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10 Biodiversity

10.1 Introduction

This report has been prepared by Padraic Fogarty of OPENFIELD Ecological Services. Pádraic Fogarty has worked for over 20 years in the environmental field and in 2007 was awarded an MSc from Sligo Institute of Technology for research into Ecological Impact Assessment (EclA) in Ireland. He has an honours degree in Analytical Science from DCU, and diplomas in Environment and Geography (Open University) and Field Ecology (UCC). Pádraic is a full member of the Institute of Environmental Management and Assessment (IEMA).

This section provides for an assessment of the potential effects of the proposed development to biodiversity.

10.2 Assessment Methodology

The assessment was carried out in accordance with the following best practice methodology: 'Guidelines to be contained in Environmental Impact Assessment Reports' from the Environmental Protection Agency (EPA, 2017), and 'Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland' by the Chartered Institute of Ecology and Environmental Management (IEEM, 2016).

Site visits were carried out on the 22nd and 26th of January, and the 22nd and 26th of June 2018. The site was surveyed in accordance with the Heritage Council's Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2010). Habitats were identified in accordance with Fossitt's Guide to Habitats in Ireland (Fossitt, 2000). A species list for each habitat was compiled and these are presented in Appendix 2 of this report. Species abundance was determined using the DAFOR scale (D = Dominant; A = Abundant; F = Frequent; O = Occasional; R = Rare), a subjective estimation but nevertheless a useful mode of habitat description. Sample digital photos were also taken. Data were then uploaded to the ArcView 9.2 GIS software suite.

The nomenclature for vascular plants is taken from The New Flora of the British Isles (Stace, 2010) and for mosses and liverworts A Checklist and Census Catalogue of British and Irish Bryophytes (Hill et al., 2009).

January lies within the optimal survey period for surveying large mammals and especially badgers. June is within the optimal season for general habitat surveys (Smith et al., 2010), breeding birds and bats. Data deficiencies will be highlighted further in this report within relevant sections. A dedicated bat survey was carried out by Brian Keeley and this report is presented separately in Appendix 10-2, while its findings are incorporated in this chapter.

10.3 Baseline Environment

10.3.1 Zone of influence

Best practice guidance suggests that an initial zone of influence be set at a radius of 2km for non-linear projects (IEA, 1995). However, some impacts are not limited to this distance and so sensitive receptors further from the project footprint may need to be considered as this assessment progresses. This is shown in Figure 10-1.

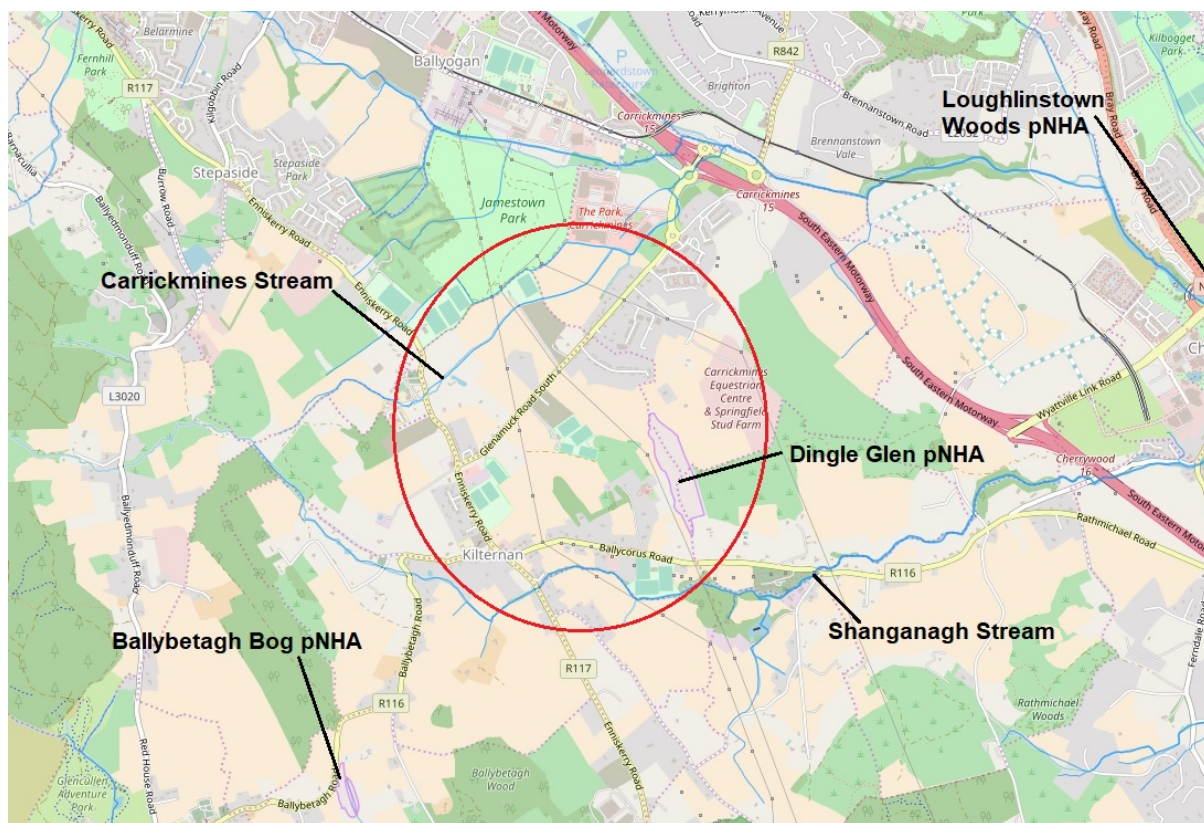


Figure 10-1 Indicative study area

Indicative study Area (in large circle) and approximate 2km radius showing areas designated for nature conservation and water courses (from www.epa.ie).

There are a number of designations for nature conservation in Ireland including National Park, National Nature Reserve, RAMSAR site, UNESCO Biosphere reserves, Special Protection Areas (SPA – Birds Directive), Special Areas of Conservation (SAC – Habitats Directive); and Natural Heritage Areas. The mechanism for these designations is through national or international legislation. Proposed NHAs (pNHA) are areas that have yet to gain full legislative protection. They are generally protected through the relevant County Development Plan. There is no system in Ireland for the designation of sites at a local or county level. The following areas were found to be located within an approximate 2km radius of the application site, while the Dalkey Coastal Zone and Killiney Hill pNHA is connected to the site via a hydrological link:

Dingle Glen pNHA (site code: 1207): This is a small area of regenerating native woodland that is of value for its relatively undisturbed character.

Ballybetagh Bog pNHA (site code: 1202). This area is composed of three separate marsh areas 5km north-west of Enniskerry. It is an important wetland site and is well known for the quantity of archaeological remnants, especially relicts of Giant Irish Elk.

Loughlinstown Wood pNHA (site code: 1211). This is a woodland site which straddles the Loughlinstown Stream and, while it is of planted origin, it has developed semi-natural characteristics.

Dalkey Coastal Zone and Killiney Hill (pNHA: 1206). The following information is available for this area:

This site includes the coastal stretch from Scotman's Bay to south of White Rock, the Dalkey Island group and Dalkey Sound, and Killiney Hill. Killiney Hill is at the edge of the Wicklow mountain intrusion and so it is formed of a mixture of granite and mica schist. It provides one of the best exposed junctions of these rock types, on the beach at White Rock, at which minerization has taken place due to contact metamorphism. The minerals include biotite, andalusite and garnet, with aplite and pegmatite veins also exposed. The seaward parts of Killiney Hill have in addition a covering of calcareous glacial drift. The rocky shore is mainly of granite.

*Dalkey Sound and its environs have been highly regarded as a valuable marine collecting area for many years. The Sound is especially noteworthy for the occurrence of west and south coast invertebrates. Species taken include Squat Lobsters (*Galathea spp.*), Swimming Crabs (*Portunus spp.*) and the Crawfish (*Palinurus vulgaris*). The area is also noted for the occurrence of gymnoblastic hydroids, with the rate *Antedon bifida* being taken regularly. Some rare European species which occur are members of the Order Nudibrachia and the Spiny Starfish (*Marthasterias glacialis*).*

*Dalkey Island lies c. 400m off Sorrento Point. The island is low-lying, the highest point at c.15m is dominated by a Martello Tower. Soil cover consists mainly of a thin peaty layer, though in a few places there are boulder clay deposits. Vegetation cover is low, consisting mainly of grasses. No woody plants have become established, probably due to constant grazing by goats. Dense patches of bracken (*Pteridium aquilinum* and Hogweed (*Heracleum sphondylium*) occur in places.*

*Lamb Island lies to the north of Dalkey Island, attached at low-tide by a line of rocks. It has a thin soil cover and some vegetation, mainly grasses, Nettles (*Urtica dioica*) and Hogweed (*Heracleum sphondylium*). Further north lies Maiden's Rock, a bare angular granite rock up to 5m high. There is no vegetation cover. Muglins, a small granite rock, lies about 1km north-east of Dalkey Island. A small lighthouse is on the rock.*

Herring Gulls nest on Dalkey Island (17 pairs in 1986), Lamb Island (29 pairs in 1986) and Muglins (207 nests in 1982). Great Black-backed Gull nests on Dalkey Island (maximum 62 nests in 1982-88), and two pairs of Lesser Black-backed Gull nested there in 1981.

