Commuting at height. Very brief. Close cloud present.	
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.								

Mature Ash Tree - 18th July 2016- Surveyor: Hazel Doyle Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dusk emergence **Weather: Clear, mild, warm, and humid.** **Start: 21:27 Finish: 23:13 Sunset: 21:42**					Temp: 19°C	Wind[1] : 2	Cloud cover[2] : 0	Rain[3] : 0
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	21:54	Leisler	5	S	C	S->N	Overhead	
2	21:58	Leisler	9	S	E	S->N	First bats emerged	
3	22:00	Leisler	1	S	F/C	S->N		
4	22:01	Leisler	1	S	F/C	S->N		
5	22:02	Leisler	1	S	F/C	S->N		
6	22:04	Leisler	1	S	F/C		Flying around tree	
7	22:07	Leisler	1	S	E		Bat emerged	
8	22:09	Leisler	1	S	F/C	W->E		
9	22:12	Leisler	1	S	F/C	W->E		
10	22:13	Leisler	5	S	E	N	Bats emerged in all directions, mainly North	
11	22:16	Leisler	3	S	E		Bats emerged in all directions, mainly North	
12	22:20	Leisler	2	S	F/C		Circling	
13	22:21	Pip 55	1	S	F/C	S->N		
14	22:28	Leisler	>2	NS	F/C			
15	22:29	Pip 55	1	S	F/C	E->W		
16	22:32	Pip 55	1	NS	F/C		Very dark, hard to see now	
17	22:34	Leisler	1	NS	F/C			

Mature Ash Tree - 18th July 2016- Surveyor: Hazel Doyle Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dusk emergence **Weather: Clear, mild, warm, and humid.** **Start: 21:27 Finish: 23:13 Sunset: 21:42**					Temp: 19°C	Wind[1] : 2	Cloud cover[2] : 0	Rain[3] : 0
18	22:35	Pip 55	1	NS	F/C			
19	22:36	35	1	NS	F/C			
20	22:36	Pip 55	1	NS	F/C			
21	22:41	Pip 55	1	S	F/C		Flying overhead	
22	22:43	Leisler	>2	S	F/C		Activity around tree	
23	22:45	Leisler	1	NS	F/C			
24	22:45	Pip 45	1	S	F/C	N->S	Flying lower then SP	
25	22:46	Leisler	1	S	F/C	NW->SE		
26	22:46	?	1	NS	F/C		Daubentons?	
27	22:50	Leisler	1	NS	F/C		Activity around tree	
28	22:58	Pip 45	1	NS	F/C			
29	22:59	Pip 45	1	NS	F/C			
30	23:00	Pip 45	1	NS	F/C			
31	23:03	Pip 45	1	NS	F/C			
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.								

Trees North of Site- 18th July 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dusk emergence								
Weather: Clear, mild, warm, and humid.					Temp: 19°C	Wind[1] : 2	Cloud cover[2] : 0	Rain[3] : 0
Start: 09:27 Finish: 11:13 Sunset: 09:42								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	21:55	Leisler		NS	F		Lots of activity foraging Leislers in trees very North end of site. Just 5 minutes after sunset very likely roost in trees at start.	
2	22:00-22:10	Leisler		NS	F		Lots of activity again, foraging Leislers	
3	22:14	Pip 45	1	S	F	NW->S	Foraging overhead	
4	22:25	Pip 55	1	NS	Pass		Pass	
5	22:26	Pip 45	1	NS	Pass		Pass	
6	22:27	Pip 55	2	S	F		2 bats foraging along tree edge	
7	22:30	Pip 45	1	S	F		Constant foraging behaviour	
8	22:37	Pip 45 or nat	1	S	F			
9	22:40	Pip 45	1	S	F		Foraging then flew off	
10	22:40-22:43	Pip 45	2	S	F		2 bats foraging around trees	
11	22:50	Pip 55	1	S	F/C		Foraging/commuting S->N	
12	22:52	Leisler		NS	C			
							Activity died off at about 11pm	
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								

[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.								
Mature Ash Tree- 19th July 2016- Surveyors: Hazel Doyle and Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dawn re-entry								
Weather: Clear sky, mild.					Temp: 15°C	Wind[1] : 0	Cloud cover[2] : 0	Rain[3] : 0
Start: 03:54 Finish: 05:54 Sunrise: 05:24								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	04:25	Leisler	>2		F/C		Activity	
2	04:25	Pip 55	1		F/C		Pass	
3	04:30	Pip 45	1		F/C		Pass	
4	04:31	Pip 45	1		F/C		Pass	
5	04:32	Leisler	1		F/C			
6	04:35	Leisler	1		F/C			
7	04:43	Leisler	1	S	C	N->S	Flew N to S over feature tree, commuting behaviour.	
8	04:46	Leisler	1		F/C		Pass	
9	04:48	Leisler	c.10		R		Circling tree area (swarming behaviour of c. 8-10 bats)	
10	04:52	Leisler	c.5		R		Still swarming with fewer bats	
11	04:55	Leisler	c.3		R		Still swarming with fewer bats	
12	04:58	Leisler	1		R		Still one bat out around tree	
13	05:08	Leisler	1		R		One last bat entered cavity	
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								

[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.

Mature Ash Tree - 26th July 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Not suitable for scheduled activity survey. Conducted dusk emergence survey.								
Weather: Raining prior to survey, stopped just before sunset, started again at 21:50.					Temp: 14°C	Wind[1] : 2	Cloud cover[2] : 4	Rain[3] : 3
Start: 21:20 Finish: 22:10 Sunset: 21:31								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	21:50-22:10	Leisler	2		Pass		No bats seen emerging from feature.	

[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale

[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.

[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.

NW corner of Building (Third Survey)- 27th July 2016- Surveyor: Hazel Doyle Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dawn re-entry **Weather: Cloudy, cool.** **Start: 04:06 Finish: 05:36 Sunrise: 05:36**					Temp: 14°C	Wind[1] : 0	Cloud cover[2] : 8	Rain[3] : 0
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	04:05	Pip 45	1	NS	Pass			
2	04:07	Pip 55	1	NS	Pass			
3	04:09	Leisler	1	NS	Pass			
4	04:10	Pip 45	1	NS	F/C			
5	04:15	Pip 55	1	NS	F/C			
6	04:16	Pip 45	1	NS	F/C			
8	04:20	Pip 55	1	NS	F/C			
9	04:21	Leisler	1	NS	F/C			
10	04:21	Pip 55	1	NS	F/C			
11	04:22	Leisler	1	NS	F/C			
12	04:22	Pip 45	1	NS	F/C			
13	04:26	Leisler	1	NS	F/C			
14	04:28	Pip 45	1	NS	F/C			
15	04:29	Pip 45	1	NS	F/C			
16	04:36	Leisler	1	NS	F/C			
17	04:38	Pip 45	1	NS	F/C			
18	04:39	Leisler	1	NS	F/C			
19	04:40	Leisler	1	NS	Pass			
20	04:43	Leisler	1	NS	C			

NW corner of Building (Third Survey)- 27th July 2016- Surveyor: Hazel Doyle Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dawn re-entry **Weather: Cloudy, cool.** Temp: 14°C Wind[1] : 0 Cloud cover[2] : 8 Rain[3] : 0 **Start: 04:06 Finish: 05:36 Sunrise: 05:36**								
21	04:50	Pip 45	1	NS	Pass			
22	04:51	Pip 45	1	S	F/C	S->N		
23	04:51	Leisler	1	NS	F/C			
24	04:52	Pip 45	1	NS	F/C			
25	04:53	Leisler	1	NS	F/C			
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale								
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.								
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.								

SE corner of Building (Third Survey)- 27th July 2016- Surveyor: Corey Cannon Detector/Recording Device Type: Anabat SD2								
Type of Survey: Dawn re-entry								
Weather: Cloudy, cool.					Temp: 13°C	Wind[1] : 2-3	Cloud cover[2] : 8	Rain[3] : 0
Start: 04:06 Finish: 05:36 Sunrise: 05:36								
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**	
1	04:09	Leisler	(?)1	NS	C	?	Brief pass	
2	04:11	Pip 45	(?)1	NS	C	?	Brief pass	
3	04:26	Leisler	(?)1	NS	C	?	Brief pass	
4	04:40	Leisler	(?)1	NS	C	?	Brief pass	
5	04:44	Leisler	(?)1	NS	C/F	?	Assumed feeding along hedgerow	
6	04:51	Pip 45	(?)1	NS	C	?	Brief pass	
8	05:02	Leisler	(?)1	NS	C	?	Brief pass	
9	05:04	Leisler	(?)1	NS	C	?	Brief pass	
10	05:13	Leisler	(?)1	NS	C	?	Brief pass	

[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale

[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.

[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.

Trees North of Site - 27th July 2016- Surveyors: Corey Cannon and Hazel Doyle Detector/Recording Device Type: Anabat SD2							
Type of Survey: Dusk emergence **Weather: Cloudy, cool.** Temp: 16°C Wind[1] : 0 Cloud cover[2] : 8 Rain[3] : 0 **Start: 21:14 Finish: 22:59 Sunset: 21:29**							
Obs. No.	**24 hour clock**	**Species**	**No. of bats**	**Seen (S)/Not seen (NS)**	**Activity type (E = Emergent, R = Returning to roost, F = Foraging; C = Commuting)**	**Direction of flight**	**Notes**
1	21:24	L	1	NS			Trees north of site, high bat roost potential. 2 mature ash trees, one of size and structure but dense ivy cover. Other ash with very large cavity on south face of east limb.
2	21:31	Pip 55	1	NS	Pass		
3	21:34	Leisler	1	NS	F		
4	21:35	Pip 55	1	S	F	N	
5	21:35	Leisler	1	NS	F		
6	21:36	Pip 55	1	S	F	S->N	
8	21:39	Leisler	1	NS	F		
9	21:40	Leisler	1	S	F	S->N	
10	21:42	Leisler	1	NS	F		
11	21:42	Pip 55	1	S	F	N->S	
12	21:44	Leisler	1	S	F	S->N	
13	21:47	Pip 55	1	S	F	S->N->S	
14	21:49	Pip 55	1	S	F	N	
15	21:59	Pip 45	1	S	F	S->N	

Trees North of Site - 27th July 2016- Surveyors: Corey Cannon and Hazel Doyle Detector/Recording Device Type: Anabat SD2							
Type of Survey: Dusk emergence							
Weather: Cloudy, cool.				Temp: 16°C		Wind[1] : 0	Cloud cover[2] : 8	Rain[3] : 0
Start: 21:14 Finish: 22:59 Sunset: 21:29							
16	22:01	Pip 55	1	S	F		
17	22:09	Leisler	1	NS	F		
18	22:11	Pip 45	2	S	F	S->N->S	
19	22:11	Pip 55	2	S	F	S->N->S	
20	22:15	Leisler	1	NS	F		
21	22:16	Pip 55	1	S	F	S->N->S	
22	22:19	Leisler	1	NS	F		
23	22:20	Pip 45	1	S	F	N->S	
24	22:21	Pip 45	2	S	F	W->E	
25	22:21	Pip 45	2	S	F	E->W	CPs foraging overhead in E-W-E direction for 5 minutes
26	22:28	Leisler	1	NS	F		
27	22:35	Leisler	1	NS	F		
28	22:43	Pip 55	1	NS	F		
29	22:45	Leisler	1	NS	F		
30	22:45	Pip 55	1	NS	F		
[1] Wind speed (where available) & score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale							
[2] Estimated cloud cover of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.							
[3] Estimate precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.							

Appendix A11.7 Breeding Bird Survey Results

Common name	Scientific name	Status	Conservation status
Blackbird	*Turdus merula*	Probable	Green
Blackcap	*Sylvia atricapilla*	Probable	Green
Blue tit	*Parus caeruleus*	Probable	Green
Bullfinch	*Pyrrhula pyrrhula*	Probable	Green
Buzzard	*Buteo buteo*	Probable	Green
Carrion crow	*Corvus corone*	Probable	Green
Chaffinch	*Fringilla coelebs*	Probable	Green
Chiffchaff	*Phylloscopus collybita*	Probable	Green
Coal tit	*Parus ater*	Probable	Green
Dunnock	*Prunella modularis*	Probable	Green
Goldcrest	*Regulus regulus*	Probable	Amber
Goldfinch	*Carduelis carduelis*	Probable	Green
Great tit	*Parus major*	Probable	Green
Greenfinch	*Carduelis chloris*	Probable	Amber
Grey heron	*Ardea cinerea*	Probable	Green
Grey wagtail	*Motacilla cinerea*	Probable	Red
Hooded crow	*Corvus cornix*	Probable	Green
Jackdaw	*Corvus monedula*	Probable	Green
Kestrel	*Falco tinnunculus*	Probable	Amber
Lesser redpoll	*Carduelis flammea cabaret*	Probable	Green
Linnet	*Carduelis cannabina*	Probable	Amber
Long-eared owl	*Asio otus*	Non-breeding	Green
Mallard	*Anas platyrhynchos*	Probable	Green
Magpie	*Pica pica*	Probable	Green
Meadow pipit	*Anthus pratensis*	Probable	Red
Pheasant	*Phasianus colchicus*	Probable	Green
Pied wagtail	*Motacilla alba yarrellii*	Probable	Green
Robin	*Erithacus rubecula*	Probable	Amber
Rook	*Corvus frugilegus*	Probable	Green
Siskin	*Carduelis spinus*	Probable	Green
Skylark	*Alauda arvensis*	Probable	Amber
Song thrush	*Turdus philomelos*	Probable	Green
Sparrowhawk	*Accipiter nisus*	Probable	Amber
Starling	*Sturnus vulgaris*	Probable	Amber
Swallow	*Hirundo rustica*	Probable	Amber
Willow warbler	*Phylloscopus trochilus*	Probable	Green
Wood pigeon	*Columba palumbus*	Probable	Green
Wren	*Troglodytes troglodytes*	Probable	Green
Yellowhammer	*Emberiza citrinella*	Probable	Red

Appendix A11.8 Frog Derogation Licence 2017

WILDLIFE ACTS 1976 TO 2012 – SECTIONS 23 AND 34

APPLICATION FOR LICENCE TO CAPTURE AND/OR HUMANELY KILL A PROTECTED WILD ANIMAL FOR EDUCATIONAL, SCIENTIFIC OR OTHER PURPOSES

1. Name of applicant:	Kildare County Council (KCC) ("The licensee")
Address:	KCC offices - Áras Chill Dara, Devoy Park, Naas
[BLOCK LETTERS]	
Email Address:	Corey Cannon ("The scientific agent") corey.cannon@jacobs.com (on behalf of KCC)
Telephone No.:	01-2028143 (Corey Cannon on behalf of KCC)
2. Species Name: **(Common & Scientific)**	Common frog *Rana temporaria*
3. Number to be captured or killed:	Unknown at present (small population present on site based on habitat assessment and frog spawn counts – Kerdiffstown Landifill).
(please specify whether capture or killing)	Capture frog spawn (and individuals, if encountered) and relocate to alternative suitable ponds."
4. Purpose of capture or killing:	To enable remediation of Kerdiffstown Landfill site, including but not limited to infilling of waterbodies on site, mobilisation of machinery on site, clearance of vegetation on site.
5. Area(s) in which applicant will operate:	Kerdiffstown, Kildare
(e.g. county and townland)	
6. Means of capture or killing:	Bucket and a hand-net for spawn and by hand and/or hand-net for individuals. All appropriate biosecurity measures will be complied with including wearing of gloves to handle individual frogs (if required).
7. Type of trap snare or net (if appropriate)	Hand-net
8. Qualifications/experience in this field of activity	Corey Cannon BSc MSc ACIEEM is a competent ecologist who has undertaken numerous surveys and translocations relating to protected amphibian species. Corey holds a personal licence to survey for Great Crested Newt (UK-Natural England, see attached). She has surveyed and translocated the above species as well as smooth and common while working in the UK. Corey has five year's professional experience in the UK and Ireland in field surveys for protected species.
9. Organisation to which applicant is	Jacobs Engineering Ireland Ltd (Dublin office).

affiliated:

10. Period for which licence is required:	The remediation of the site including infilling of ponds and clearance of vegetation will be grouped into seven phases of works, taking place over a 3.5 year period; each phase of works lasting approximately six months in duration. Licence for period 01.05.17 to completion of remediation works expected 01.01.22
11. Number of previous licence (if any) and date of expiry:	None in relation to common frog. UK licence to survey great crested newt attached. Corey also holds UK licences for the following European Protected Species; bats and dormice. Corey has held other licences in the RoI including: A photography licence to monitor badger sett at the above mentioned site (Licence No. 017/2016, expires 28th February 2017) and a licence for the temporary exclusion of a badger sett at the same site (DER/BADGER 2016-42- Amended, expired 31st October 2016).

I declare that the above particulars are, to the best of my knowledge and belief, true and correct.

Signature: J Mullen Date: 4/4/17

Please return completed application form to:

Wildlife Licensing Unit
National Parks and Wildlife Service
7 Ely Place
Dublin 2
D02 TW98

Tel.: (01) 888 3242
Email: wildlifelicence@ahg.gov.ie

An Roinn Ealaíon, Oidhreachta,
Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage,
Regional, Rural and Gaeltacht Affairs

Appendix A11.9 Artificial Sand Martin Bank Creation

RSPB Langford Lowfields artificial sand martin bank creation

Partnership project delivered by RSPB and Lafarge Tarmac with support from Sita funding and construction by Sandinyoureye Ltd.

At Langford Lowfields, a 175ha reedbed restoration reserve, **Sandinyoureye** sand sculptors and RSPB designed and created an artificial sand martin bank that is purpose built to look and function as naturally as possible with sand martin nesting ecology.

Creating an artificial bank with washed reject sand from the quarry can be a challenge - particularly on an exposed site and with sand that is not immediately compatible for high quality sand compaction, as it has little clay and fewer angular fragments.

The Langford Lowfields bank was created over four days of construction with **130 tonnes** of reject sand combined with low mix rates (75-1 to 100-1) of cement and keyed into an existing subsoil bank with a view over the water.

It was built according to key sand martin specifications including a **vertical face** (2.5 meters high) to limit predation impacts from predators such as weasels and foxes. It is also designed to be **concave** as the birds have a preference to view each other in a colonial set-up.

Main construction points:

- The main construction process involves creating a sturdy framework of wooden forms that hold the sand for compaction. The Langford structure is 7 metres wide, 2.5 metres high and 5 metres deep (to allow several years of use by carving back the face).
- Sand and cement are mixed at 100 to 1 ratio in 300mm layers which are then rotavated with large quantities of water followed by hydraulic compaction.
- This process is repeated to create highly compacted layers, raising the structural forms as required. It is critical to **ensure compaction is wet** as the quality of the final structure and settling of the sand requires large quantities of water.
- After a minimum of a week the forms are removed and the main face can be cleaned/carved by hand with the blade of a spade to create a concave vertical face.
- It is advisable to add a layer of **chicken wire and seeded topsoil** to the surface to encourage vegetation growth that will reduce the impact of surface run-off from large precipitation events and reduce surface burrowing from predators/rabbits.

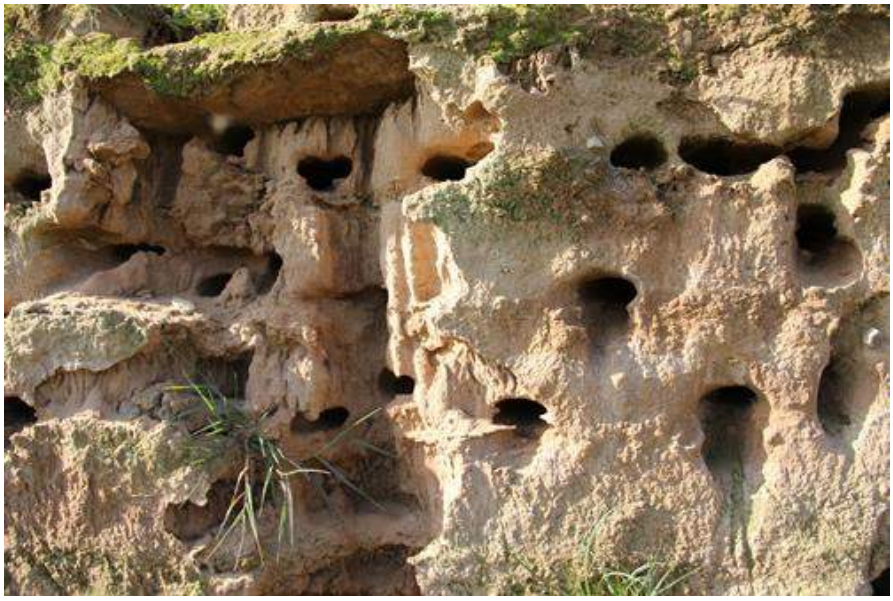
Sandinyoureye constructing the sand bank with Paul Afford plant hire on the digger.

In 2012 the bank was occupied by 150 nests, in 2013 over 200 nests occupied. Parasite loading – in particular fleas, are a key reason for sand martin's excavating new nest chambers annually. For this reason the bank is designed so that it can be cut annually for between 4-7 years by the volunteers so a new face is exposed for each spring.

The first sand martins made nests three weeks after construction.

Measuring a cross section of the sand martin bank. The burrows run on a slight incline for on average of 650mm with a nesting chamber at the back

RSPB images courtesy of Ben Hall, Jamie Wardley and Michael Copleston



Naturalised appearance of structure

Compacted sand is critically stronger at resisting digging from fox as shown above

RSPB images courtesy of Ben Hall, Jamie Wardley and Michael Copleston

Early establishment in 2013 of the banks second year of colonists – note the face has been re-carved following winter flooding and the establishment of turf on the surface has improved.

In summary:

- Each bank will be site-specific with regards to topography, availability of sand, and cost of machinery.
- Compaction is required to retain strength in the structure and create a vertical face – ensure this process is completed with water.
- Maintenance will be required to carve back a new face of the bank every 1-2 years by 500mm to 1000mm
- Costs for a standard structure of this size following similar protocol should be in the region of £2,000 to £5,000 pending resources for labour and machinery.
- For more information and advice contact michael.copleston@rspb.org.uk

RSPB images courtesy of Ben Hall, Jamie Wardley and Michael Copleston

Appendix A11.10 Appropriate Assessment Screening Report

Kerdiffstown Landfill Remediation Project

Kildare County Council

Screening Report for Appropriate Assessment

32EW5604 DOC 0057 | Final

August 2017

Document history and status

Revision	Date	Description	By	Review	Approved
Draft Rev0	16 Dec 2016	DRAFT	CC	PG	RR
Final	10 Aug 2017	Final	CC	RK	RR

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Revision	Issue approved	Date issued	Issued to	Comments

Kerdiffstown Landfill Remediation Project

Project No:	32EW5604
Document Title:	Screening Report for Appropriate Assessment
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Client Name:	Kildare County Council
Project Manager:	Rhianna Rose
Author:	Corey Cannon
File Name:	G:\JI\Sustainable Solutions\Kerdiffstown Landfill\4 - Documents\4.3 - Draft Documents\32EW5604 E EIA IED Planning\EIA\EIAR Chapters\12-Biodiversity\AASS\Kerdiffstown_Appropriate Assessment 080817.docx

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Contents

1. Introduction

Kildare County Council (KCC) engaged Jacobs to provide consultancy services in respect of the proposed remediation of the former Kerdiffstown Landfill site in Co. Kildare (hereafter 'the proposed Project'). The proposed Project is required to make the site safe for public health and to protect the environment from waste-derived pollution. The end-use for the site will be a public park including multi-use playing pitches, changing rooms, a playground, walking paths and car parking. There will also be infrastructure required to be installed across the site for the continued control of emissions, namely a gas management system, leachate management system and monitoring boreholes.

In accordance with the EC Habitats Directive 92/43/EEC (hereafter "The Habitats Directive") this Appropriate Assessment Screening Statement (AASS) assesses whether there are likely significant effects from the proposed Project on European sites ("Natura 2000 sites"[1]); comprising Special Areas of Conservation (SACs[2]) and Special Protection Areas (SPAs). All other known proposed plans or projects, including the overall proposed Project were also assessed with regard for in-combination effects, where required. Websites referenced in this report are included as footnotes. Published reports are cited in the text and included in the References section.

1.1 Programme

The remediation and construction programme will depend upon the date of issue of appropriate permissions, approvals, and licencing under the Planning Acts, and Waste Acts. However, the remediation of the site is predicted to take approximately 3.5 years. The remediation will be phased, a total of seven phases are proposed with each lasting approximately 6 months.

[1] "European site" replaced the term "Natura 2000 site" under the EU (Environmental Impact Assessment and Habitats) Regulations 2011 S.I. No. 473 of 2011.

[2] There are currently no SACs in Ireland. All remain 'candidate' (cSAC) until the European Commission approves and ratifies the final list of cSACs. cSACs are afforded the same protection as SACs..The process of making cSACs SACs by means of Statutory Instrument has begun. While this process is ongoing the term SAC will be used, in conformance with nomenclature used in NPWS databases.

2. The Appropriate Assessment Process

2.1 Introduction to Appropriate Assessment

The requirement to carry out an Appropriate Assessment comes from Article 6(3) of the Habitats Directive. The first step of the Appropriate Assessment process is to carry out a Screening to establish whether, in relation to a particular plan or project, an Appropriate Assessment is required. Article 6(3) states:

"*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*."

The above requirement has been implemented in the Republic of Ireland by the European Communities (Birds and Natural Habitats) Regulations 2011 and the Planning and Development Acts 2000 (as amended). Under Section 177U (1) of the Planning Acts, a Screening for AA of the project "*shall be carried out by the competent authority* "*to assess in view of best scientific knowledge, if that project, individually or in combination with another plans or projects, will have a significant effect(s) on any European sites."*

The methodology in this report draws on, and has evolved from European Commission guidance (European Commission, 2001) and Irish guidance from the former Department of Environment, Heritage and Local Government (DEHLG, 2010) and recommendations from international AA practitioners (Levett-Therivel, 2009; Chvojková et al., 2013). The entire process can be broken down into four stages (EC, 2001), as outlined below:

- **Stage 1- Screening for AA -** Screening determines whether stage 2 Appropriate Assessment is required by determining if the project would be likely to have significant effect(s) on any European site(s). The test is a 'likelihood' of effects rather than a 'certainty' of effects. In accordance with the Waddenzee Judgement[3] a likely effect is one that cannot be ruled out on the basis of objective information. This is underpinned by the precautionary principle which is enshrined in law in the Habitats Directive, and the test of beyond reasonable scientific doubt as presented in the Habitats Directive. Paragraph 49 of the same judgement adds 'where a plan or project is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site. The assessment of that risk must be made in the light inter alia of the characteristics and specific environmental conditions of the site concerned by such a plan or project.'
- **Stage 2 - AA** – If the Screening has determined that an AA is required, the competent authority then considers the effect of the project or plan on the integrity of the European site(s). The AA considers the structure and function of European sites, and their conservation objectives, and effects from the project/plan both alone and in combination with other projects or plans. Where there are adverse effects on site integrity identified, mitigation measures are proposed as appropriate to avoid adverse effects. For projects, the AA process is documented within a Natura Impact Statement (NIS). This is provided to the competent authority by the applicant, to facilitate an informed assessment of the project.
- **Stage 3- Assessment of alternative solutions** – If following AA including proposal of mitigation, adverse effects on integrity remain, or uncertainty remains, an Assessment of Alternatives is required. The process of examining alternative ways to complete the project and avoid adverse effects to the integrity of any European sites is likely to have been incorporated into Screening and AA. However, if adverse effects remain after mitigation, alternatives are revisited at this stage.
- **Stage 4 - Imperative Reasons of Over-Riding Public Interest (IROPI)** - In the unlikely event where an Assessment of Alternatives was required, and only if this failed to identify any alternatives which would not adversely affect European sites, Imperative Reasons of Over-Riding Public Interest (IROPI) could potentially be enacted, whereby compensatory measures are implemented to maintain the coherence of

[3] [ECJ case C-127/02]

the European site network in the face of adverse effects to site integrity. If a proposed project is to be authorised on the basis of IROPI, an application a 'statement of case' is required to serve as the basis for an IROPI decision. Referral to the relevant Minister is also required, in advance of informing or obtaining the opinion of the European Commission.

3. Detailed Screening Methodology

This Appropriate Assessment Screening Statement assesses the potential for likely significant effects (LSE) of the proposed Project on European sites. It was informed by a desk study of all relevant environmental information and involved the following steps (broadly based on EC, 2001):

- determined if the proposed Project was directly connected with or necessary to the management of the site;
- described the proposed Project;
- described the baseline environment;
- listed European sites which are those sites potentially connected to the proposed Project by source-pathway-receptor linkages; and
- concluded if linkages to sites could give rise to LSE

3.1 Method for Identifying Relevant European Sites

3.1.1 The Source-Pathway-Receptor Model and Zones of Influence

The standard 'source-pathway-receptor' conceptual model is a standard tool in environmental assessment. In order for an effect to occur, all three elements of this mechanism must be in place. The absence or removal of one of the elements of the mechanism means there is no likelihood for the effect to occur. An example of this model is provided below:

- Source(s); – e.g. Earthworks;
- Pathway(s); e.g. Vibration; and
- Receptor(s); e.g. Underground otter resting site at risk of collapse.

The model is focused solely on the Qualifying Interest(s) (QIs) for which sites are designated as per the latest Conservation Objectives from the National Parks and Wildlife Service (NPWS) website, or substitute detailed objectives from other sites where only generic objectives are available.

The precautionary principle prevails where 'reasonable scientific doubt' cannot be ruled out (see Section 3.1.3). Known threats to QIs of relevant sites are analysed to avoid overlooking subtle or far-field effect pathways on the Conservation Objectives of relevant QIs. The duration of potential effects on Conservation Objectives is a key consideration, in particular because the European Court of Justice has recently ruled—albeit in specific reference to priority habitats—that effects to site integrity must be "lasting"[4].

LSEs to European sites are identified by applying the source-pathway-receptor model to receptor-specific 'zones of influence' (i.e. the area over which effects may occur) Zones of influence.