Common Terns breed annually on Maiden's Rock, with a maximum of 54 nests between 1980 and 1986. One pair of Arctic Tern bred on Maiden's Rock in several years and in 1986 two pairs of Roseate Terns nested but were unsuccessful. Manx Shearwater is suspected of breeding on Dalkey Island.

Sheluck, Mallard and Oystercatcher nest on Dalkey and Lamb Island. Meadow and Rock Pipits breed on Dalkey Island. Maiden's Rock is an important autumn roosting site for up to 2,000 terns, including Roseates from the Rockabill colony. In autumn and winter Dalkey Island is an evening roosting site for Cormorants, Shags, Curlew and large gulls. Up to 50 Turnstones and 15 Purple Sandpipers occur in winter.

*Killiney Hill is a complex of coastal heath and mixed woodland. The woods are mostly planted and include Sycamore (*Acer pseudoplatanus*), Horse Chestnut (*Aesculus hippocastanum*), some Oak (*Quercus spp.*), Ash (*Fraxinus excelsior*) and Holly (*Ilex aquilinum*). The ground flora is mainly Ivy (*Hedera helix*) and Brambles (*Rubus spp.*) but there are some areas with more typical woodland species such as Wood Sorrel (*Oxalis acetosella*) and Herb Robert (*Geranium robertianum*).*

*Many of the rock surfaces on the open and bushy areas on the east side of the summit of the hill are roches moutonnes while near the summit spodumene is found in a small scarp exposure. This results in an interesting flora, with Wood Vetch (*Vicia sylvatica*), Yellow Fumitory (*Corydalis claculata*) and Madder (*Rubis peregrina*) growing amongst the Gorse (*Ulex europaeus*). The shallow soils overlying the rock support a community of winter annuals and early flowering perennials such as Spring Squill (*Scilla verna*) and Crow Garlic (*Allium vineale*).*

*The drift banks above and below the railway have warm shallow soils. Here grow scarce plants such as Bloody Cranesbill (*Geranium sanguineum*), Bee Orchid (*Ophrys apifera*), Sea Storksbill (*Erodium maritimum*) and Clovers (*Trifolium ornithopodioides*, *T. striatum* and *T. scabrum*). The naturalized Silver ragwort (*Senecio cineraria*) is widespread.*

Up to five pairs of Fulmar breed on the cliffs below the railway line. Kestrel breeds in the area, as well as Stonechat. (NPWS, 1995).

The NPWS web site (www.npws.ie) contains a mapping tool that indicates historic records of legally protected species within a selected Ordnance Survey (OS) 10km grid square. The study area is located within the square O22 and seven species of protected mammal, and flowering plant are highlighted.

These species are detailed in Table 10-1. It must be noted that this list cannot be seen as exhaustive as suitable habitat may be available for other important and protected species.

In summary it can be seen that none of the previous records of protected plants is extant within this square. The mammals however are known to be present and may be of relevance to this study.

Table 10-1 Known records for protected species within the O22 10km square

Species	Habitat ^{1 2}	Current status
<i>Clinopodium acinos</i> Basil thyme	Field margins and sandy or gravelly places	Record pre-1970 ³
<i>Galeopsis angustifolia</i> Red Hemp-nettle	Calcareous gravels	
<i>Misopates orontium</i> Lesser snapdragon	Arable fields	
<i>Puccinellia fasciculata</i> Borrer's salt-marsh grass	Muddy inlets on the coast	
<i>Cervus nippon</i> Sika deer	Coniferous woodland and adjacent heaths	Current ⁴
<i>Lutra lutra</i> Otter	Rivers and wetlands	Not recorded
<i>Sciurus vulgaris</i> Red squirrel	Woodlands	Present ⁵

Additional records of protected species are available from the database of the National Biodiversity Data Centre. Table 10-2 lists mammal species that are protected under the Wildlife Act 1976 and highlights those for which there are current records in this 10km square.

¹ Parnell et al., 2012

² Hayden & Harrington, 2001

³ Preston et al., 2002

⁴ Harris & Yalden, 2008

⁵ Carey et al., 2007

Table 10-2 Protected mammals in Ireland

Protected Mammals in Ireland and their known status within the zone of influence⁶. Those cells that are greyed out indicate no records for this species in the O22 square.

Species	Level of Protection	Habitat	Red List Status ⁷
Otter <i>Lutra lutra</i>	Annex II & IV Habitats Directive; Wildlife (Amendment) Act, 2000	Rivers and wetlands	Near Threatened
Lesser horseshoe bat <i>Rhinolophus hipposideros</i>		Disused, undisturbed old buildings, caves and mines	Least Concern
Grey seal <i>Halichoerus grypus</i>	Annex II & V Habitats Directive; Wildlife (Amendment) Act, 2000	Coastal habitats	-
Common seal <i>Phocaena phocaena</i>			-
Whiskered bat <i>Myotis mystacinus</i>	Annex IV Habitats Directive; Wildlife (Amendment) Act, 2000	Gardens, parks and riparian habitats	Least Concern
Natterer's bat <i>Myotis nattereri</i>		Woodland	Least Concern
Brown long-eared bat <i>Plecotus auritus</i>		Woodland	Near Threatened
Leisler's bat <i>Nyctalus leisleri</i>		Woodlands and buildings	Least Concern
Common pipistrelle <i>Pipistrellus pipistrellus</i>		Farmland, woodland and urban areas	Least Concern
Soprano pipistrelle <i>P. pygmaeus</i>		Rivers, lakes & riparian woodland	Least Concern
Daubenton's bat <i>Myotis daubentonii</i>		Woodlands and bridges associated with open water	Least Concern

⁶ Excludes marine mammals

⁷ Marnell et al., 2009

Nathusius' pipistrelle <i>P. nathusii</i>		Parkland, mixed and pine forests, riparian habitats	Least Concern
Irish hare <i>Lepus timidus hibernicus</i>	Annex V Habitats Directive;	Wide range of habitats	Least Concern
Pine Marten <i>Martes martes</i>	Wildlife (Amendment) Act, 2000	Broad-leaved and coniferous forest	Least Concern
Hedgehog <i>Erinaceus europaeus</i>	Wildlife (Amendment) Act, 2000	Woodlands and hedgerows	Least Concern
Pygmy shrew <i>Sorex minutus</i>		Woodlands, heathland, and wetlands	Least Concern
Red squirrel <i>Sciurus vulgaris</i>		Woodlands	Near Threatened
Irish stoat <i>Mustela erminea hibernica</i>		Wide range of habitats	Least Concern
Badger <i>Meles meles</i>		Farmland, woodland and urban areas	Least Concern
Red deer <i>Cervus elaphus</i>		Woodland and open moorland	Least Concern
Fallow deer <i>Dama dama</i>		Mixed woodland but feeding in open habitat	Least Concern
Sika deer <i>Cervus nippon</i>		Coniferous woodland and adjacent heaths	-

As can be seen there are a number of species of bat as well as larger mammal species for which there are current records in this area. Records of Badger are available from the National Biodiversity Data Centre. These date from 1968 at the resolution of the O22 10km square. More recent records date from 2007 and are confined to the two 2km squares centered on the townland of Glenamuck South, between the Glenamuck Road and the Ballycorus Road.

The Kiltiernan Local Area Plan 2013-2018 includes background information and specific objectives in relation to natural heritage (chapter 3). The following extracts are among those which are of relevance to this study.

The CDP currently identifies significant trees/woodlands in a location in the extreme northern portion of the LAP area immediately east and west of Glenamuck Road. There are no formal statutory Tree Preservation Orders in the LAP area. Of additional significance is a wooded strip, located along the south-eastern perimeter of the LAP area and zoned 'Objective G' (see Map No. 7), which contains a small stand of pure blackthorn. This blackthorn forms a dense stand of ten metre tall bushes that diminish to bushes of about one metre in the adjacent field. [...]

The most significant habitat type in the LAP area is hedgerow. Many of the hedgerows have a high biodiversity value and preliminary inspection undertaken during the HLCA study identified those classified as mature as being over one hundred years old. In general, the condition of the hedgerows ranges from very good to excellent. While lands within the LAP area which have been zoned for future development, contain mature hedgerows, it is acknowledged that it may not be possible to retain all these hedgerows. [...]