The proposed Project has the potential to result in a number of impacts, which could potentially have effects on European sites. As per Table 3.1, the analysis of these effects, using scientific knowledge and professional judgement, leads to the identification of a 'Zone of Influence' (ZoI) for each effect i.e. the distance at which the impact of the proposed Project could have potential effects.

[4] Judgment Of The European Court (Third Chamber) on 11 April 2013 in Case C 258/11 (REQUEST for a preliminary ruling under Article 267 TFEU from the Supreme Court (Ireland)) in relation to Peter Sweetman, Ireland, Attorney General, Minister for the Environment, Heritage and Local Government v An Bord Pleanála, para 46 (and others).

Potential Impact and Effect	Description	Zone (s) of influence and rationale ('zones of influence' distinguished from rationale with bold text)
-Land-take resulting in habitat loss or degradation. -Potential indirect effects to fauna species utilising habitats	-The temporary or permanent loss of the habitat present in the footprint of the proposed Project. -Degradation of habitats present within the footprint or immediately adjacent works (including temporary works areas).	Land within the proposed development footprint of works (including temporary works).
-Changes in surface water quality and quantity/distribution resulting in habitat loss or degradation. -Potential indirect effects to fauna species utilising habitats	Reduction in the quality of retained habitat or loss of habitat as a result of surface water pollution (e.g. sedimentation) and/or changes to direction of flow or volume of surface water.	Changes in surface water quality, as a result of the remediation, are assessed downstream of the proposed Project, but the potential spatial extent of effects is difficult to quantify due to the significant variables including the varying concentrations/types of contaminants which could be released, the resilience to pollution of different receiving waterbodies (i.e. 'assimilative capacity'), and the resilience of different aquatic species to toxicity or physical changes in the environment. A precautionary approach is applied to include the entire freshwater catchment downstream for highly sensitive aquatic receptors such as Atlantic salmon *Salmo salar*.
-Changes in groundwater quality and quantity/distribution resulting in habitat loss or degradation. -Potential indirect effects to fauna species utilising habitats	Reduction in the quality of retained habitat or loss of habitat as a result of groundwater pollution (e.g. sedimentation) and/or changes to direction of flow or volume of groundwater.	- Changes to groundwater features as a result of construction or operation are assessed within a radius of 250 m from intrusive works[5],
-Direct species mortality during proposed Project	Death or mortal injury of individuals of QI species as a direct result of the proposed Project in both terrestrial and aquatic habitats.	Land within the proposed development footprint.
-Disturbance of invasive species resulting in habitat degradation -Potential indirect effects to fauna species	Reduction in quality of retained habitat by reduction in species diversity.	Land within/adjacent the proposed development footprint and access routes.
-Noise/vibration resulting in indirect species disturbance.	Indirect impact on QI fauna species reducing their ability to feed, rest or breed.	Group or species-specific: -Up to 150 m for otter underground sites[6]; -Up to 500 m of the proposed development footprint for wintering birds[7]; -Refer to Appendix A for other species.

[5] A radius of 250m m is the area within which further survey of groundwater-dependent habitats is recommended, where intrusive excavation is proposed (e.g. for borrow pits or wind turbine foundations) , according to the Scottish Environmental Protection Agency (SEPA, 2014).
[6] Vibration and human presence effects to otter assessed within 150 m in accordance with guidance on road construction-related disturbance of underground sites from the National Roads Authority (NRA, 2006).

[7] Wintering birds are collectively considered at risk of disturbance at up to 500m from works based on conservative interpretation of data compiled from Madsen (1985); Smit & Visser (1993) and Rees et al., (2005). Hen harrier flight initiation distance of 750 m from Whitfield et al., (2008).

Potential Impact and Effect	Description	Zone (s) of influence and rationale ('zones of influence' distinguished from rationale with bold text)
-Human presence resulting in perceived disturbance to highly sensitive bird species at significant distance from works.	Indirect impact on feature populations, due to reduced breeding success (e.g. associated with interruptions to feeding of young resulting from adult birds temporarily abandoning breeding sites).	-Zones of influence similar to noise/vibration above.

Table 3.1: Zones of Influence from the proposed Project Criteria to Identify a Preliminary List of Sites

3.1.2 Zones of influence

A single worst-case ZoI encompassing all pathways for significant impacts generates a list of preliminary sites potentially impacted. Next, the list of sites and features is revised by scoping out features based upon the receptor-specific ZoI and QIs for which the sites are designated. ZoI are identified based on professional judgement and published studies (see Appendix A for full details).

3.1.3 The Precautionary Principle

Reasoned application of the 'Precautionary Principle' is fundamental to the Screening Stage (and AA). The precautionary principle is referenced in Article 191 of the Treaty on the Functioning of the European Union (TFEU). It relates to an approach to risk management whereby if there is the possibility that a given policy or action might cause harm to the public or the environment and if there is still no scientific consensus on the issue, the policy or action in question should not be pursued. Once more scientific information becomes available, the situation should be reviewed.

3.1.4 In-combination Effects

Where source-pathway-effect linkages are identified between the proposed Project and European sites, the potential for in-combination effects with other plans and projects is examined. If there are no identified pathways, there is no potential for the proposed Project to have LSE, and subsequently no potential for in-combination effects.

If required, the in-combination assessment would include plans and projects, whose implementation is 'reasonably foreseeable', including:

- the incomplete parts of projects that have been started but which are not yet completed;
- projects given consent but not yet started;
- projects that are subject to applications for consent;
- projects that are subject to outstanding appeal procedures;
- any known projects that are not subject to any consent;
- ongoing projects subject to regulatory reviews, such as discharge consents or waste management licences;
- policies and proposals that are not yet fully implemented in plans that are still in force; and
- draft plans that are being brought forward by other public bodies.

4. Field Survey Methodology

4.1.1 Survey Dates and Types

A suite of ecology surveys were undertaken between September 2015 and 2016 by Jacobs (and Aquens Ltd. working on behalf of Jacobs) to inform the screening for AA. Surveys spanned all four seasons and covered the optimal survey periods for all flora and fauna species as defined in Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2009b). A surface and groundwater monitoring programme has also been ongoing on site since 2012. Water quality monitoring results informed the identification of source-pathway-receptor links via hydrological pathways. Relevant ecology and water quality surveys are summarised in **Table 4.1**.

Surveys of Species/Habitats which could be QIs of European sites	Field Survey Area (m beyond boundary)	Survey Date(s)
Habitat survey of terrestrial areas, to include invasive species therein, within the ZoI of LSEs	50m	September and November 2015; March, June, and July 2016
Habitat survey for ground-water-dependent habitats within the ZoI of LSEs, and any associated species	250m	
Habitat suitability assessment for marsh fritillary butterfly *Euphydryas aurinia* within the ZoI of LSEs	50m	September 2015
Breeding bird surveys within ZoI of the proposed development.	100m	March and June 2016
Otter surveys, focusing particularly on potential underground or above ground breeding or resting sites within the ZoI of LSEs in the Morrell River, and canal feeder.	150m beyond boundary for resting sites; 300m for watercourse crossing points	November 2015
Groundwater monitoring	Water quality monitoring is currently undertaken monthly at seven locations including the Morell River and the Canal Feeder Stream (see Aquens Ltd. Report in Appendix B) An extended suite of sampling is undertaken on a bi-annual basis for an increased number of locations (sixteen) and parameters.	Regularly since 2011 (refer to text following table)
Surface water monitoring	Multiple surface water samples upstream and downstream of the proposed development site) from the River Morrell and Canal feeder stream. Also surface water sample at the site discharge point to the Canal feeder. Surface water run-off samples are also collected onsite from the oil interceptor in Zone 2 adjacent to the entrance road along the southern part of the site.	Regularly since 2011 (refer to text following table)
Surface water monitoring (biological)	Eight locations on the River Morrell; two locations on the Hartwell river (tributary of Morrell)	2012, 2015 and 2016.

Table 4.1: Ecology surveys informing the Screening for AA (Surveys by Jacobs Engineering Ltd. unless otherwise noted)

The survey areas shown in **Table 4.1** were determined with reference to the description of the proposed Project set out in Section 5.1 which informed the potential ZoI of different effects from the proposed Project, given the varying spatial sensitivities/ranging distances of different species and habitats (Appendix A).

The groundwater and chemical surface water sampling monitoring has been undertaken following completion of a Remedial Options Appraisal in July 2013 and builds upon earlier rounds of groundwater and chemical surface water monitoring undertaken by or on behalf of the Environmental Protection Agency (EPA) at the site since 2011.

Biological samples of surface water were positioned to indicate the upstream and downstream water quality in relation to the facility. As the Hartwell River joins the Morell River along the length of the river that may be affected by the proposed Project both upstream and downstream of the confluence were included. The macroinvertebrate sampling method adopted employed 'kick-sampling' combined with 'stone-washing' to identify species present in substrates, as applied by the EPA in the national river monitoring programme (McGarrigle et.al., 2002). Macroinvertebrate sampling was complemented by the recording of physical characteristics including Temperature, Dissolved Oxygen, pH, and conductivity.

Any invasive species listed on Schedule 3 to the Bird and Habitat Regulations 2011-2015 were identified and mapped from spring through summer (March & June-July 2015) to record both early and later-flowering species whose disturbance could, if dispersed beyond the proposed Project boundary, could pose a risk of LSEs on European sites.

Otter surveys were undertaken in November 2015, within the optimal survey window (NRA, 2009b) after vegetation dieback. Otters were surveyed through detection of tracks, markings, feeding signs, and spraints and by direct observation. The objective of the survey was to record any activity of otters potentially associated with populations of European sites, which were using the Kerdiffstown site temporarily (e.g. for feeding, resting or breeding).

The field survey area for breeding birds was a minimum of 100m beyond the proposed Project to record all birds within the potential ZoI of indirect effects during construction and operation (including disruption in territorial singing due to increased road noise). Surveys for kingfisher extended to 150m to address potential impacts to kingfisher nest holes in soft substrates collapsing at distance (i.e. applying the same rationale as that for mammal underground resting sites). Field surveys were complemented by a desktop search of potentially suitable breeding habitat for highly sensitive QI breeding species potentially associated with European sites.

Breeding birds were surveyed on two visits (March and June 2016), in calm conditions, between sunrise and 11am, having regard for the Common Birds Census territory mapping method (Gilbert et al., 1998). The objective of the survey was to record any breeding activity of birds potentially associated with European sites, which were using the Kerdiffstown site temporarily (e.g. for feeding or roosting).

4.1.2 Surveys not relevant to the Screening for AA

Bat activity and roost surveys were completed on various dates in summer 2016 as part of ongoing EIA surveys. However, only one bat (lesser horseshoe bat *Rhinolophus hipposideros*) is the QI of SACs in Ireland and would be relevant to AA. Lesser horseshoe bat does not occur in the eastern half of Ireland, as its favourable reference range is restricted to the western Atlantic seaboard (NPWS, 2013b). The bat surveys completed for EIA purposes are not discussed further in this Screening Statement for AA.

QI non-breeding birds associated with designated SPAs were 'scoped out' as a relevant consideration in AA at an early stage in the ecology survey programme. There was no potential habitat for QI non-breeding populations to occur (e.g. swans, geese, waterfowl, waders) due to the absence of pasture, cropland, or semi-natural wetland features within the proposed development boundary.

5. Proposed Development

5.1 Description of Proposed Project

Kerdiffstown Landfill in County Kildare is a former quarry which has been progressively backfilled with wastes. In June 2010, the former operator of the landfill vacated the site and it was left in an unsecured condition. In January 2011, a major fire developed within the mass of mounded waste material present in the north of the site. The landfill poses a number of risks due to large areas of uncapped waste, remnants of buildings and structures on-site, man-made ponds, steep slopes and the lined cell with a temporary cap. The former landfill requires remediation to reduce the risks to public health and safety and the environment. The proposed Project is to remediate the site by providing an engineered capping system, providing a landscaped profile and improving the management of landfill gas, leachate and surface water to ultimately provide a multi-use public park.

This remediation strategy for the site will include the following key elements:

- Re-profiling the site to address current over-steep slopes to stabilise slopes on the perimeter of the site, permit installation of a capping system across areas of waste and to allow for surface water drainage;
- Capping predominant areas of waste to prevent on-going infiltration of rainwater, reducing leachate production, and to facilitate management of landfill gas and odour;
- Surface water drainage to manage run-off and control discharge from the site;
- Leachate management to remove and transfer leachate to a wastewater treatment plant; and
- Gas management to extract landfill gas from identified bodies of waste reducing the risk of migration from the site.

5.2 Programme and Timing of Works

Subject to the relevant approvals the remediation is likely to commence early 2018. The remediation of the site is predicted to last approximately five years and will be phased. A total of seven phases are proposed with each lasting approximately 6 months.

6. Baseline Environment

6.1 Sources Informing the Baseline Description

The baseline environment of the site for the proposed Project in relation to European sites was analysed using the key desktop sources below:

- Recent aerial photography for the site captured by drone in 2016;
- Mapping of European site boundaries, Conservation Objectives and habitat /species distributions from the NPWS[8];
- Protected species and habitat mapping data obtained from the NPWS Research Branch on various dates in 2015 and 2016;
- Information on the conservation status of relevant SAC and SPA species and habitats from NPWS conservation status assessments online;
- Information on the conservation status of bird species of designated sites from the Birds of Conservation concern in Ireland 2014-2019 (Colhoun & Cummins, 2013; and
- Information on land zonings and land-use plans available from the Department of the Environment, Community and Local Government9.
- Data from the NPWS Research Branch including:
- 'Favourable Reference Range' GIS data for Habitats Directive species/habitats as used in Article 17 reports (NPWS, 2013a and b); and
- Tabulated threats and pressures for relevant QIs.

Relevant plans from county to local scales are critical to inform a robust assessment of in-combination effects, and these are listed below:

- Draft Kildare County Development Plan 2017-2023.
- Kildare County Development Plan 2011-2017.
- Naas Town Development Plan 2011 – 2017.

6.2 Baseline Description

6.2.1 Existing Site Condition

The proposed development site is the Kerdiffstown landfill site, located in Naas, Co. Kildare. The proposed development site is a disused landfill, on the site of a former sand and gravel quarry. The quarry was progressively backfilled with wastes by a variety of operators from its operation as a landfill from the 1950s onwards. In June 2010 Neiphin Trading, who operated the site as a licenced landfill between 1995 and 2010, vacated the site and left the site in an unsecured condition. Since February 2011, the Environmental Protection Agency (EPA) has been taking action to limit environmental impacts at the Kerdiffstown landfill. Jacobs has assisted the EPA in environmental control, and are currently providing site supervision.

The proposed Project footprint supports a variety of habitats. Scrub and grassland were dominant, while treelines and hedges were common along the proposed Project boundary. Other habitats included recolonising bare ground, buildings and artificial waterbodies. Scrub and grassland habitats dominated in the north while the majority of buildings and areas of hardstanding were associated with the southern end of the proposed Project footprint. The proposed Project footprint also supported steep sandy banks along the north-east and south-eastern boundaries. The site is abutted to the north and east by Naas golf course, woodland, and parkland

[8] Available online at www.npws.ie; Accessed September 2016
[9] Available online at at www.myplan.ie; Accessed September 2016

associated with Kerdiffstown House. An inactive quarry abuts the site to the northwest; while residential dwellings and pasture fields grazed by horses abut the site to the south and southwest respectively.

6.2.2 Current Site Conditions and Drainage – Pre Remediation

The site has been divided into four zones as shown in **Table 6.1** below and Figure 6.1. Table 6.1 summarises those elements within each zone of relevance to surface water assessment. The existence of uncapped wastes means that surface water currently infiltrates the site to mix with leachate produced through the waste mass, most notably in Zones 1 and 3.

No.	Current Zone Characteristics (relating to Surface/Groundwater See Section 2.1 for more details)
1/1A	Wastes in this area of the Site are uncapped although large areas are covered in vegetation. This zone is unlined and localised areas of free leachate are present within the wastes. Currently there is no surface water control within Zone 1 and rainfall largely infiltrates into the ground, runs-off to the surrounding ground or evaporates.
2A/2B	Much of this zone is covered by thick, reinforced concrete pads, which form an impermeable layer over the wastes and prevent direct rainwater ingress. The smaller area of wastes not covered by concrete allows rainwater to infiltrate in a similar manner to Zone 1 above. Leachate production in this area is already significantly reduced by presence of the concrete slabs. Currently, hard-standing surface water run-off from Zone 2A (from around the site office, former buildings 1 & 2 and the site access road) drains into road gullies and flows through a settling tank and subsequently through an oil interceptor via piped network to the Canal Feeder Stream. Foul drainage from the Site offices currently drains to a septic tank which is cleaned out on a regular basis.
3	Zone 3 comprises a lined cell, which has been partially infilled with wastes, and this infilled area has been capped (temporarily) with a combination of geosynthetic liner and heavy gauge polyfilm . Leachate is collected by pumps transferring the leachate to two tanks above the cell area for removal by road tanker, where the leachate is treated at Ringsend Waste Water Treatment Plant (WwTP). The lined cell has not been completely infilled to date but the entirety of the basal drainage layer is covered with temporary liner and a ditch has been formed to collect surface water run-off from the temporary capped area, which transfers surface water to a surface water channel and to a surface water lagoon located in Zone 4. This lagoon has no outlet hence waters dissipate to groundwater. Due to a permeable horizon lying above a clay layer on the south slope of the cell, groundwater has been noted to build up behind the liner. This water is extracted via pin wells and drains into the surface water channel feeding the surface water lagoon.
4	Zone 4 contains the surface water lagoon, which is cut into the surface which is considered to include some waste deposits. Any leachate generated in this area is considered to be weak and discharges directly to groundwater.

Table 6.1: Zonation of Kerdiffstown Site

Existing drainage conditions on site can be summarised as follows:

- An area located to the south extents of the site, within the land ownership boundary, comprises houses, access roads, a stockpile of fill material and drainage features;
- Drainage from a property located to the south of the site flows into drains, transferring into road gullies to the settling tank and oil interceptor, to then be discharged via piped network to the Canal Feeder Stream;
- A septic tank extending from a property located to the south-west of the site is located within the site boundary. It is understood that this septic tank is of a soakaway design, and discharges into the site;
- Limited surface water run-off currently drains to the Canal Feeder Stream (i.e. only hardstanding around the site offices, and two partially demolished buildings adjacent to the site offices);
- This run-off is first treated in a settling tank and an oil interceptor before entering the Canal Feeder Stream via the existing piped network;

- Water from the Canal Feeder Stream currently enters the Grand Canal approximately 2 km north of the proposed development; and
- The Grand Canal enters the River Liffey in Dublin City, via the Grand Canal Basin.

Note: Neither the Grand Canal nor the River Liffey are designated as European sites (the River Rye tributary of the Liffey is designated as the Rye Water Valley/Carton cSAC, but is upstream of the River Liffey) and some 14km upstream of the proposed Project.

6.2.3 Future Site Condition and Drainage – Post Remediation

Foul water and Leachate: will be collected pumped to the Landfill Infrastructure Compound where it will be treated and then transported off site, via gravity mains, to the Irish Water pumping station at Johnstown. From there it will be pumped on to Osberstown WwTP,

Clean Surface Water: Following capping and restoration works clean surface water (from Zones 1, 2A, 2B, 3 and 4) will run-off for collection in a series of open channels to be directed to a surface water pond located within Zone 4 where it will ultimately be discharged to the Morell River

A local area over the north flank of the site in Zone 1 cannot be collected and transferred to the pond due to the ground levels, hence this will be collected in a swale located at the toe of the slope and will soak to ground. A limited area to the north-west of the site again in Zone 1 will collect surface water in a storage pond and attenuated before draining to a soakaway.

Potentially contaminated water: Surface water from the car parks and internal road network will be directed via a kerb and gully system to a petrol interceptor and then on to the surface water pond where it will be ultimately discharged to the Morell River.

6.2.1 Rivers, Wetlands and Aquatic Species

There are no semi-natural wetlands within the site. Figure 6.2 shows the existing surface water environment in the vicinity of the site. There are two existing leachate 'lagoons' as described above. These have no surface water connectivity with other watercourses. These have no potential to provide habitat to QI species such as wetland birds in transit to designated areas, due to their polluted status, and lack of semi-natural vegetation.

As described above, the existing facility discharges surface water via an existing pipe into the 'Canal Feeder Stream 'which lies to the south-west of the proposed Project footprint. This stream, which is approximately 2m wide, has low, open banks which are heavily poached by cattle. The flow is sluggish, and there is little significant instream vegetation other than algae and scattered macrophytes. At its closet point, the Canal Feeder Stream is less than 120 m from the site boundary. There is no potential for Atlantic salmon to occur in the stream, and surveys in November 2015 recorded no otter breeding or resting sites.

The Morell River lies to the east of the proposed development and has a WFD status of moderate (see Section 6.2.2). At its closest point, the Morell River is less than 20m from the site boundary. There are no SACs designated for Atlantic salmon or lamprey upstream or downstream of the Morrell River. However, these two species and white-clawed crayfish are known to occur within the Morell River. Potential impacts on these non-QI species is assessed separately within the EIA. The Morrell River discharges into the River Liffey south of Straffan approximately 3km upstream of the site. There are no European sites or QIs affected by the proposed Project.

6.2.2 Overview of Surface Water Quality

The national monitoring programme conducted by the Environmental Protection Agency (EPA) has shown that both the Hartwell and Morell Rivers have been impacted in the past with Q-values as low as Q3 recorded (www.epa.ie last accessed November 2015). The most recent water quality results (2013) indicate that the Morell River has deteriorated from 2012 with a Q3 recorded above Kerdiffstown and improving to a Q3-4

approximately 1.5km below. Similarly, the Hartwell River had also deteriorated from 2012 and was assigned a Q3-4 in 2013.

Aquens Ltd. undertook water quality monitoring in 2012, 2015 and 2016. The most recent report (Aquens Ltd. 2015) is provided in Appendix B. In 2016 their assessment concluded that both the Morell and the Hartwell are somewhat impacted. The Morell River is slightly polluted in the upper stretches but is moderately polluted directly upstream of the proposed Project footprint. As the Morell River flows alongside the proposed Project footprint the status remains as a Q3 until the Hartwell River joins and appears to dilute the Morell River. The two sampling sites on the Hartwell River indicate that the biological quality is slightly better than that of the Morell River and therefore is improving the quality of the Morell River. Overall findings of the water quality monitoring indicated that the Morell and Hartwell rivers are somewhat impacted, with a score of Q3-4 at different locations. Water quality in the Morell has reduced since 2012. However, there is no evidence from the benthic invertebrates that the Kerdiffstown facility is significantly affecting the community composition in the Morell River.

6.2.3 European Sites in the Vicinity of the proposed Project

The assessment focuses on QIs for which sites are designated as per the latest Conservation Objectives from the NPWS website, or substitute detailed objectives from other sites where only generic objectives are available.

In the context of Appropriate Assessment, identifying the European sites overlapping or adjacent to the proposed Project is significant to the initial characterisation of baseline environment. There are no European sites overlapping or adjacent to the proposed Project (see Figure 6.3) as such there is no potential for Qualifying Interest (QI) habitats or flora to be impacted as part of the proposed Project as impacts on such QI would only arise from direct land take. Mobile QI species (e.g. otter) which can move outside the confines of a designated site are discussed in detail below.

6.2.4 Distribution of Potential QI Species

Otter

Otter *Lutra lutra* is a widespread species (Reid et al., 2013). Otter could potentially feed in or commute along the Morrell River and/or Canal Feeder Stream on the margins of the proposed Project site, outside of the confines of any SAC. However, otter surveys in November 2015 found no potential or confirmed otter breeding or resting sites in either of these watercourses. As will be shown in Section 8, there are no SACs designated for otter within at least 10km of the proposed Project (10km is the mean territory size used in this screening report for AA; see Appendix A).

Bats

The lesser horseshoe bat *Rhinolophus hipposideros* is the only bat species which is a QI of Irish SACs. The NPWS' Article 17 mapping (NPWS, 2013b) shows that the favourable reference range for lesser horseshoe bat does not overlap the proposed Project. There are no SAC for the species within 50 km of the proposed Project. The species is not relevant to the screening assessment.

Invertebrates

There are a number of invertebrate species which are QIs of SACs in Ireland; including marsh fritillary *Euphydryas aurinia*, the freshwater pearl mussel (FWPM) *Margaritifera margaritifera* and three species of whorl snail *Vertigo spp.* The desktop study and site surveys have confirmed there is no potential habitat for these species within the proposed Project footprint or immediate surrounding habitat.

The NPWS' Article 17 mapping confirms the favourable reference range for FWPM does not overlap the proposed Project footprint. Furthermore, there are no QI populations of the species downstream of the proposed development.

Bird Populations

The proposed Project does not overlap any SPAs, and the nearest SPA is more than 10km distant, as identified in Section 8. There is no cropland, or arable land within the site or surrounding it with the potential to host feeding or roosting swans or geese, which may move significant distances beyond their core areas. The location of the site inland makes it unlikely to be favoured by QI waders or waterfowl, and the artificial leachate lagoon within the site is heavily eutrophic and provides poor feeding opportunities to wetland birds generally. Breeding bird surveys in spring/summer 2015 recorded no species which could form part of designated QI populations.

Fish

The Morell River provides spawning habitat for lamprey and a key population of Atlantic salmon in addition to supporting significant populations of brown trout. In their scoping response to the EIS Inland Fisheries Ireland noted that the River Liffey and several of its tributaries (including the Morrell River) are exceptional in the area in supporting Atlantic salmon and sea trout, in addition to resident brown trout populations. However, there are no SACs downstream designated for freshwater life stages of aquatic species sensitive to siltation such as spawning Atlantic salmon or lamprey.

7. Consultation

In undertaking the assessment, consideration has been given to the scoping responses and other consultation as undertaken and detailed in Table 7.1 below

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
National Park and Wildlife Service (NPWS)	Inter-agency group meeting held on 31 March 2016	Damien Clarke (NPWS District Conservation Officer for Kildare, Laois and Offaly) noted that no Special Area of Conservation (SAC) is in close proximity to the site	Separate AA screening was undertaken to assess any potential for LSE arising from the proposed Project.
Development Application Unit (DAU)	Scoping report acknowledged. Further letter sent to the DAU 23 February to request feedback.	-	-
Inland Fisheries Ireland (IFI)	Scoping response received on the 18 November 2016	- Highlighted the importance of the Morell River and its tributaries for spawning Atlantic salmon and brown trout, lamprey and white-clawed crayfish. - Reiterated the need for implementation of comprehensive leachate and surface water management measures to avoid ecological impacts on receiving waters.	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid any impacts on ecological interests within the Morell River and the Grand Canal.
An Taisce	Scoping response received on the 18 November 2016	- Any wetland habitat created will be beneficial to wildlife, use of plants of local provenance. - Where unavoidable damage to the habitats and protected species, ensure strong mitigation measures are implemented.	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid any impacts on protected species and overall biodiversity of the site.
EPA	Scoping response received on the 18 November 2016	- In relation to Biodiversity the EPA raised concerns about the spread of invasive species (listed on Part 1 or Part 3 of the Third Schedule of the European Communities Regulations, 2011) and/or the risk of invasive species being brought on site in vector material (imported soils).	All issues raised are addressed in the EIAR and appropriate mitigation put in place to avoid the spread of invasive species or the importation of invasive species into the site via vector materials (see Chapter 4).

Table 7.1: Consultation undertaken as part of the EIA

8. Screening Assessment

8.1 Proximity of European Sites and their Qualifying Interests

European sites in the vicinity of the proposed Project are shown in Figure 6.3. A list of SACs potentially within the ZoI of the proposed Project footprint are shown in Table 8.1 and SPAs in Table 8.2. In summary:

- There are no SACs with mobile QI species located within 10km of the proposed Project footprint (i.e. the mobile ranging distance of otter according to the published scientific research in Appendix A).
- There were no SACs downstream designated for freshwater life stages of aquatic species sensitive to siltation such as spawning Atlantic salmon or lamprey.
- There are two SPAs within 20km of the proposed Project (i.e. the maximum potential foraging range of wetland QI species from their designated sites according to the published scientific research in Appendix A)

Site and Code	Distance from Proposed Development (km)	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs) (* = Priority Habitat)
Red Bog, Kildare SAC (000397)	7.5	Transition mires and quaking bogs [7140]
Ballynafagh Bog SAC (000391)	10	Active raised bogs [7110]
		Depressions on peat substrates of the Rhynchosporion [7150]
		Degraded raised bogs still capable of natural regeneration [7120]

Table 8.1: SACs potentially within the ZoI of the proposed Project footprint

Site and Code	Distance from Proposed Development	Qualifying Interests (cSACs/SPAs) or Reason for Designation (pNHAs)
Poulaphouca Reservoir SPA (004063)	10	Greylag Goose *Anser anser* Lesser Black-backed Gull *Larus fuscus*
Wicklow mountains SPA (004040)	16.5	Merlin *Falco columbarius* Peregrine *Falco peregrinus*

Table 8.2: SPAs potentially within the ZoI of the proposed Project footprint

The proposed Project footprint is not situated within or next to any European sites and there are no QI habitats or species of any SAC or SPA within the ZoI of the proposed Project boundary. As shown on Figure 6.3 the two closest European sites are the 'Red Bog, Kildare' SAC, located approximately 7.5km away and the Ballynafagh Lake SAC, located approximately 10km from the proposed Project. The two closest SPAs are Poulaphouca Reservoir located 10km from the site and the Wicklow mountains SAC located over 16.5km from the proposed Project footprint.

The River Liffey is not designated for nature conservation at its confluence with the Morell River, or downstream of the confluence. The River Rye, which flows into the River Liffey downstream of the proposed Project at Leixlip is designated as the Rye Water Valley/Carton SAC, but is upstream of any potential hydrological effect pathway with the proposed Project. The nearest European site hydrologically connected to the site is at least 30km downstream (Dublin Bay), measured by connecting watercourses, including the Morell River. However, designated sites in Dublin Bay do not support any aquatic QI species such as Atlantic salmon or lamprey and therefore there is no potential for LSE on these designated sites arising from the proposed Project.