The Heritage and Planning Division, DoECLG, advise that as part of any significant development proposals, Badger and Bat surveys should be conducted, particularly in the townlands of Jamestown, Glenamuck North and Glenamuck South.

Objectives

LHC10: Conserve, enhance and manage the natural heritage within the LAP area including its biodiversity, landscapes and geological heritage and promote understanding of and sustainable access to it.

LHC19: To carry out a detailed ranking survey of the hedgerows be undertaken as part of any future development proposals, and where possible to incorporate these hedgerows within the development. It is acknowledged, however, that it will not be possible to retain all of the current hedgerows.

LHC20: To recognise and contribute towards protection of habitats from alien / invasive species (e.g. Japanese knotweed, giant hogweed, Himalayan balsam, etc.) in accordance with Action Number 4.7 of the Dun Laoghaire-Rathdown Biodiversity Plan 2009-2013.

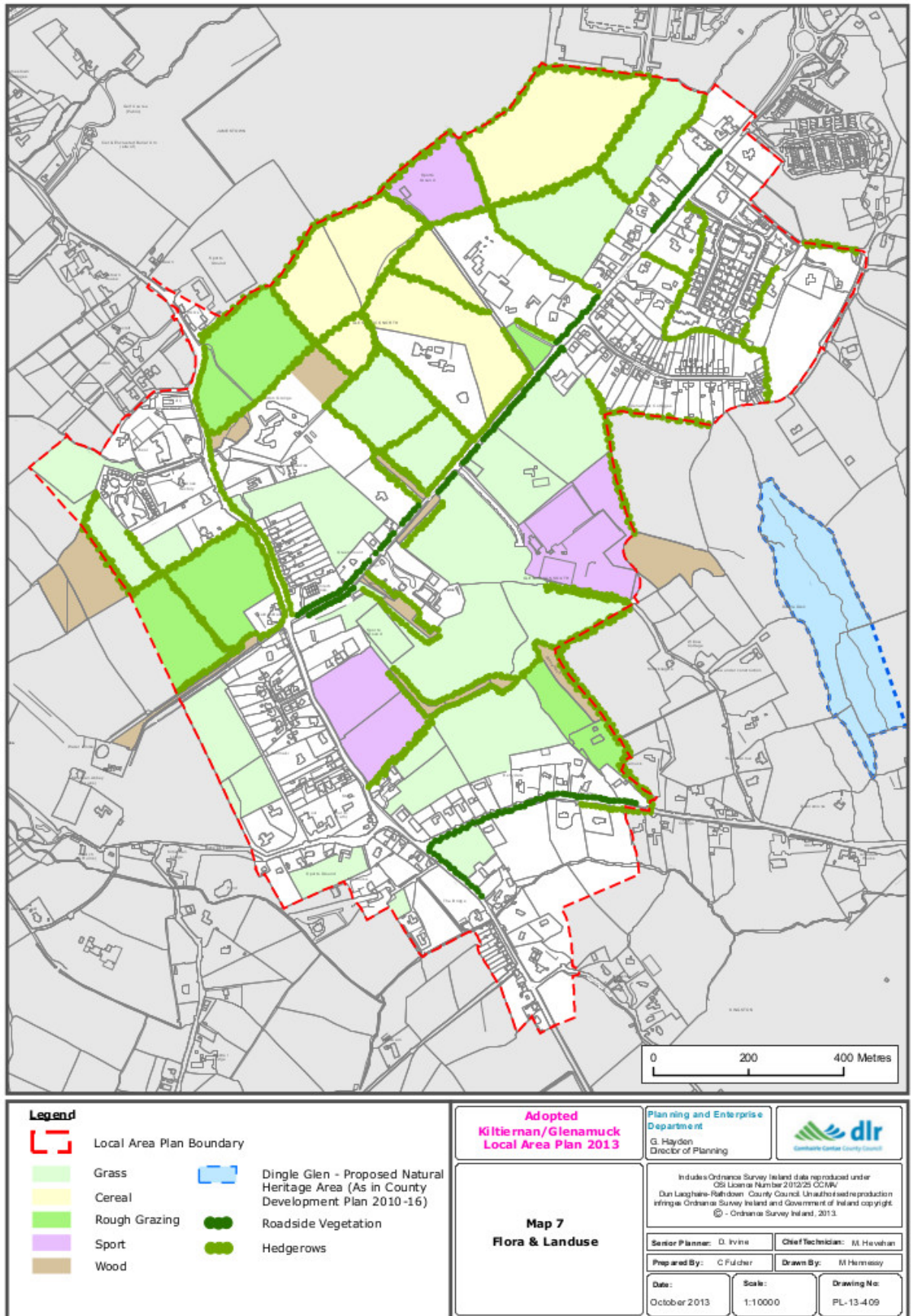


Figure 10-2 Habitats map (Extract from the Kiltiernan Local Area Plan)

Water quality in rivers is monitored on an on-going basis by the Environmental Protection Agency (EPA). They assess the pollution status of a stretch of water by analysing the invertebrates living in the substrate as different species show varying sensitivities to pollution. They arrive at a 'Q-Value' where Q1 = pristine quality and Q5 = grossly polluted (Toner et al., 2005). OSI mapping shows a number of streams in the vicinity of the lands that pass into the Loughlinstown River, ultimately draining into the Irish Sea south of Killiney, including the Glenamuck Stream and the Shanganagh Stream. There are no monitoring points upstream of the development site and the nearest downstream station is on the Carrickmines Stream where it crosses the N11 dual carriageway. At this point the river was most recently (2012) assessed as Q3-4 indicating slightly polluted status. This is unchanged since the previous samples in both 2009 and 2004. Further downstream water quality improves and is Q4 (unpolluted) in Loughlinstown. These data are taken from www.epa.ie.



Figure 10-3 Local water quality

WFD status: Yellow = moderate; Green = good. Sampling points on the Shanganagh Stream are shown with Q-value and most recent year of sampling (from www.epa.ie). Q3 = moderate pollution; Q3-4 = slight pollution; Q4 = unpolluted.

10.3.2 Stakeholder Consultation

The Development Applications Unit (DAU) of the Department of the Culture, Heritage, the Gaeltacht, was contacted for nature conservation observations. A response to this was received on February 12th 2018 (reference no. GPre00016/2018). In addition to general information on the preparation of ecological reports there is specific content relating to the subject development, it states:

This Department notes from your letter dated 24th January that a habitat survey is currently underway. January could not be considered an adequate time to carry out a habitat survey or indeed most botanical work. A flora survey should be carried out at appropriate times in Spring and Summer to enable a complete list of flora to be compiled.

It is noted that only a winter survey had been carried out at the time of response and a summer survey was subsequently completed as described in Section 10.2.

This Department also notes two streams running through the study area. And note that care should be taken to ensure there are no negative impacts on these streams and their flood plains to ensure no loss of biodiversity and request that the impact of the proposed development on the biodiversity of the site and on the nearby Dingle Glen pNHA should also be assessed (An Bord Pleanála reference TC0028).

Details were also sent to Inland Fisheries Ireland. A written response to this was received on January 25th 2018:

*The proposed road development is located on the in the catchment of the Carrickmines and Shanganagh system. These two systems support a resident population of Brown trout (and several other fish species) while further downstream they support a migratory population of Sea trout (both *Salmo trutta*). The coastal waters of the area currently retain a "high" water quality status. The Glenamuck and Shanganagh Rivers represent a valuable resource both in terms of local natural heritage (biological diversity value) and particularly from a native fisheries perspective. Both these systems constitute a local natural heritage feature warranting careful protection and conservation.*

Ground preparation and associated construction works, including large-scale topographic alteration and the creation of roads and infrastructure have significant potential to cause the release of sediments and pollutants into surrounding watercourses. Pollution of the adjacent freshwaters from poor on-site construction practices could have a significantly negative impact on the fauna and flora of this freshwater system. A comprehensive and integrated approach for achieving freshwater ecological protection during road construction and operation should be implemented.

In-stream works in salmonid systems can only be undertaken during the period July to September of each year. Of particular concern to IFI are the proposed river crossings. Any crossings must ensure the unhindered passage of fish. Therefore, IFI recommend a clear spanning of these rivers. It is essential that the detail design for all associated river works including crossings are agreed in advance with IFI.

It is recommended that the "Guidelines on protection of fisheries during construction works in and adjacent to water" be consulted when undertaking any works in the vicinity of surface water features. It is important to highlight the following key constraints (all included in our guidelines document which can be found on the IFI website) at this time:

All watercourses should be maintained in their natural open state

Disturbance of in-stream habitats should be minimised.