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8.2 Source-Pathway-Receptor Links

8.2.1 European Sites and Qualifying interests

Following the methodology described in Section 3, the screening assessment comprised determining if there were any 'Relevant' European sites (and 'Relevant' QIs therein). 'Relevant' European sites/QIs are those potentially linked to the proposed Project by a source-pathway-receptor link. If identified, such sites/QIs would require further analysis to determine if the identified link(s) could result in LSEs.

Having identified a preliminary list of European sites in Section 8.3 the source-pathway-receptor conceptual model was applied, given the characteristics of the proposed Project, to identify which designated sites, and specific features within sites, may be scoped into a further impact assessment, see below.

Table 8.3: Identification of Designated Site Potentially Affected

Site and Code	Distance from Proposed Development (km)	Qualifying Interests (cSACs/SPAs)	Potential Source-~Pathway-Receptor Link?	Scoped into Assessment?
Red Bog, Kildare SAC (000397)	7.5	Transition mires and quaking bogs [7140]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
Ballynafagh Bog SAC (000391)	10	Active raised bogs [7110]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
		Depressions on peat substrates of the *Rhynchosporion* [7150]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
		Degraded raised bogs still capable of natural regeneration [7120]	No – no loss of QI habitat associated with the proposed Project. No other potential source-pathway-receptor links identified.	No
Poulaphouca Reservoir SPA (004063)	10	Greylag Goose Lesser Black-backed Gull	No - Desktop and field survey indicates no populations within ZoI of disturbance or other potential impacts. Furthermore likely to be well outside core foraging range for these species from designated sites. Core foraging range for greylag goose is up to 12 km from designated roosts/feeding sites[10], much less for gulls (<1km).	No
Wicklow mountains SPA (004040)	16.5	Merlin Peregrine	No - Desktop and field survey indicates no populations within ZoI of disturbance or other potential impacts. Nests within 500 m of effect could be subject to disturbance[11].	No

[10] see reference list, Bell (1988).
[11] Nests are not mobile, but birds can perceive disturbance at significant distances to pose a threat. Distance is likely critical reaction distance based on Whitfield et al. (2008).

8.3 Relevant European Sites

Only 'Relevant' sites and QIs potentially linked to the proposed Project by a source-pathway-receptor would require further analysis to determine if the identified pathway could result in LSE. No source-pathway-receptor links were identified for the proposed Project as outlined in Table 8.3 above.

8.4 In-combination Effects

Where source-pathway-effect linkages are identified between a proposed Project and European sites, the potential for in-combination effects with other plans and projects has to be examined. No potential for LSE were identified and therefore there is no potential for in-combination effects.

8.5 Screening Conclusion Statement

An Appropriate Assessment of the proposed Project(s) is not required. It can be excluded, on the basis of objective scientific information, and in light of no implications for the conservation objectives of relevant sites from the proposed Project that the proposed Project, either individually or in-combination with other plans or projects, will have likely significant effects on any European site.

References

Aquens Ltd. (2015). Water Quality Assessment of the Morell and Hartwell Rivers adjacent to the Kerdiffstown Facility In Co. Kildare. Unpublished Draft report to Kildare County Council.

Bell, M.V. (1988) Feeding behavior of wintering Pink-footed and Greylag Geese in north-east Scotland. Wildfowl, 39, pp. 43-53.

Benson, L. (2009). Use of inland feeding sites by Light-bellied Brent Geese in Dublin 2008- 2009. M.Sc Project. School of Biology and Environmental Science, University College Dublin.

Bontadina, F., Schmied, S. F., Beck, A., & Arlettaz, R. (2008). Changes in prey abundance unlikely to explain the demography of a critically endangered Central European bat. *Journal of Applied Ecology*, 45(2), pp. 641-648.

Carney, K. M., & Sydeman, W. J. (1999b). A review of human disturbance effects on nesting colonial waterbirds. *Waterbirds*, pp. 68-79.

Chvojkova, E., Volf, O., Kopeckove, M., Hummel, J., Cizek, O., Dusek, J., Brezina, S. and Marhoul, P. (2013). Manual for assessment of significance of impacts on target features of natura 2000 sites. Ministry of the Environment of the Czech Republic.

Colhoun, K. & Cummins, S. (2013. Birds of Conservation Concern in Ireland 2014-2019. Irish Birds 9, 523-544.

DoEHLG (2010). Appropriate Assessment of plans and projects in Ireland. Guidance for Planning Authorities. Department of Environment, Herixtage and Local Government: Ireland.

Draft Kildare County Development Plan 2017 -2023. Kildare: Ireland.

EC (2000). Managing Natura 2000 sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC.

EC (2001). Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General).

Jacobs Engineering (2016). *Groundwater and Surface water Monitoring Report*. Unpublished report to Kildare County Council. May 2016.

Kildare County Development Plan 2011 – 2017. Kildare: Ireland.

KCC (2011). Naas Town Development Plan 2011 – 2017. Kildare: Ireland.

Levett-Therivel, (2009). Principles for Good Practice Appropriate Assessment of Plans under Article 6(3) Habitats Directive: Draft International Workshop on Assessment of Plans under the Habitats Directive Oxford, UK, 1-2 October 2009Available on http://www.levett-therivel.co.uk/principles.htm

Madsen, J. (1985). Relations between spring habitat selection and daily energetics of Pink-footed Geese *Anser brachyrhynchus*. *Scandinavian Journal of Ornithology*. 16, pp. 222–228.

McGarrigle, M.L., Bowman, J. J., Clabby, K. J., Lucey, J., Cunningham, P., MacCárthaigh, M., Keegan, M., Cantrell, B., Lehane, M., Clenaghan C. and Toner, P. F. (2002) Water Quality in Ireland 1998 – 2000. EPA.

National Roads Authority (2006). Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes. National Roads Authority: Ireland

National Roads Authority (NRA) (2009b) Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. National Roads Authority.

NPWS (2013a). The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

NPWS (2013b). The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3, Version 1.0, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Rees, E. C., Bruce, J. H., & White, G. T. (2005). Factors affecting the behavioural responses of whooper swans (*Cygnus c. cygnus*) to various human activities. *Biological conservation*, 121(3), pp. 369-382.

Reid, N., Hayden, B., Lundy, M.G., Pietravalle, S., McDonald, R.A. & Montgomery, W.I. (2013) National Otter Survey of Ireland 2010/12. Irish Wildlife Manuals No. 76. DAHG, Ireland.

Schofield, H.W. (1996). The ecology and conservation biology of *Rhinolophus hipposideros*, the lesser horseshoe bat. Unpbl. Ph. D. Thesis, University of Aberdeen (198pp).

Seale, E. (2010). The conservation biology and genetics of the marsh fritillary, *Euphydryas aurinia* (Rottemburg, 1775) (*Lepidoptera, Nymphaliidae*), in Northern Ireland. A thesis submitted to Queen's University Belfast in accordance with the requirements of the degree of Doctorate of Philosophy in the Faculty of Medicine, Health and Life Science.

SEPA (2014). Land Use Planning System SEPA Guidance Note 31. Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and groundwater Dependent Terrestrial Ecosystems. Scottish Environment Protection Agency: Scotland.

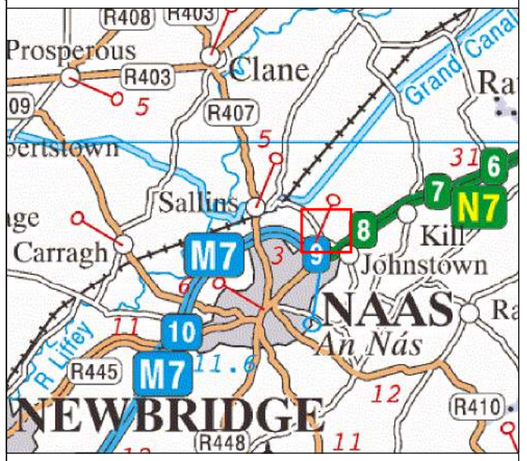
Smit, C.J. & Visser, G.J.M. (1993). Effects of disturbance on shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta area. Wader Study Group Bull. 68: 6-19.

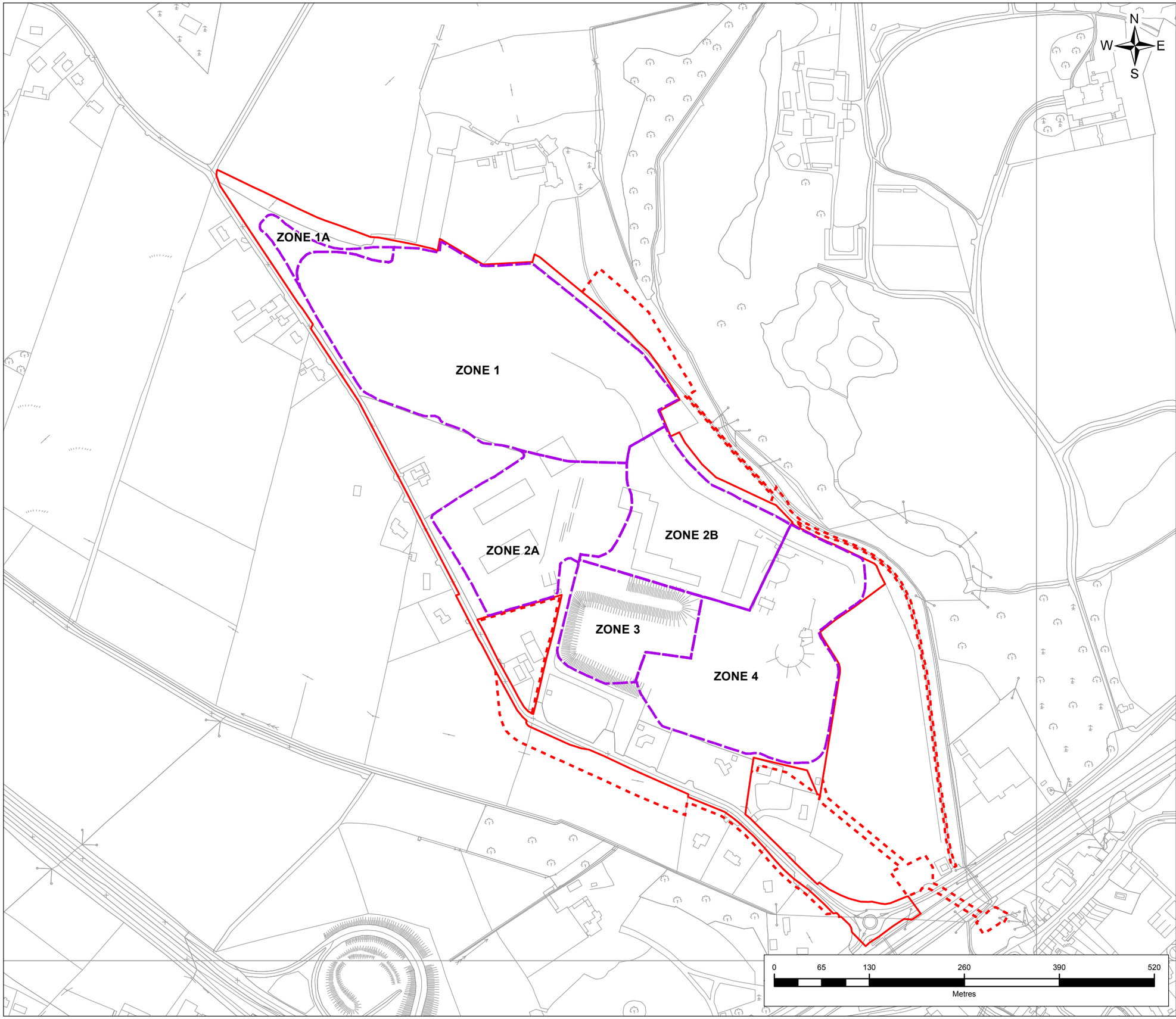
SNH (2013). Scottish Natural Heritage: Scotland

Whitfield, D. P., Ruddock, M., & Bullman, R. (2008) Expert opinion as a tool for quantifying bird tolerance to human disturbance. *Biological Conservation*,141(11), pp. 2708-2717.

Figures

FIGURE 6.1





Legend

- Proposed CPO Boundary
- Proposed Temporary CPO Boundary
- Indicative Zone Boundary

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	10/08/2017	SCREENING REPORT FOR AA	AC	PW	CC	RR

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Client: Kildare County Council
Comhairle Contae Chill Dara

Project: KERDIFFSTOWN LANDFILL REMEDIATION PROJECT

Drawing Title: FIGURE 6.1 - EXISTING SITE LAYOUT

Drawing Status: SCREENING REPORT FOR AA

Scale @ A3	1:5,000	DO NOT SCALE
Jacobs No.	32EW5604	
Client No.	6286	
Drawing No.	32EW5604-601 P1	Rev 1

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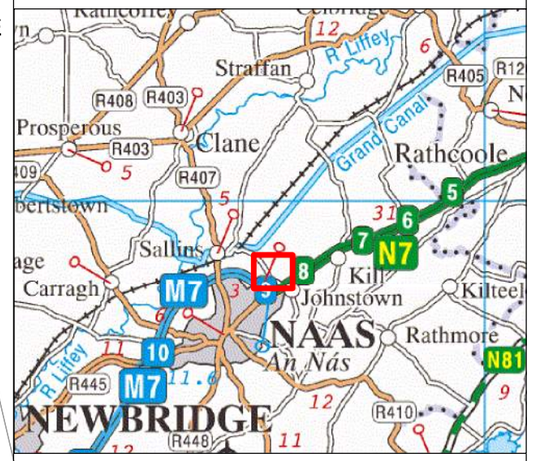
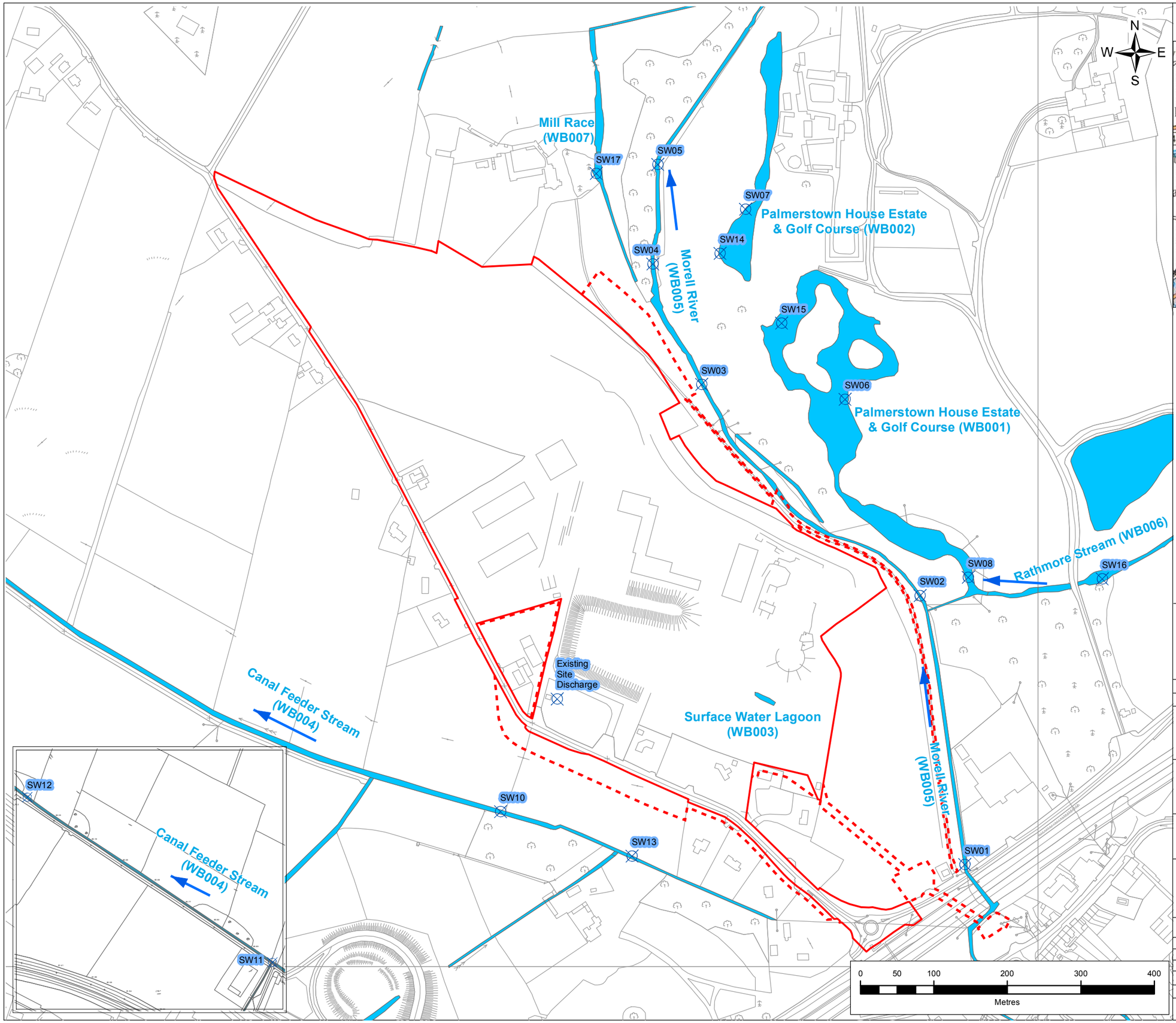
FIGURE 6.2





Legend

- Proposed CPO Boundary
- Proposed Temporary CPO Boundary
- Surface Water Monitoring Point (Existing)
- Watercourses

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	10/08/2017	SCREENING REPORT FOR AA	AC	PW	CC	RR

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Drawing Title: FIGURE 6.2 - SURFACE WATER QUALITY MONITORING LOCATIONS & WATERCOURSES

Drawing Status: SCREENING REPORT FOR AA

Scale @ A3	1:5,000	DO NOT SCALE
Jacobs No.	32EW5604	
Client No.	6286	
Drawing No.	32EW5604-602 P1	Rev 1

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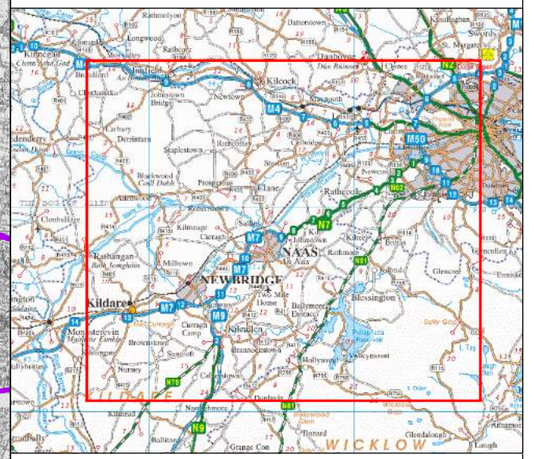
FIGURE 6.3



N
W E
S

Ballina Bog pNHA
Carbury Bog NHA
Donadea Wood pNHA
Hodgestown Bog NHA
The Long Derries, Edenderry SAC
Ballynafagh Bog pNHA
Ballynafagh Lake pNHA
Ballynafagh Bog SAC
Grand Canal pNHA
Ballynafagh Lake SAC
Rye Water Valley/Carton pNHA
Rye Water Valley/Carton SAC
Royal Canal pNHA
Liffey Valley pNHA
Dodder Valley pNHA
Lugmore Glen pNHA
Slade Of Saggart And Crooksling Glen pNHA
Glenasmole Valley pNHA
Glenasmole Valley SAC
Wicklow Mountains SAC
Kilteel Wood pNHA
Liffey At Osberstown pNHA
Mouds Bog SAC
Mouds Bog pNHA
Pollardstown Fen pNHA
Pollardstown Fen SAC
Curragh (Kildare) pNHA
Liffey Bank Above Athgarvan pNHA
Red Bog, Kildare SAC
Red Bog, Kildare pNHA
Glencree Valley pNHA
Liffey Valley Meander Belt pNHA
Poulaphouca Reservoir pNHA
Poulaphouca Reservoir SPA
Wicklow Mountains SPA
Newtown Marshes pNHA
Dunlavin Marshes pNHA
Hollywood Glen pNHA
River Barrow And River Nore SAC

0 1.75 3.5 7 10.5 14
Kilometres

Legend

- Site Location
- 10 km Buffer of Site
- 20 km Buffer of Site
- Special Area of Conservation (SAC)
- Special Protected Area (SPA)
- Natural Heritage Areas (NHA)
- Proposed Natural Heritage Areas (pNHA)

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
1	10/08/2017	SCREENING REPORT FOR AA	AC	PW	CC	RR

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Drawing Title: FIGURE 6.3 - ECOLOGICAL DESIGNATED SITES

Drawing Status	SCREENING REPORT FOR AA	
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Jacobs No.	32EW5604	
Client No.	6286	
Drawing No.	32EW5604-603 P1	Rev 1

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Appendix A. Extents of Sensitivity of QIs

Table A.1– Extents of Sensitivity for QI Habitats and Plant species informing the Screening for AA

QI Feature(s)	Effects to which QIs Potentially Sensitive	Sensitivity Extent and Potential Mobility	Rationale
Terrestrial habitats and plant species without groundwater or surface-water dependency (e.g. oak woodlands, Killarney fern, limestone pavement)	Direct habitat loss or damage within footprint of works.	QIs have no mobility; no effects unless works overlap habitat/plant species.	No habitat loss/damage can occur unless works overlap the extent of the habitat/plant.
	Habitat loss or damage or invasive species establishment.	QIs have no mobility; no effects unless works overlap or are adjacent to habitat/plant species.	No invasive species spread can occur unless works carry plant fragments or seeds into or adjacent to the habitat/plant
Ground-Water Dependent habitats and plant species. (e.g. turloughs, petrifying springs petalwort *Hamatocaulis verniculosus*).	Habitat loss or indirect effects from changes to direction of groundwater flow or groundwater volume.	Although QIs have no mobility, they are dependent on groundwater flow which has high mobility. Any significant effects to groundwater resources within 250 m of the QIs could be significant.	The area over which intrusive excavations (e.g. foundations or borrow pits) may pose a risk to Ground Water Dependent Terrestrial Ecosystems has been estimated at 250 m by the Scottish Environmental Protection Agency (SEPA, 2014). This distance does not account for significant abstraction effects, which are not applicable in the case of the proposed development.

Qualifying Interest Species (Other than Birds)

Table A.2– Extents of Sensitivity for QI Non-bird fauna species informing the Screening for AA

QI Feature(s)	Effects to which QIs Potentially Sensitive	Sensitivity Extent and Potential Mobility	Scientific Rationale
Otter breeding or resting sites	Mortality or reduced breeding success resulting from loss or collapse of underground sites (or lighting of underground sites at night)	QI is highly mobile and territories can extend over **10 km** from designated areas.	Based on mean territory size of male and female Irish otters, in radio-tracking study on the River Boyne (O'Neill, 2008, cited in Reid et al., 2013).
Lesser horseshoe bat *Rhinolophus hipposideros* roosts or foraging habitat	Mortality or reduced breeding success due to loss of roosts or foraging habitat within core area.	QI is highly mobile and bats can require core foraging habitat over **4 km** from designated areas.	Although maximum foraging ranges for the species have approached 6 km in Ireland, which Bat Conservation Ireland have recommended as a precautionary distance over which to consider effects (BCI, 2012; e.g. 5.2 km in Galway; Rush and Billington, 2014), and Wales (4.2 km; Bontadina et al., 2008 no studies have found core foraging ranges (i.e. mean foraging ranges) in excess of 4 km (Schofield, 1996; Bontadina et al., 2008; Rush and Billington, 2014).
Marsh fritillary individuals or their habitat	Direct injury to butterflies or their habitats.	QI is highly mobile and butterflies could establish metapopulations up to **10 km** beyond designated areas, as this corresponds to their potential dispersal range.	10 km is maximum dispersal range of the species (Seale, 2010; Zimmerman et al., 2011). *Note: no overall mean dispersal range available.*
Atlantic salmon, Lamprey spp. (river, brook, sea), Freshwater Pearl Mussel .	Direct loss or damage to spawning/nursery grounds or mussel beds during instream works. Potential indirect effects from noise and lighting.	QIs are highly mobile, but spawning grounds are not; effects only where **spawning habitats within footprint** of works. Effects assessed on a case-by-case basis subject to the lighting intensity and underground noise levels.	No habitat loss/damage predicted beyond footprint of works.
	Siltation/pollution effects to gravels and mussel beds.	Silt/pollutants are highly mobile and can be dispersed throughout a **river catchment**.	Once released, silt/pollutants could be remobilised over time potentially reaching any downstream gravels or mussel beds within the same river catchment.

Qualifying Interest Bird species

Table A.3– Extents of Sensitivity for QI Breeding Bird species informing the Screening for AA

Breeding Bird QI (s)	Effects to which QIs Potentially Sensitive	Sensitivity Extent and Potential Mobility	Scientific Rationale
Chough *Pyrrhocorax pyrrhocorax*	Significant disturbance effect to nest site.	Nests within **1 km** of disturbance subject to professional judgement (e.g. regarding local topography that may screen disturbance).	Sensitivity buffer of this distance recommended for nest sites by Bright et al., (2006).
Cormorant *Phalacrocorax carbo* nests	Significant disturbance effect to nest site.	Nests within **200 m** of disturbance subject to professional judgement (e.g. regarding local topography that may screen disturbance).	This distance is precautionary based on data in Carney & Sydeman (1999).
Nests of gulls, terns, fulmar *Fulmarus glacialoides* storm petrel *Hydrobates pelagicus*	Significant disturbance effect to nest site.	Nests within **500 m** of disturbance subject to professional judgement (e.g. regarding local topography that may screen disturbance).	This distance is precautionary based on data in Carney & Sydeman (1999).
Hen harrier nests	Significant disturbance effect to nest site.	Nests within **750 m** of disturbance subject to professional judgement (e.g. regarding local topography that may screen disturbance).	750 m is the likely critical reaction distance based on Whitfield et al., (2008).
Merlin *Falco columbarius* nests	Significant disturbance effect to nest site.	Nests within **500 m** of effect.	Distance is likely critical reaction distance based on Whitfield et al., (2008).

Table A.4– Zones of Influence for QI Wintering Bird species informing the Screening for AA

Wintering Bird QI (s)	Sensitivity Extent and Potential Mobility	Scientific Rationale
Barnacle Goose	15 km	SNH, 2013
Greenland white-fronted goose	8 km roosts/feeding sites.	SNH, 2013
Greylag goose	15-20 km from designated roosts/feeding sites.	SNH, 2013
Light-belled goose	15 km from designated roosts/feeding sites.	Benson (2009)
Wading birds	Up to 5 km for birds feeding at inland sites	Professional judgement, expert opinion from consultation exercise, and preliminary unpublished oystercatcher re-sighting data from Birdwatch Ireland from Dublin Bay (pers. Comm., Birdwatch Ireland)
Waterfowl (ducks, moorhen *Gallinula chloropus*)	None known at time of writing. Habitat availability, and existing records used to determine potential presence	N/A
Whooper swan	5 km from roosts/feeding sites.	SNH, 2013

Appendix B. Aquens Ltd. (2016)

WATER QUALITY ASSESSMENT OF THE MORELL AND HARTWELL RIVERS ADJACENT TO THE KERDIFFSTOWN FACILITY IN CO. KILDARE

FINAL REPORT

PREPARED BY AQUENS LTD.

SEPTEMBER 2016

INTRODUCTION

AQUENS Ltd. was commissioned by Kildare County Council to undertake a biological assessment of the water quality of the Morell and Hartwell Rivers, Co. Kildare to assess the potential impact the Kerdiffstown facility may be having on the Morell River. A water quality assessment was undertaken at eight sampling localities on the Morell River and two on the Hartwell stream to assess the upstream and downstream water quality as indicated by the benthic macroinvertebrate community. The Hartwell River joins the Morell River adjacent to the Kerdiffstown facility and therefore the water quality had to be assessed to determine its influence on the Morell River.

Most of the sites were previously monitored in 2012 and 2015 at which time the quality rating indicated that the Morell upstream of the facility was moderately polluted and improved to slightly polluted once the Hartwell joined the Morell River. The results showed that the facility had no discernible impact on the biological quality of the Morell River. Upstream sources of pollution meant that the Morell River was already impacted upstream of the Kerdiffstown landfill and no further impact was detected in 2015. in addition, the quality improved further downstream of the facility, probably as a result of the dilution effect of the Hartwell River on the Morell River. An additional two sites on the Morell and one on the Hartwell River were monitored in the present survey to determine the water quality further upstream and assess the extent of the impacted stretch.

The national monitoring programme conducted by the Environmental Protection Agency (EPA) has shown that both these rivers have been impacted in the past with Q-values as low as Q3 recorded (www.epa.ie last accessed November 2015). The most recent water quality results (2013) indicate that the Morell River has deteriorated from 2012 with a Q3 recorded above Kerdiffstown and improving to a Q3-4 ~1.5km below. Similarly the Hartwell River had also deteriorated from 2012 and was assigned a Q3-4 in 2013.

MATERIALS & METHODS

The water quality assessment was undertaken using the benthic macroinvertebrates as bioindicators. These are standard bioindicators of water quality as the various taxa exhibit differential responses to physical and chemical changes in their environment and the composition reflects the extent of environmental change. Some macroinvertebrates are sensitive to pollution while others are tolerant and the percentage composition of the community provides a realistic record of the prevailing water quality conditions (as an integrated signal of relatively long water quality conditions).

On request of the client macroinvertebrate sampling took place on 23rd June 2016. The same seven sites were sampled on the Morell and Hartwell Rivers to compare to previous surveys conducted in 2012 and 2015 (Baars & Kelly-Quinn, 2012; 2015). Three additional sites were added in the present survey (2016), and included two further upstream on the Morell River (M7 & M 8) 1km upstream of M1 and one on the Hartwell River (H2) above H1. The sites were chosen to represent the upstream water quality and to help interpret the proximity of the source of upstream pollution sources (Figure 1). Because the Hartwell River joins the Morell River along the length of the river that may be affected by the Kerdiffstown facility the Hartwell had to be included to determine its influence on the water quality of the Morell River. As a result three sites (M1, M7 & M8) provided an indication of the water quality entering the area immediately upstream, and the other sites provided the progression downstream (M2 to M6) (Figure 1). Two sites (H1 & H2) provided an indication of the water quality status of the Harwell River (Figure 1). The location of the tributary and feeder streams of the constructed ponds on the golf course are not as indicated on the OSI maps but no other natural or man-made surface runoff point enters the Morell River along the length assessed. The Hartwell River enters the Morell River directly below sampling site M2. The indicative site characteristics are provided in Table 1 to assist in the interpretation of the water quality. These measurements do no provide an exhaustive account of the physical conditions of the sampling sites.