A method statement for all riparian / in-stream works must first be submitted to IFI for approval.

Comprehensive surface water management measures must be implemented at the construction and residential stage to prevent any pollution of the Glenamuck and Shanganagh rivers. Policies and recommendations made under the Greater Dublin Strategic Drainage Study (GSDSDS) should be applied in development of a drainage strategy for this site.

Best practice should be implemented at all times in relation to any construction activities that may impact on riverine or riparian habitats. Any discharges to surface streams present on the site must not impact negatively on the salmonid status of the system. Comprehensive surface water management measures must be implemented at the construction stage to prevent any pollution of streams in the area. On-site attenuation ponds may be required to allow for the settlement of fine/particulate materials out of potentially discharging surface waters from works areas. Good housekeeping measures are integral to achieving prevention of excessive turbid run-off to surface water systems. Silt fencing of discharge streams would also be essential during construction and possibly during operation.

The short-term storage and removal / disposal of excavated material must be considered and planned such that risk of pollution from these activities is minimised.

Details were also sent to the Biodiversity Officer for Dún Laoghaire-Rathdown County Council.

The response referenced the Kiltiernan/Glenamuck Local Area Plan 2013 and in particular Section 3.2. Natural Environment which contains a number of objectives there in relation to Biodiversity. Also, the Landscape, geology and water elements of the same chapter have relevance for biodiversity. For example, any pathways to groundwater or surface water to protected sites including watercourses and also Dingle Glen pNHA. It referenced the importance of checking for any protected habitats and species including tufa springs.

The response also summarized bryophyte surveys and noted that Dingle Glen pNHA was found to support a number of bryophyte species which are rare/ very rare in Co. Dublin (Vice-county H21). These include:

- 2 species for which this is the first recorded site in Co. Dublin;
- 2 species for which this is the first recent (post 1950) record in Co. Dublin;
- 6 species for which this is only the second site in Co. Dublin; and
- 21 species which have less than 10 records within Co. Dublin.

On June 7th An Taisce made a written submission which primarily focused on the issue of biodiversity:

The Scoping Report at Section 8.2.5 rightly refers to Dingle Glen pNHA (site code 1207) as an area of value for its relatively undisturbed character. However, there is another area which has the Zoning Objective G 'To protect and improve high amenity areas' and which is to the west of Dingle Glen, closer to the proposed route of the Link Distributor Road. This is the glen called "Glenamuck" on Map 9 of the County Development Plan 2016-2022, also known locally as "The Little Dingle". It is identified as parcel 24b on the map of the LAP reproduced at Figure 4.1 of the Scoping Report. At its north-west

corner there is an adjacent small High Amenity area which is called parcel 24a on the LAP map. This almost touches the Link Distributor Road route.

Chapter 11 of the Written Statement for the LAP says the following regarding Parcels 24a + b:

'Special' natural open space – important to retain biodiversity and walking route linkages. Is however privately owned.

We have more detailed information as follows:

The glen is very much a wilderness area with old beech trees, holly, thorn trees, bramble, etc.. It is a haven for birds and animals. In its N.W. corner there is a significant number of badger setts.

We think that a special study will be required to assess the implications of constructing the Link Distributor Road so close to this High Amenity area and its habitat. In particular the potential disturbance of wildlife corridors will need to be taken into account. The Scoping Report at 6c on page 31 acknowledges that the road system will sever lands and prevent any movement between Badger populations in the region. Special care and protection should be given to the badger population in the Glenamuck glen.

10.3.3 Site survey

Aerial photography from the OSI shows that the predominant land use in this area remains agricultural. However, in recent years significant built development has been underway which has seen land use change to more urban uses.

The site survey included incidental sightings or proxy signs (prints, scats etc.) of faunal activity, while the presence of certain species can be concluded where there is suitable habitat within the known range of that species. Table 10-2 details those mammals that are protected under national or international legislation in Ireland.

Habitats/Flora

The study area can be broadly described as agricultural lands divided by traditional field boundaries. There are also areas of woodland and artificial habitats (including homes and gardens) which are all drained by a network of ditches and small streams. These are shown as a habitat map in Figure 10-5.

Agricultural fields are a combination of **arable crops – BC1** and **improved agricultural grassland – GA2**. These are intensively managed and are of negligible biodiversity value. Where agriculture has ceased, grassland develops into **dry meadow – GS2** and this can contain some diversity of grasses and broad-leaved plants including Thistles *Cirsium sp.*, Willowherbs *Epilobium sp.*, Docks *Rumex sp.*, Clovers *Trifolium sp.* etc. Meadows are generally nutrient-rich and have low diversity when compared with low intensity, semi-natural grassland habitats, and so are of low biodiversity value. Nevertheless, they do provide some habitat for invertebrates and small mammals. Where agriculture has been abandoned for many years, young trees become established in a natural process which ultimately leads to high woodland. This intermediate stage is known as **scrub – WS1** and on the study lands is typically groves of young or sapling Willow *Salix sp.* or Alder *Alnus glutinosa*, or bands of Brambles *Rubus fruticosus agg.* or Blackthorn *Prunus spinosa* expanding out from hedgerows.

Immature woodland – WS2 is found in three small areas to the north of the study area. These are generally planted, even aged stands of Ash *Fraxinus excelsior*. One is associated with a private garden and includes non-native conifers and Birch *Betula sp.* For a small stretch along the Glenamuck Stream there is a more developed **broad-leaved woodland – WD1**. This is shown on historic OSI maps and is associated with Glenamuck House. It is therefore likely to be 200 years old or older. There are tall Birch, and Ash along with Hazel *Corylus avellana*, Holly *Ilex aquifolium* and Cherry Laurel *Prunus laurocerasus*. At ground level there is Primrose *Primula vulgaris*, Soft-shield Fern *Polystichum setiferum*, Male-fern *Dryopteris filix-mas* and Herb Robert *Geranium robertianum*. Another area of this woodland type is found in a small valley north of the Ballycorus Road. This is more developed, with a greater number of tall trees. It is locally known as the 'little Dingle'. It was found to have a mature canopy of Ash and Sycamore *Acer pseudoplatanus* and an understorey of Elder *Sambucus nigra*, Blackthorn *Prunus spinosa* and Holly. The ground level meanwhile was found to consist of abundant Ivy *Hedera helix* with Brambles, Soft-shield Fern, Ground Ivy *Glechoma hederacea*, Hogweed *Heracleum sphondylium*, Primrose and Wood Avens *Geum urbanum*. There was a reasonable quantity of dead wood (an essential component of healthy woodland habitats) while the bryophyte component was not visually significant. These habitats are of high local value.

Occasional patches of **spoil and bare ground – ED3**, **buildings and artificial surfaces – BL3** – which include gardens with mostly horticultural shrubs – and **amenity grassland – GA2** are of negligible biodiversity value.

Field boundaries generally date from the mid-18th Century however those laid down as townland boundary can be much older (8th Century). Within the study area these boundaries are a combination of **hedgerow – WL1** and **treeline – WL2**, habitats which can be of similar species composition and are differentiated by the average tree height (treelines are composed of trees over 5m in height). These features are further subdivided into those of 'higher significance' or 'lower significance'. This classification is set out as a scoring system in guidelines from the Heritage Council and is based on the feature's historical significance, species diversity (trees and woody species/ground flora), structure

and associated features (Foulkes et al., 2013). Within the study area, 'higher significance' field boundaries are marked on the first edition OSI maps (and so of historical significance), are dominated by native species, and are associated with field drains or water courses. 'Lower significance' boundaries meanwhile are mostly composed of non-native species (e.g. Leyland Cypress *Cuprocyparis leylandii* or Poplar *Populus sp.*), recently planted or have very low species diversity with poor structure (e.g. dominated by Brambles and/or with large gaps).

Many fields are accompanied by **drainage ditches – FW4** and these are common features of agricultural landscapes in Ireland. They lead into one of two streams, the Glenamuck Stream, to the north, or the Shananagh Stream, to the south. They can both be described as **eroding rivers – FW1**.

A number of plant species listed as alien invasive under SI No. 477 of 2011 were recorded in the wider study area, namely: Japanese Knotweed *Fallopia japonica*, Giant Hogweed *Heracleum mantegazzianum*, Giant Rhubarb *Gunnera tinctorial* and Three-cornered Garlic *Allium triquetrum*. Their locations are given in Figure 10-5. The Japanese Knotweed appeared to have been chemically treated at the time of the June survey. Of these plants, only the Three-cornered Garlic falls within the construction zone of the project.