Table 1: Characteristics of the sampling sites on the Morell and Hartwell Rivers.

Sampling Site (OSI)	Width	Depth	T°C	DO	pH	Cond.	Dominant Substrates	In-stream Vegetation	Flow Conditions
Morell River									
M1 (N918 216)	2.8	0.50	14.3	10.65	8.84	622	Gravel (fine & course)	*Ranunculus* spp., *Fontinalis*, *Apium* & good marginal	Deep fast flowing run
M2 (N918 219)	4.9	0.35	14.4	10.25	8.82	637	Sand (F & C) some gravel, large parts consolidated	Algae & little *Fontinalis* spp.	Shallow depositing, limited riffle
M3 (N918 220)	3.9	0.26	14.7	10.34	8.92	598	Gravel, sand and some cobble	*Ranunculus* spp., *Fontinalis* spp., Filamentous algae	Fast shallow run & riffle
M4 (N915 222)	5.4	0.26	14.6	10.31	8.93	613	Cobble, gravel & sand	little *Fontinalis* spp.	Glide, Run & Riffle
M5 (N914 225)	4.9	0.31	14.4	10.34	8.64	628	Cobble, gravel & sand	little *Fontinalis* spp., *Apium nodiflorum*	Run & Riffle some glide
M6 (N916 227)	3.4	0.43	14.3	10.43	7.48	605	Cobble, gravel & sand	little *Fontinalis* spp.	Glide, Run & Riffle
M7 (926 204) ~1km upstream of M1	1.5	0.21	14.8	10.88	8.92	667	Course gravel dominated and some cobble, mostly consolidated substrate	Some *Fontinalis*	Mostly glide/run, minimal Riffle
M8 (913 204) ~1km upstream of M1	2.8	0.24	12.6	10.01	8.55	619	Cobble course gravel dominated, some fine sediment and consolidated sections	Large *Apium* beds, some liverworts and *Fontinalis* spp.	Run/Glide and some deep riffle
Hartwell River									
H1 (N919 220)	4.1	0.25	15.9	9.95	8.95	541	Compact clay, gravel and some cobble & boulders	Filamentous algae & *Fontinalis* sp., *Glyceria* on margins	Fast Riffle & Run
H2 (N926 218)	2.4	0.13	15.9	9.82	8.93	545	Cobble, course gravel dominated with some boulders	Considerable algal growth, marginal Glyceria and *V. becabunga*	Fast riffle & Run

The sampling method adopted was that applied by the EPA in the national river monitoring programme (McGarrigle *et. al*., 2002). Using an FBA (Freshwater Biological Association) pond net (1mm mesh), a 2-minute, multi-habitat kick-sample was taken at each site. In addition, one minute stone-washing was also undertaken. The samples were preserved in 70% IMS and processed in the laboratory. They were sorted in an illuminated tray and all the macroinvertebrates were identified to the appropriate taxonomic resolution using FBA taxonomic keys.

The macroinvertebrate data were used to derive a Q-value using the EPA methodology (McGarrigle *et al*., 2002). This Q-value system is a five point scale (Q1-Q5: with intermediate scores obtainable, e.g. Q3-4) based on the proportions of five groups of macroinvertebrates, with different pollution tolerances (Appendix A). Two other biotic indices (BMWP and ASPT) were calculated (See Appendix B). The BMWP score is based on the presence of pollution-tolerant to pollution-sensitive families. Each family is assigned a score. The BMWP score is the sum of these family scores. Families that are sensitive to pollution are assigned higher scores than pollution-tolerant families. A high overall score indicates that the water quality is good. The ASPT is determined by dividing the BMWP score by the number of scoring taxa yielding a score between 1 and 10, values >6 usually indicate good water quality. In addition, taxon richness and the percentage of Ephemeroptera/Plecoptera/ Trichoptera (%EPT) were determined.

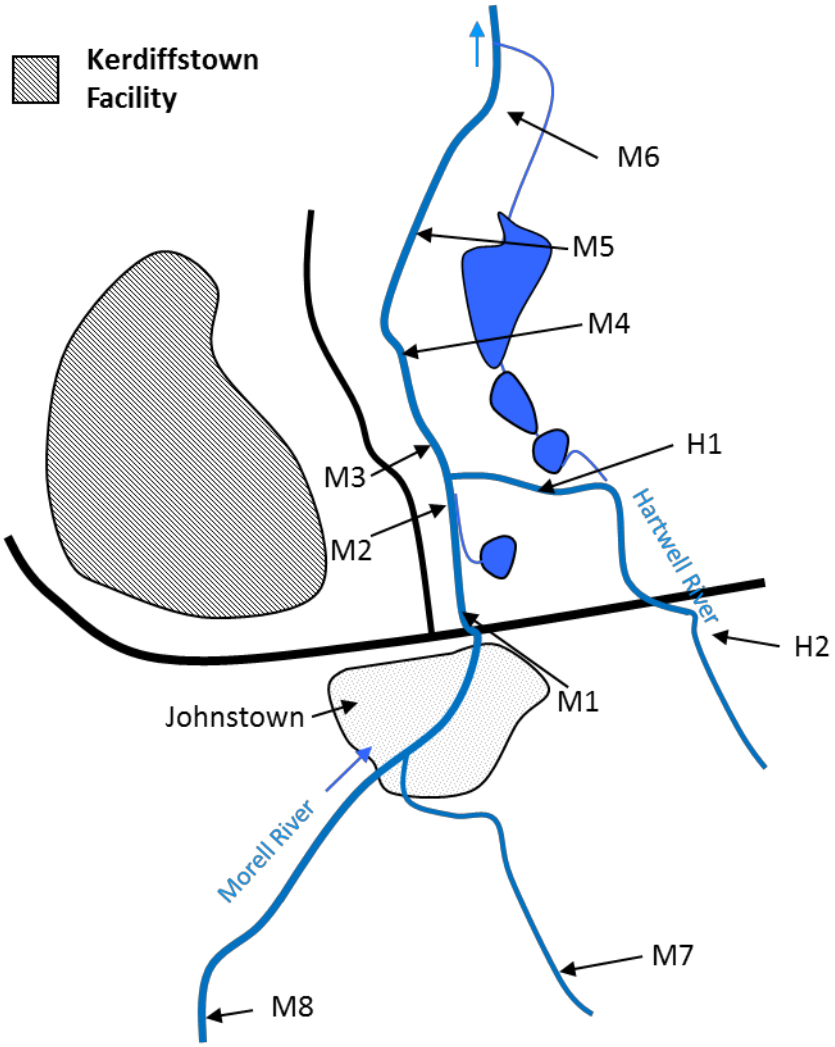

Figure 1: Schematic diagramme showing the location of sampling sites M1-8 on the Morell River and tributary and H1 & H2 on the Hartwell River in relation to the Kerdiffstown facility.

Plate 1: Sites assessed on the Morell River (M) adjacent to the Kerdiffstown facility. M7, tributary upstream, M8 Morel upstream, M1 upstream & downstream of Johnstown, M2 upstream of confluence with Hartwell River, M3 ~30m downstream of Hartwell River confluence, M4 further downstream.

Plate 2: Sites assessed on the Morell (M) and Hartwell (H) Rivers adjacent to the Kerdiffstown facility. M5 & M6 further downstream on Morell River. H1 50m before it joins the Morell River, H2 East of M7 motorway on the Hartwell River.

A range of physical (average depth and width, mesohabitat type and substrate composition) and chemical characteristics (dissolved oxygen, temperature, conductivity and pH) were determined on site using hand-held meters (Table 1).

RESULTS

Site Characteristics

As in the previous survey the banks of both rivers are disconnected from the adjacent habitat due to past flood relief/river redirection works. Most of the banks were at least >1m in height and steep sided. Flow was relatively fast at most of the sites with little in-stream vegetation, with the exception of *Fontinalis* sp., *Ranunculus* spp., liverworts and some filamentous algae (see Table 1).

Most of the substrates were relatively clean but largely consolidated through calcification leaving little loose cobble and coarse gravel available for invertebrates. Sites did have accumulations of fine sand and sediments. Very few boulders were present and most sites appeared scoured. The water chemistry is indicative of the soil and geology in the area with alkaline pH and high conductivities (Table 1). Oxygen levels were within normal ranges (80-120%) with the exception of Site M2 & M6 (>120%).

Benthic Invertebrates

A total of 42 taxa were recorded during the survey, with individual sites recording between 19 and 30 taxa in the single, 2-minute kick sample taken at each site (Table 2). Overall the list of taxa was dominated in diversity by the less sensitive species, with only 17 taxa belonging to the Ephemeroptera, Plecoptera and Trichoptera (EPT) groups considered more pollution sensitive. In terms of abundance EPT made up the majority of the taxa at only four of the seven sites.

One of the notable absences were the cased caddis (Trichoptera) as had been noted in the previous assessment (Baars and Kelly-Quinn, 2012), again probably as a result of the fast flow, embedded substrates and limited marginal vegetation (steep disconnected river banks) that usually offer sheltered microhabitats.

Water Quality

The taxa recorded and their abundances at each site are presented in Table 2. Several metrics were applied to the benthic invertebrate taxa collected at each site. The Q-values were assigned on the basis of the sensitivity groups present in abundance, % representation and taxon richness (Table 3). The majority of the sites on both the Morell and Hartwell Rivers have either few or no Group A taxa, a small percentage of group B taxa present and a dominance of Group C. As a result the sites were assigned either a Q3 or Q3-4 indicating moderate to slight pollution.

Sites M1, M2 & M3 were assigned a Q3 and are thus moderately polluted. These three sites were dominated by Group C taxa, no Group A taxa present and a low percentage representation and diversity of Group B (Table 3 & Table 4). The two upstream sites (M7 & M8) about 1km above M1 on the Morell River were assigned a Q3-4 indicating slight pollution. These indicate that the Morell River deteriorates either directly above Johnstown or as a result of inputs coming from Johnstown. The Q3 status at M1 indicates that the river is moderately impacted before any potential impact arising from the Kerdiffstown facility.

The sampling sites on the Hartwell River were both assigned a Q3-4, on the basis of the high proportion of Group C and relatively higher proportion of Group B with some Group A taxa present. The Hartwell River before entering the Morell River is therefore considered slightly polluted, but has better water quality than the upstream sites on the Morell River including M2 (directly above the confluence of the Morell and Hartwell Rivers) which was assigned a Q3. Directly below the confluence the Morell River (site M3) was still assigned a Q3 (Table 4) but all the other sites further downstream on the Morell River were assigned a Q 3-4 and are considered slightly polluted. The Hartwell River is diluting pollutants in the Morell River and improving the status downstream. The other metrics including the ASPT and EPT are in line with the Q values assigned but indicate that M7 & M8 are on the low side of Q3-4 possibly indicating that the Hartwell is in a better ecological status than the upper stretches of the Morell River. The ASPT values of M7 and M8 were 5.67 and 5.5 respectively. The EPT were well represented in terms of their abundance, but were once again largely made up of those considered less sensitive, e.g. *Baetis rhodani*, *Seratella ignita* and *Hydropsyche* species.

Table 2: Benthic macroinvertebrate taxa recorded at each of the ten sampling sites.

Group	Family	Species/genus	M1	M2	M3	M4	M5	M6	H1	H2	M7	M8
Crustacea	Asellidae	*Asellus aquaticus* (L.)		4	3	4	3	3	1	3	4	2
	Gammaridae	*Gammarus duebeni* (Lilj.)	255	108	222	156	160	81	372	308	140	384
	Astacidae	*Austropotamobius pallipes* (L.)					1	1				
Ephemeroptera	Baetidae	*Baetis rhodani* (Pictet.)	17	1	37	14	4	4	11	73	3	63
		Alianites muticus (L.)				2	1		1			2
	Ephemerelliidae	*Seratella ignita* (Poda)	313	171	534	290	303	295	221	767	99	231
	Eohemeridae	*Ephemera danica* Muller					1	2			2	
	Heptageniidae	*Rhithrogena semicolorata* (Curtis)							1			
	Leptophlebidae	*Paraleptophlebia* spp.				1						
Plecoptera	Leuctridae	*Leuctra fusca* (L.)					1		3	2		
Trichoptera	Hydropsychidae	*Hydropsyche instabilis* (Curtis)	5	15	10	28	18	8	15	7	37	
		Hydropsyche fulvipes (Curtis)	3	9	6	15	6	4	4	3	19	
	Rhyacophilidae	*Rhyacophila dorsalis* (Curtis)		1	3	5	1	1		2	4	
	Limnephilidae	*Micropterna sequax* McLachlan	1			1	1			2	1	2
		Drusus annulatus (Stephens)				2	1		4	31	5	14
		Chaetopteryx villosa (Fab.)	1									
	Sericostomatidae	*Sericostoma personatum* (Spence in K & S)		2			3	3			4	1
Coleoptera	Elmidae	*Elmis aenea* (Müller)			4	2	1		4	4	8	
		Limnius volckmari (Panzer)			3				3	2	4	
		Esolus parallelepipedus (Müller)									2	
Mollusca	Sphaeriidae	*Sphaerium/Pisidium* spp.					1					
	Lymnaeidae	*Lymnaea peregra* (Müller)		1							1	
Hirudinea	Erpobdellidae	*Erpobdella octoculata* (L.)	1	4						5	4	3
Diptera	Chironomidae	spp. indet.	8	2	45	35	40	13	7	14	30	15
	Simuliidae	spp. indet.	57	40	177	45	4	54	126	324	68	36
	Pedicidae	*Dicranota* spp.	1		1		2			1	1	2
	Empedidae	spp. indet.		1							1	
Oligochaeta	Oligochaeta	spp. indet.	1	9	3			3	1			3
		Eiseniella spp.				4	4					

Table 3: The representation of each invertebrate group as separated by the Q-value system in each of the sampling sites on Morell (M1-6) and Hartwell (H1) Rivers.

Sensitivity grouping	M1	M2	M3	M4	M5	M6	H1	H2	M7	M8
Total Abundance										
Group A	0	0	0	3	3	3	2	0	2	2
Group B	2	2	0	3	6	3	7	35	10	17
Group C	659	348	1042	590	539	460	763	1505	416	731
Group D	2	18	6	8	8	6	2	8	9	8
Group E	0	0	0	0	0	0	0	0	0	0
Percentage Abundance										
Group A	0.0	0.0	0.0	0.5	0.5	0.6	0.3	0.0	0.5	0.3
Group B	0.3	0.5	0.0	0.5	1.1	0.6	0.9	2.3	2.3	2.2
Group C	99.4	94.6	99.4	97.7	96.9	97.5	98.6	97.2	95.2	96.4
Group D	0.3	4.9	0.6	1.3	1.4	1.3	0.3	0.5	2.1	1.1
Group E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of Taxa										
Group A	0	0	0	2	3	2	2	0	1	1
Group B	2	1	0	2	4	1	2	3	3	3
Group C	8	9	11	9	10	8	9	11	13	6
Group D	2	4	2	2	3	2	2	2	3	3
Group E	0	0	0	0	0	0	0	0	0	0

Table 4: Water quality scores, metric scores and invertebrate richness and abundances for 8 sampling sites on Morell (M1-8) and two on Hartwell (H1 & H2) Rivers respectively.