Mammals

No evidence for Otter was recorded from the sections of streams to be crossed by the proposed road (note (Bailey et al., 2006). Nevertheless, there are records of Otter from along the Shanganagh Stream, including one from as recently as 2010. According to the NPWS in their response to the EIAR scoping report:

As part of the national otter survey carried out by National Parks & Wildlife Service staff in 2010 otter spraint was identified at the site where it is proposed the Link Distributor Road is to cross the Bride's Glen branch of the Loughlinstown River; altogether 7 sprainting sites were identified in the 600 m stretch of this river downstream of Kiltiernan Bridge. A survey by Scott Cawley Ltd for the Biodiversity Office of Dún Laoghaire-Rathdown Co. Council in 2012 found otter sprainting sites every 150 m along this branch of the Loughlinstown River, from the Ballyedmonduff Road to the sea. Otters have also recently been reported from Carrickmines. This Department recommends that a comprehensive otter survey of the Glenamuck Stream, the Bride's Glen branch of the Loughlinstown River and connecting waters should be carried out as soon as possible in order to assess the potential impact of the proposed road scheme on this species, which is afforded a regime of special protection under the Habitats Directive.

Note that due to issues with land accessibility, a full survey of the Glenamuck Stream was not carried out and only those (relatively short) sections to be directly affected by the road scheme were surveyed. Based on NPWS input, otters are assumed to be present along both the Glenamuck Stream and Loughlinstown/Shanganagh River and mitigation measures are applied accordingly.

January is an ideal time for surveying for Badgers as vegetation has died back, making it easier to follow trails or notice field signs. Evidence for Badger activity was recorded at the edge of woodland north of the Ballycorus Road (Little Dingle). It could be seen that trails were leading into the adjacent area of dry meadow and scrub. A sett was found near the edge of the woodland and two entrances were located. Well-worn trails were noted although no other setts were found. Elsewhere no evidence

of Badger activity was recorded. To the east, an affected landowner remarked that Badgers once visited her garden but had not been seen recently. This location is adjacent to a number of gardens which were not surveyed as part of this study. Trails nearby could not be definitively assigned to Badgers and may have been of Fox origin.

A dedicated bat survey was carried out by Brian Keeley of Wildlife Surveys Ireland during the summer of 2018. This included field surveys in July and September. It found that “there were 8 species of bat noted within the area with evidence of roosts of no less than 3 species in close proximity to the route. No roosts were noted within the land-take. There will be a loss of mature trees that may serve as roost sites.” Field boundaries and meadows provide ample foraging opportunities within the study area while buildings and older trees may act as roosting sites. All species of bat are protected under national and EU legislation.

Woodlands provide habitat for Red Squirrel *Sciurus vulgaris* and the non-native, invasive Grey Squirrel *S. carolinensis*. There is a record for Red Squirrel from within the study area from 2016 (but not from any of the woodland habitats). Pine Marten is not recorded from this area but is known to have expanded its range in recent years.

While limited data are available on the distribution of Hedgehog, Pygmy Shrew and Irish Stoat, they are considered ubiquitous in the Irish countryside and suitable habitat is available for them (Marnell & Lysaght, 2016).

Sika Deer *Cervus nippon* are known from the Glenamuck/Kiltiernan area and field signs were noted during the winter survey near the woodland north of the Ballycorus Road. Deer were also seen during the summer survey.

Rabbits *Oryctolagus cuniculus* and Fox *Vulpes vulpes* were noted throughout (including direct sightings). These are not protected species. Other common and widespread small mammals that are likely to be present include Wood Mouse *Apodemus sylvatica*, House Mouse *Mus domesticus*, Brown Rat *Rattus norvegicus*, and the invasive American Mink *Neovison vison*.

Birds

January is not a suitable month for surveying breeding birds. The following birds were recorded and may be breeding on these lands: Jackdaw *Corvus monedula*, Blue Tit *Parus caeruleus*, Song Thrush *Turdus philomenus*, Wren *Troglodytes troglodytes*, Magpie *Pica pica*, Hooded Crow *Corvus corone*, Wood Pigeon *Columba palumbus*, Starling *Sturnus vulgaris*, Chaffinch *Fringilla coelops*, Raven *Corvus corax* Blackbird *T. merula*, Buzzard *Buteo buteo*, Robin *Erithacus rubecula*, Long-tailed Tit *Aegithalos caudatus*, Pheasant *Phasianus colchicus*, Sparrowhawk *Accipiter nisus* and Goldfinch *Carduelis carduelis*. These are all species listed on the ‘green’ list – birds of low conservation concern- from BirdWatch Ireland (Colhuon & Cummins, 2013).

A breeding bird survey was undertaken in June 2018. Species recorded are listed in Table 10-3 and these data are represented graphically in Figure 10-4. All species noted are listed on BirdWatch Ireland’s ‘green’ list. In addition to those listed, Barn Swallow *Hirundo rustica* was noted foraging across fields. This bird is on the ‘amber’ list and so is of medium conservation concern.

Barn Owl *Tyto alba* is listed as of high conservation concern (red list). The records of the National Biodiversity Data Centre indicate a historical presence, with a 'possible breeding' record from this 10km square. Barn Owls are nocturnal and elusive however are known to nest in buildings and outhouses where signs of their activity can be easily detected. There are no such nesting sites available within the study area. There was no indication that Barn Owls are using the land from either the summer or winter surveys, including the bat survey (which took place at night time).

Amphibians and reptiles

Common Frog *Rana temporaria* and Common Lizard *Lacerta vivipara* are protected under the Wildlife Act 1976 and are likely to be present on this site. Suitable habitat for spawning Frogs is present in drainage ditches. Smooth Newts *Lissotriton vulgaris* are to be found in Dublin but there are no permanent ponds on this site in which they are likely to be breeding.

Fish

IFI has confirmed that Brown Trout and Sea Trout are present in the Ballyogan (Shanganagh) Stream. River Lamprey *Lampetra fluviatilis* and Brook Lamprey *L. planeri* may also be present (NPWS, 2008). Extensive existing culverting of the Glenamuck Stream severely limits its suitability for fish in the vicinity of the subject lands.

Invertebrates

Protected species of aquatic invertebrates are not recorded from the streams in the subject area. The Marsh Fritillary *Euphydryas aurinia* is the only insect protected by law in Ireland. Suitable grassland habitat is not present and there are no available records from the study area. The following butterflies were recorded during the summer survey: Meadow Brown *Maniola jurtina* (frequent), Speckled Wood *Pararge aegeria tircis* (occasional), Small Tortoiseshell *Aglais urticae* (occasional), Common Blue *Polyommatus icarus* (rare), Ringlet *Aphantopus hyperantus* (frequent), and Peacock *Inachis io* (rare). The conservation status of each of these species is listed as of 'least concern' in the red data list.

Table 10-3 Breeding birds of Glenamuck

Species	BoCCI Status	CBS Code ⁸	Birds Directive
<i>Aegithalos caudatus</i> Long-tailed tit	Green	LT	-
<i>Carduelis carduelis</i> Goldfinch	Green	GO	
<i>Columba palumbus</i> Wood pigeon	Green	WP	-
<i>Corvus corone</i> Hooded crow	Green	HC	
<i>Corvus frugilegus</i> Rook	Green	RO	
<i>Corvus monedula</i> Jackdaw	Green	JD	-
<i>Erithacus rubecula</i> Robin	Green	R.	-
<i>Fringilla coelops</i> Chaffinch	Green	CH	-
<i>Garrulus glandarius</i> Jay	Green	J.	
<i>Parus major</i> Great tit	Green	GT	-
<i>Parus caeruleus</i> Blue tit	Green	BT	-
<i>Passer domesticus</i> House sparrow	Green	HS	
<i>Periparus ater</i> Coal tit	Green	CT	-
<i>Phasianus colchicus</i> Pheasant	Green	PH	
<i>Phylloscopus collybita</i> Chiffchaff	Green	CC	-
<i>Pica pica</i> Magpie	Green	MG	-
<i>Prunella modularis</i> Dunnock	Green	D.	-
<i>Pyrrhula pyrrhula</i> Bullfinch	Green	BF	
<i>Regulus regulus</i> Goldcrest	Green	GC	-
<i>Streptopelia decaocto</i> Collared dove	Green	CD	
<i>Sturnus vulgaris</i> Starling	Green	SG	
<i>Sylvia atricapilla</i> Blackcap	Green	BC	-
<i>Troglodytes troglodytes</i> Wren	Green	WR	-

⁸ Countryside bird survey, RSPB, BirdWatch Ireland

<i>Turdus merula</i>	Blackbird	Green	B.	-
<i>Turdus philomelos</i>	Song thrush	Green	ST	-

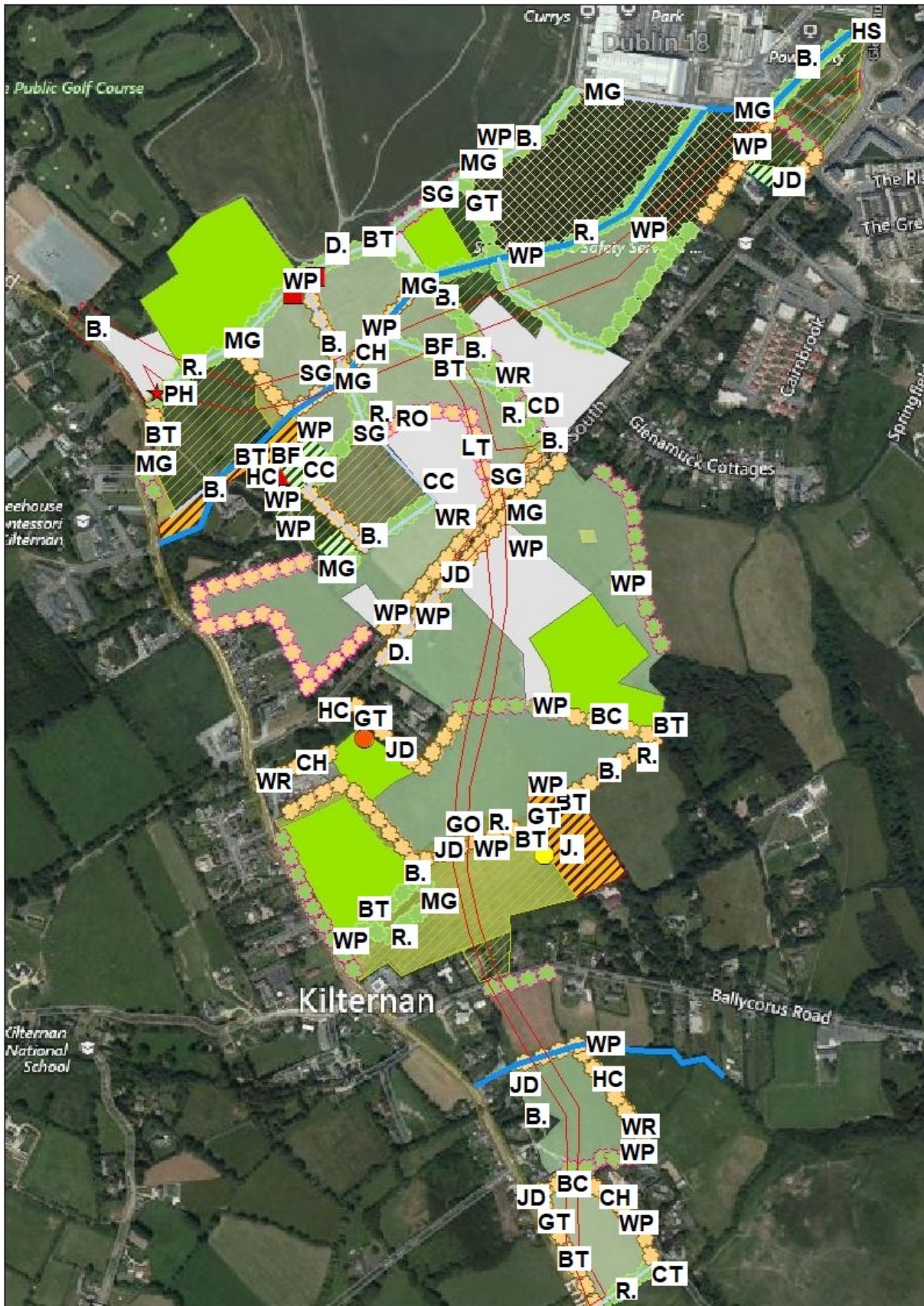


Figure 10-4 Breeding birds of Glenamuck

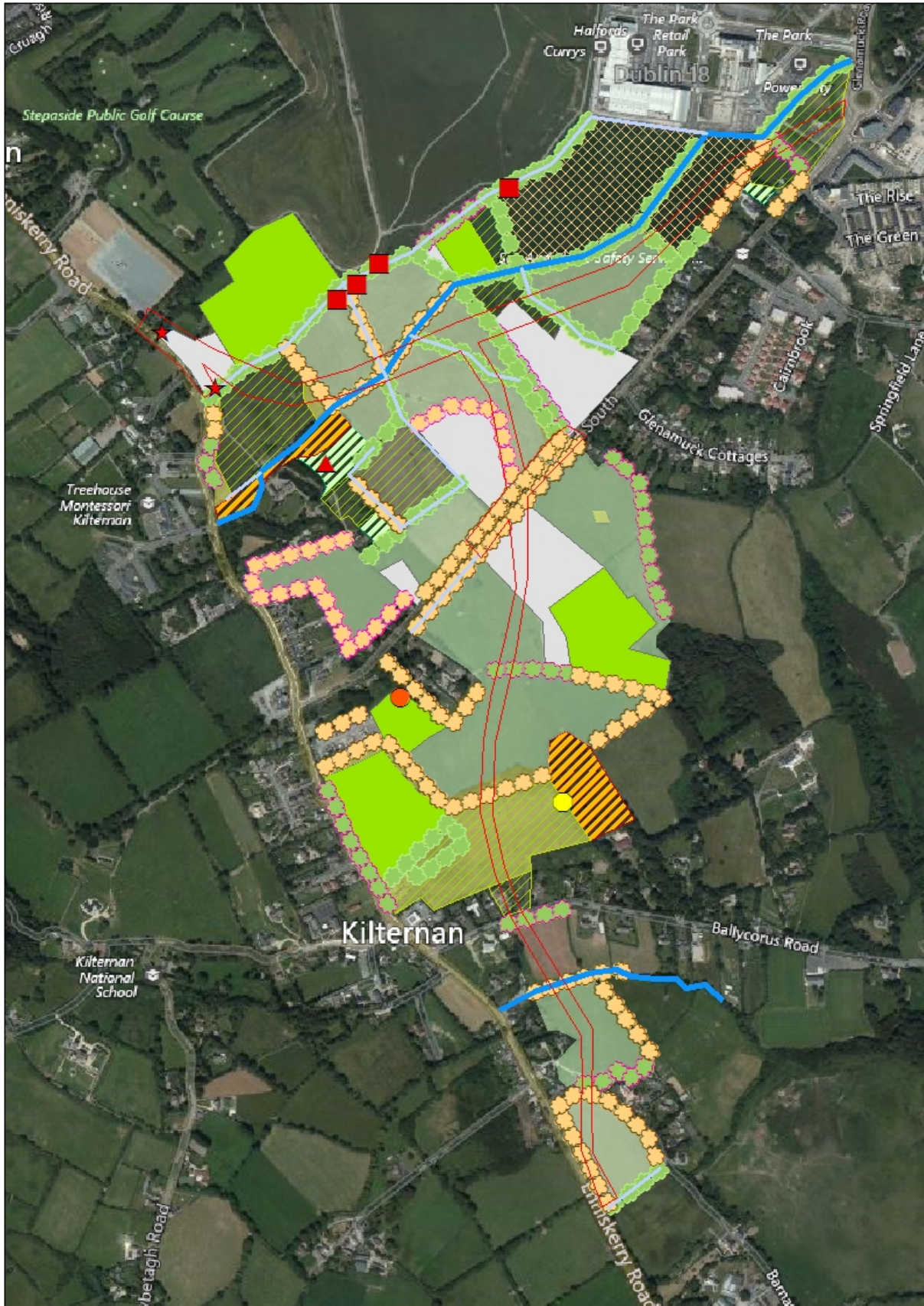


Figure 10-5 Habitat map of the subject lands
(see Figure 10-6 for legend)



Figure 10-6 Habitat map legend

10.3.4 Overall Evaluation

An Overall Evaluation of the Context, Character, Significance and Sensitivity of the Proposed Development Site has been carried out.

In summary, it has been seen that the application site is not within or adjacent to any area that has been designated for nature conservation at a national or international level. There are no examples of habitats listed on Annex I of the Habitats Directive or records of rare or protected plants. There is Three-cornered Garlic, an alien invasive species, growing on the site (other invasive species were encountered in the wider study area as described in Section 10.3.3). Significance criteria are available from guidance published by the National Roads Authority (NRA, 2009). From this an evaluation of the various habitats and ecological features on the site has been made and this is shown in Table 10-4.

Table 10-4 Evaluation of the importance of habitats and species on the Study Area

Higher significance hedgerows and treeline – WL1/WL2 with drainage ditches – FW4 or accompanying an eroding river – FW1 Broadleaved woodland – WD1	Local Importance (higher value) Foraging habitat for badgers and bats as well as breeding habitat for birds Streams with at least Salmonid potential
Lower significance hedgerow and treeline – WL1/WL2 Dry meadow – GS2 Scrub – WS1 Immature woodland – WS2	Local Importance (lower value)
Spoil and bare ground – ED2 Buildings and artificial surfaces – BL3 Improved agricultural grassland – GA1 Amenity grassland – GA2 Arable crops – BC1	Negligible ecological value

10.4 Predicted Impacts

This section provides a description of the potential impacts that the proposed development may have on biodiversity in the absence of mitigation. Methodology for determining the significance of an impact has been published by the NRA (NRA, 2009).