	M1	M2	M3	M4	M5	M6	H1	H2	M7	M8
Q value	Q3	Q3	Q3	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4
BMWP	48	59	53	64	92	62	67	72	85	55
ASPT	4.8	4.92	4.82	5.82	6.13	6.2	6.09	5.54	5.67	5.5
Scoring	10	12	11	11	15	10	11	13	15	10
EPT Taxa (%)	51.3	54.1	56.3	59.3	61.2	67.2	33.6	57.3	39.8	41.3
Taxon Richness	14	17	15	17	19	16	17	17	22	15
Total Abundance	663	368	1048	604	556	472	774	1548	437	758

CONCLUDING COMMENTS

Both the Hartwell and Morell Rivers have been modified in the past (flood relief & urbanisation) and are quite disconnected from the riparian habitats and river banks. The steep banks, the lack of natural sinuosity as a result of past modification and the rhithral nature of these rivers have resulted in very limited marginal habitats. The steep sides and linear nature are likely to have increased the flow which has led to the stretches under investigation being scoured leaving small amounts of cobbles and boulders within the river channel available for invertebrate colonisation. Both rivers are also high in calcium carbonate which has led to the substrates being embedded through calcium carbonate precipitation. It would be expected that as a result of these factors the community would be under stress and highly heterogeneous in spatial distribution.

However, there are patches of suitable substrates and in-stream habitat (fast and slow flowing riffles) that should support a range of invertebrate species, and in the past both the Morell and Hartwell Rivers have supported a high density and diversity of sensitive taxa as indicated by the 2012 survey and earlier surveys conducted by the EPA (Hartwell Q4-5 in 2002/5 and Q5 in 1980, and Morell Q4 in 1982-1991 & 2005)(see Figure 2, page 13).

The results of this assessment indicate that both rivers are impacted. The Morell River is slightly polluted in the upper stretches (M7 & 8) but is moderately polluted directly upstream of the Kerdiffstown facility (M1). As the Morell River flows alongside the facility the status remains as a Q3 until the Hartwell River joins and appears to dilute the Morell River. The two sampling sites on the Hartwell River indicate that the biological quality is slightly better than that of the Morell River and therefore is improving the quality of the Morell River. Based on the other metrics (slightly higher ASPT) the community does have more sensitive taxa present and from past observations on the Hartwell River (site H2) there are sensitive taxa that occur in Spring in the Hartwell River including several Plecoptera (e.g. *Isoperla grammatical*, *Brachyoptera risi*, *Siphonoperla torrentium, Leuctra inermis* and *L. hippopus*).

The present survey indicates that the Hartwell River only has a diluting effect on the Morell River by site M4 where Q3-4 rating was assigned. The Morell River was slightly polluted from this point on including both sites M5 and M6. Because the water quality improved to a Q3-4 after the Hartwell River joined the Morell River there is no evidence from the benthic invertebrates that the Kerdiffstown facility is significantly affecting the community composition in the Morell River.

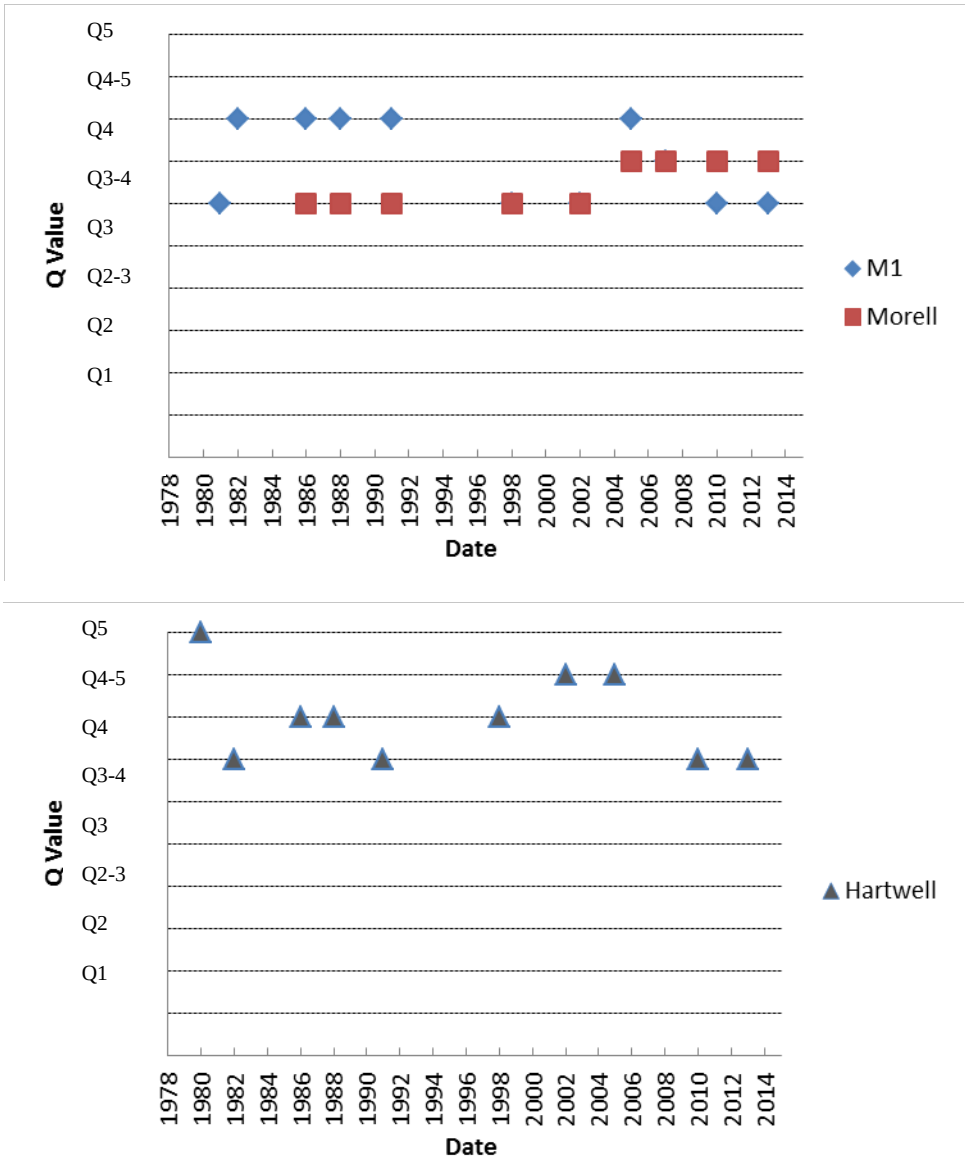

Figure 2: Historical EPA water quality data on the Morell and Hartwell rivers. Sites on Morell refer to same upstream site as one assessed in present survey and Morell refers to site 1.5km downstream of the facility. Site on Hartwell River about 500m upstream of H1 and 150m downstream of H2 in the present study.

The present survey (2016) indicates that the recent deterioration observed in the Morell and Hartwell Rivers since 2012 (Baars and Kelly-Quinn, 2012) is still maintained. The upstream stretches of both rivers, particularly on the Morell River are slightly impacted indicating that there are multiple sources of pressures that need to be addressed in order to improve the quality of these rivers. The present survey indicates that there is a significant pollution pressure either directly above or arising from Johnstown lowering the ecological quality of the Morell River before it gets to the Kerdiffstown facility. Water quality in both of these rivers has been fluctuating over many years according to the data available from the EPA river monitoring programme. As indicated in Figure 2 the Morell has fluctuated between Q3 and Q4 and Hartwell between Q3-4 and Q5 over the last 30 years. Due to their low water volume it is likely these rivers are vulnerable to even low volume of pollution inputs.

Based on the results of the survey conducted, there is no indication that the Kerdiffstown facility is causing a discernible impact on the Morell River as it passes the area. With an upstream status of moderately polluted (Q3) and a slightly polluted status along the lower stretches small changes in water quality that may be arising from the Kerdiffstown facility would theoretically be difficult to detect. Regular monitoring would be advisable, particularly timed to coincide with late spring or early summer (April-June). To assess any likely specific pollutants arising from the facility, if indicated by the water chemistry of the boreholes, other additional monitoring may be considered (given that the Morell River is moderately-slightly polluted upstream) that include 1) a population density assessment of key taxa (to include sensitive and less sensitive taxa), 2) heavy metal bioaccumulation in the freshwater shrimp *Gammarus deubeni*, 3) assessment of the fish tissues for bioaccumulation of heavy metals (although fish are highly mobile).

REFERENCES

Armitage, P. D., Moss, D., Wright, J. F. and Furse, M. T. (1983). The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites. *Water Research* **17** (3): 333-347.

Baars, J-R. and Kelly-Quinn, M. (2012) Water quality assessment of the Morell and Harwell rivers adjacent to the Kerdiffstown facility in Co. Kildare. Report to the EPA.

Baars, J-R. and Kelly-Quinn, M. (2015) Water quality assessment of the Morell and Harwell rivers adjacent to the Kerdiffstown facility in Co. Kildare. Report to the EPA.

McGarrigle, M.L., Bowman, J. J., Clabby, K. J., Lucey, J., Cunningham, P., MacCárthaigh, M., Keegan, M., Cantrell, B., Lehane, M., Clenaghan C. and Toner, P. F. (2002) Water Quality in Ireland 1998 – 2000. EPA.

Appendix A: Macroinvertebrates grouped according to their sensitivity to organic pollution (taken from McGarrigle *et al.*, 2002).

Biological Assessment of Water Quality in Eroding Reaches (Riffles & Glides) of Rivers and Streams*						
Biotic Indices (Q Values) and typical associated macroinvertebrate community structure. See overleaf for details of the Faunal Groups.						
Macroinvertebrate Faunal Groups**	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon Few - Common	Absent	Absent	Absent
Group B	Few to Numerous	Few to Numerous	Few/Absent to Numerous	Few/Absent	Absent	Absent
Group C	Few	Common to Numerous *Baetis rhodani* often Abundant Others: never Excessive	Common to Excessive (usually Dominant or Excessive)	Dominant to Excessive	Few or Absent	Absent
Group D	Few or Absent	Few or Absent	Few/Absent to Common	Few/Absent to Common	Dominant to Excessive	Few or Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few / Absent to Common	Dominant
Additional Qualifying Criteria						
Cladophora spp. Abundance	Trace only or None	Moderate growths (if present)	May be Abundant to Excessive growths	May be Excessive growths	Few or Absent	None
Macrophytes (Typical abundance)	Normal growths or absent	Enhanced growths	May be Luxuriant growths	May be Excessive growths	Absent to Abundant	Present/Absent
Slime Growths (Sewage Fungus)	Never	Never	Trace or None	May be Abundant	May be Abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	Fluctuates from < 80% to >120%	Very unstable. Potential fish-kills	Low (but > 20%)	Very low, sometimes zero
Substratum Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic
Note occurrence/abundance of groups in above table refers to some but not necessarily all of the constituents of the group. The Additional Qualifying Criteria apply in virtually all circumstances. Single specimens may be ignored. Seasonal and other relevant factors (i.e., drought, floods) must be taken into account.						
* Macroinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc.						
** See Further Observations overleaf.						

Appendix A cont.: Abundance categories and interpretation of macroinvertebrate survey results.

Macroinvertebrates grouped according to their sensitivity to organic pollution					
TAXA	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**
	Sensitive	*Less Sensitive*	*Tolerant*	*Very Tolerant*	*Most Tolerant*
Plecoptera	All except *Leuctra* spp.	*Leuctra* spp.			
Ephemeroptera	Heptageniidae Siphlonuriidae *Ephemera danica*	Baetidae (excl. *Baetis rhodani*) Leptophlebidae	*Baetis rhodani* Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		***Aphelocheirus aestivalis***	All except *A. aestivalis*		
Coleoptera			Coleoptera		
Diptera			Chironomidae (excl. *Chironomus* spp.) Simuliidae Tipulidae		*Chironomus* spp. *Eristalis* sp.
Hydracarina			Hydracarina		
Crustacea			*Gammarus* spp. *Austropotamobius pallipes*	*Asellus* spp. *Crangonyx* spp.	
Gastropoda			Gastropoda (excl. *Lymnaea peregra* & *Physa* sp.)	*Lymnaea peregra* *Physa* sp.	
Lamellibranchiata	***Margaritifera margaritifera***		*Anodonta* spp.	Sphaeriidae	
Hirudinea			*Piscicola* sp.	All except *Piscicola* sp.	
Oligochaeta					Tubificidae
Platyhelminthes			All		

Table 3 Abundance categories and relationship to percentage frequency of occurrence (After McGarrigle *et al*., 2002).

Abundance Category	Approx. percentage frequency of occurrence
Absent	no specimens
Present	1 or 2 individuals
Scarce/few	<1% of the total fauna
Small numbers	<5%
Fair Numbers	5-10%
Common	10-20%
Numerous	25 -50%
Dominant	50 -75%
Excessive	>75%

Table 4 Interpretation of quality ratings (After McGarrigle *et al.,* 2002).

Quality ratings	Pollution status
Q5, Q4-5 and Q4	Unpolluted
Q3-4,	Slightly polluted
Q3 and Q2-3	Moderately polluted
Q2, Q1-2 and Q1	Serious pollution

APPENDIX B: BMWP (Biological Monitoring Working Party) Score (after Armitage *et al.*, 1983).

Families	Score
Siphlonuridae, Heptageniidae, Ephemerellidae, Leptophlebiidae, Potamanthidae, Ephemeridae, Taeniopterygidae, Leuctridae, Capniidae, Perlididae, Chloroplidae, Aphelocheiridae, Phyrganidae, Molannidae, Beraeidae, Odontoceridae, Leptoceridae, Goeridae, Lepidostomatidae, Brachycentridae, Sericostomatidae, Perlodidae	10
Astacidae, Lestidae, Agriidae, Gomphidae, Cordulegarsteridae, Aeshnidae, Cordulliidae, Libellulidae, Psychomyidae, Philopotamidae	8
Caenidae, Nemouridae, Rhyacophilidae, Polycentropodidae, Limnephilidae	7
Neritidae, Viviparidae, Ancylidae, Hydroptilidae, Unionidae, Corophidae, Gammaridae, Platycnemididae, Coenagriidae	6
Mesovelidae, Hydrometridae, Gerridae, Nepidae, Naurcoridae, Notonectidae, Pleidae, Corixidae, Halipildae, Hygrobiidae, Dytiscidae, Gyrinidae, Hydrophilidae Clambeidae, Helodidae, Dryopidae, Elmidae, Chrysomelidae, Curculonidae, Hydropschyidae, Tipulidae, Simuliidae, Planariidae, Dendrocoelidae	5
Baetidae, Sialidae, Piscicolidae	4
Valvatidae, Hydrobiidae, Lymnaeidae, Physidae, Planorbidae, Sphaeridae, Glossophoniidae, Hirudinidae, Eropbellidae, Asellidae	3
Chironomidae	2
Oligochaeta	1