10.4.1 Construction Phase

The following potential impacts are likely to occur during the construction phase in the absence of mitigation:

Habitat Loss

The removal of habitats including agricultural fields, scrub, field boundaries, artificial surfaces, drainage ditches and eroding rivers.

Higher value habitat loss is estimated as follows:

- Higher significance treeline: 960m (including 280m of townland boundary);
- Higher significance hedgerow: 320m.

The permanent loss of these habitats is assessed as being a SIGNIFICANT EFFECT.

- Lower significance hedgerow: 180m;
- Scrub: 9,950m².

The permanent loss of these habitats is assessed as being a SLIGHT EFFECT.

- Length of Glenamuck Stream to be directly affected: 80m;
- Length of Shanganagh Stream to be directly affected: 60m.

The temporary loss of these habitats is assessed as being a SLIGHT EFFECT.

The direct mortality/disturbance of species during land clearance

The scale of this impact depends upon the timing of works as mortality principally arises when vegetation is cleared during the breeding season and when young in nests, dens, etc. are not mobile. No bat roosts were identified from the construction zone. However, mature trees provide potential roosts and eight species of bat were found foraging across the landscape. All bat roosts are protected by law and can only be disturbed under license from the National Parks and Wildlife Service. Since 2018, the bird breeding season is defined in law as commencing on March 1st and ending on July 31st. Under the Wildlife Act all birds' eggs and nests are protected at all times. No evidence of Otter holts was found along the sections of stream to be directly impacted by the road. However, new holt site may develop in time. As Otters are a protected species, this impact is potentially SIGNIFICANT.

The loss of such features is therefore assessed as potentially SIGNIFICANT.

There will be no direct disturbance to Badger setts in the Little Dingle woodland. However, sett tunnels can stretch for substantial distances underground and construction works may involve activity within

50m of sett entrances. Badgers and their setts are protected species and so potential disturbance must be assessed as a SIGNIFICANT effect.

The installation of culverts along water courses has the potential to directly affect aquatic life throughout a river's catchment, not only in the area directly affected by works but upstream (through blocking of migration pathways) and downstream (through the release of pollutants, especially sediment). Inland Fisheries Ireland confine instream works to the months between July and August to minimize these effects.

This temporary impact to aquatic life is assessed as SIGNIFICANT.

Pollution of water courses through the ingress of silt, oils and other toxic substances.

The loss of pollutants to water courses from the disturbance of soils can affect aquatic habitats by fouling fish spawning beds and directly affecting species, particularly fish. Pollutants can include oils and fuels, toxic substances such as concrete and cement, and especially sediment. Inland Fisheries Ireland has produced guidelines to minimize the effects to fish habitats during construction works.

This temporary impact to aquatic life is assessed as SIGNIFICANT

Spread of invasive species.

Japanese Knotweed, Giant Hogweed, Giant Rhubarb and Three-cornered Garlic were recorded within the study area. With the exception of Three-cornered Garlic none is within the direct footprint of the road. Nevertheless, extreme caution will be required.

The effect to biodiversity from the spread of alien invasive species is potentially long-term, albeit reversible, and so is assessed as SIGNIFICANT.

Protected Areas

There are no areas protected for nature conservation within the zone of influence of this project. The Dingle Glen pNHA is found approximately 600m from the work zone and there is no pathway for negative impacts to occur to this area. The area known as the 'Little Dingle' is closer and will be adjacent to the construction zone. Nevertheless, there can be no direct negative effects to this habitat arising from the project. The stand of tall Blackthorn identified in the LAP will not be affected by the project.

Indirect effects may occur through the loss of ecological connectivity, disturbance to Badgers or artificial lighting and these impacts have been addressed. The boundary of this area will be fenced and labelled 'sensitive ecological zone' for the duration of the project and this will help to ensure accidental damage does not occur (e.g. through the use of machinery or storage of materials).

10.4.2 Operation Phase

The following potential impacts are likely to occur during the operation phase in the absence of mitigation:

Impacts to species through the disruption of ecological corridors:

A. Bats

Bats will be impacted through the loss of foraging routes (hedgerows/treelines). The following is from the bat report:

Bats may be killed while feeding along roads or flying across them to feeding areas or roosts. This is most significant close to major roosts. All Irish bat species have been noted as road fatalities within their European range, but lower-flying bats are more at risk.

Vegetation removal to construct the road will interrupt hedgerow continuity and lead to loss of mature trees and scrub. This will lead to loss of feeding for bats.

The impact of this effect is SIGNIFICANT

B. River Corridors

River crossings will be maintained passable for fish and Otters. These have been designed in accordance with guidelines from Inland Fisheries Ireland (fish) and the National Roads Authority (Otter). The Water chapter details the four new culverts which are to be installed. There will be one each along the Glenamuck and Loughlinstown Streams and one on a drainage ditch. A fourth is proposed to replace an existing pipe culvert on the Glenamuck Stream. All culverts are 'box' design and will be both fish and mammal passable, designed in accordance with guidelines from IFI and the NRA respectively. The crossing of the Loughlinstown River will be clear span and will retain the existing stream banks. Because of these design features the impact to ecological corridors will be NEUTRAL.

C. Badger Corridors

The road does not cut across any known Badger territory (albeit Badgers are known from the Little Dingle to the north of the road route). However, the road will traverse across the lands and may prevent any movement between Badger populations in the region.

To avoid this impact underpasses have been incorporated at two points. These are envisaged as features which will allow for the movement of wildlife under the road. They are especially designed to facilitate the continued movement of Badgers in the wider region but will benefit other species of small mammal such as Hedgehog, Pygmy Shrew, mice etc. It is intended that landscape planting will mimic native linear woodlands to integrate these features with the surrounding countryside. In addition the proposed watercourse crossings will be passable by mammals. The locations of mammal passes have been aligned with existing streams and existing HV overhead ESB lines (which preclude development underneath) in order to maintain key wildlife corridors.

The impact to biodiversity (with the exception of bats) is assessed as short-term and will be a SLIGHT EFFECT

D. Deer Corridors

Deer are known from throughout this locality. Transport corridors can present barriers to deer where insurmountable fences or walls are erected. In this instance no such barriers are planned. While the movement of deer across the road may present health and safety issues (see traffic chapter), the road is not likely to negatively impact upon the wider movement of deer in this locality.

The impact to deer will be IMPERCEPTIBLE.

Pollution of water from surface water run-off

The Greater Dublin Strategic Drainage Study (2005) identified issues of urban expansion leading to an increased risk of flooding in the city and a deterioration of water quality. This arises where soil and natural vegetation, which is permeable to rainwater and slows its flow, is replaced with impermeable hard surfaces. Surface water drainage measures comply with SUDS principles (See Chapter 14).

The effect to biodiversity from this aspect of the project will be IMPERCEPTIBLE.

Disturbance to species from increased human activity

Limited data is available on the impact of artificial lighting to wildlife and it is believed that many species have become habituated to the level of lighting which exists near our towns and cities. Research has focused on bats as they are nocturnal and all species are protected by law. Bat Conservation Ireland lists a number of species which are considered to be especially sensitive to this effect including Brown Long-eared Bat, Whiskered Bat, Natterer's Bat, Daubenton's Bat and the Lesser Horseshoe Bat. The first three species on this list were noted from the site. Lighting should be designed so that it minimised impacts to Bats. The following is taken from the bat report:

Road lighting must not overspill on to the surrounding vegetation. Lighting must not increase the level of illumination of tree canopy level by greater than 3 lux to ensure that bats do not lose feeding and commuting areas. This has greatest impacts on species such as brown long-eared bat, Natterer's and whiskered bats.

The effect to bats from lighting is potentially SIGNIFICANT.

Given the already built up nature of the surroundings, with roads and residential development, it is not considered that the likely increase in ambient noise or human activity can impact negatively on biodiversity in general. With regard to bat, the bat report states that noise "may affect the ability of species such as brown long-eared bat to use audible sound for hunting and will affect the ability of bats to hear lower frequency social calls with interference from car brakes etc."

The effect to biodiversity from this aspect of the project will be SLIGHT.

10.5 Mitigation Measures

10.5.1 Construction Phase

The following potential impacts are likely to occur during the construction phase in the absence of mitigation:

Habitat Loss

New areas of land where semi-natural habitats can develop, either through natural regeneration or the planting of native species, have been identified. If it can be assumed that the width of the linear habitats to be lost is a maximum of 10m, then the total area to be lost is calculated at 12,800 m² (~1.3 hectares). New areas identified for habitat compensation are shown in Figure 10-7. These are wetland/attenuation areas for surface water run-off or severed land portions not affected by the proposed scheme but within the proposed land take and which are to be allowed to develop natural vegetation with minimal management. The total area to be provided will be in excess of 4.5 hectare and so – in area terms – will be well in excess of the habitat area to be lost.

The landscaping scheme will include the erection of 14 new bat roosting boxes which will provide new habitat for these species. Preliminary/indicative locations of these are given in Figure 10-7. These are intended to avail of existing semi-natural corridors (treelines and hedgerows) as well as new habitat compensation areas.

Prior to works taking place along the Shanganagh Stream the riparian zone to be affected should be surveyed for Otters, and in particular for the potential presence of any holt sites.

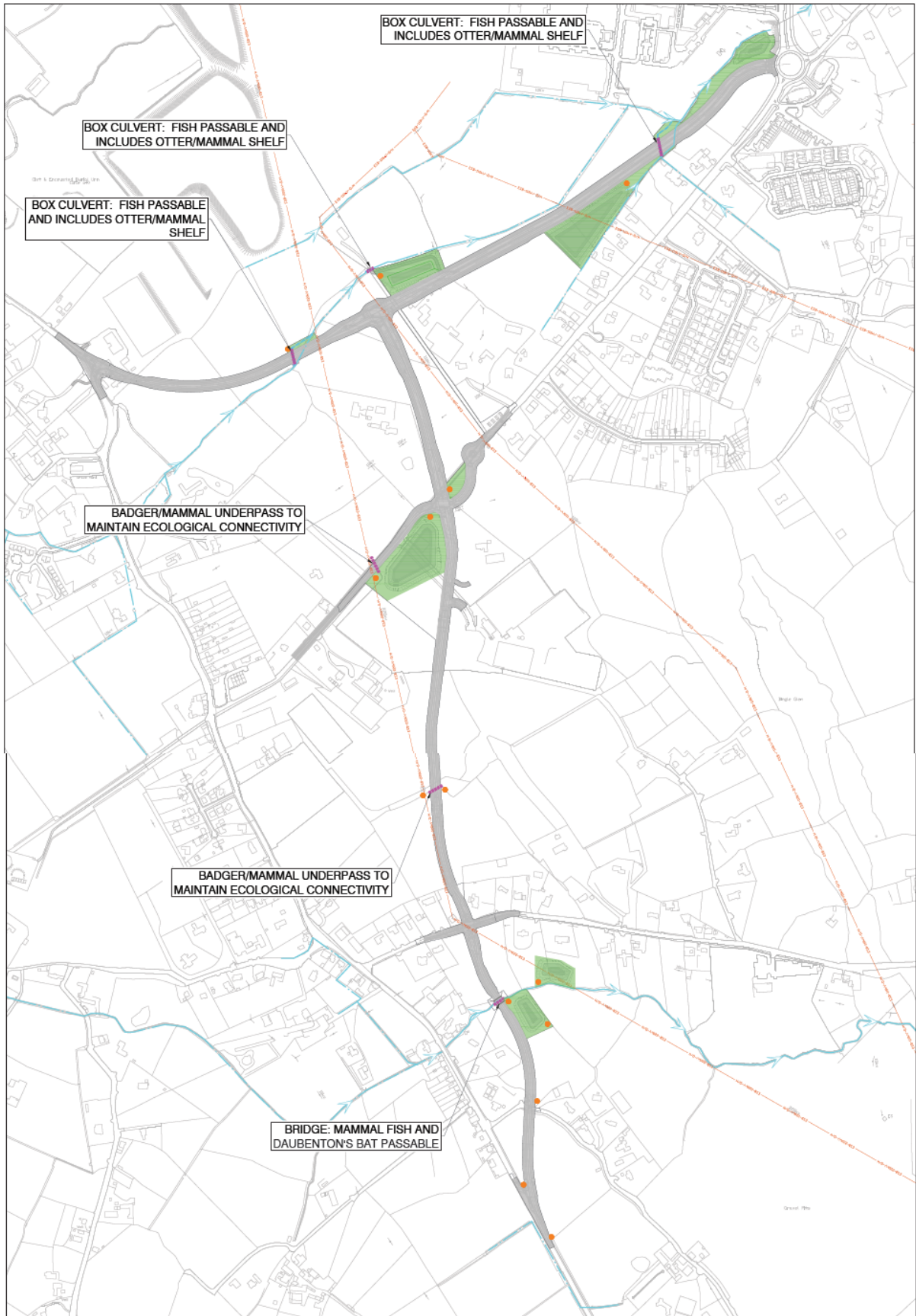


Figure 10-7 Ecology mitigation measures
Green areas show compensation habitat. Orange dots show indicative locations of bat boxes to be erected.

The direct mortality/disturbance of species during land clearance

Woody vegetation (scrub, hedgerows etc.) should not be cleared during the bird nesting season (March to July).

All mature trees should be checked by a bat specialist prior to felling.

Pollution of water courses through the ingress of silt, oils and other toxic substances.

A Construction Management Plan should be prepared which includes full details of all pollution prevention measures. This should include consultation with Inland Fisheries Ireland at all stages of the project. Dangerous substances should be stored away from water courses and in bunded areas at all times. Measures must be taken to ensure that loss of sediment to water course is minimized to the greatest degree possible and only attenuated, silt-free water should be directed towards ditches or streams. This can be achieved through the use of silt fencing, screening berms and/or settlement ponds. Full details should be contained within the CMP. The contractor will be responsible for ensuring that pollution to water courses does not occur. A record will be kept of daily inspections and any incidents which may occur, along with the action taken. Additional mitigation measures to protect the water environment are included in Chapter 14.

Spread of invasive species

Appropriate measures should be taken to eradicate invasive species within the zone of influence of the project. The stands of Three-cornered Garlic should be treated with standard herbicide prior to the commencement of works. The Construction Management Plan for the project should recognize the presence of this species, as well as the proximity of other noxious weeds in the study area, and adopt appropriate control measures to ensure there can be no spread of any invasive species.

10.5.2 Operation Phase

The following is taken from the bat report:

Disruption of ecological corridors – effects to bats

Culvert cross-sectional area of no less than 47m² is considered adequate to allow pipistrelles to avail of culverts while smaller sizes such as 7m² can facilitate Daubenton's bats (based on a probability of 95% that a culvert is used). Low culverts may be used by bats to pass under roads but the taller the culvert the more beneficial to bats.

The culvert over the Loughlinstown River will be passable for Daubenton's Bats as it will have an aperture greater than 7m². However other culverts will not meet this requirement.

Disturbance to bats from artificial lighting

A lighting plan will be prepared in consultation with the bat ecologist in order to minimize the negative impact of artificial lighting on bat foraging behavior. The following is taken from the bat report:

Road lighting must not overspill on to the surrounding vegetation. Lighting must not increase the level of illumination of tree canopy level by greater than 3 lux to ensure that bats do not lose feeding and commuting areas. This has greatest impacts on species such as brown long-eared bat, Natterer's and whiskered bats.

This requirement is satisfied within the lighting design.

10.6 Residual Impact

It is not possible to fully compensate for the loss of high significant field boundaries due to their age and complexity. It is likely however that the range of species will be maintained while the area of mitigation will exceed that of the habitat to be lost. Nevertheless, the loss of treelines and hedgerows will result in a residual impact to biodiversity. There will also be an effect to bats from the disruption of ecological corridors. These is assessed as SLIGHT.

There will also be a SLIGHT residual effect to water courses during the construction phase as it will not be possible to completely eliminate the likelihood of pollution entering the water.

10.7 Difficulties Encountered

Some areas of land were inaccessible for surveys. From aerial photography it was seen that these are agricultural fields with traditional boundaries. These boundaries have been taken into account in evaluating the impact of this project. A full set of ecological surveys were carried out for the project at appropriate seasons. A lack of data, or uncertainty in the results, is not a factor in assessing the impact of this development on biodiversity.

10.8 References

- Arnold N. & Ovenden D. 2004. Collins Field Guide: Reptiles & Amphibians. Collins.
- Atherton I, Bosanquet S. & Lawley M. (editors) 2010. Mosses and Liverwort of Britain and Ireland : a field guide. British Bryological Society.
- Bailey, M. and Rochford J. 2006. Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals, No. 23. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Bang P. & Dahlstrøm P. 2006. Animal Tracks and Signs. Oxford University Press.
- Bat Conservation Ireland. 2010. Bats & Lighting. Guidance Note for planners, engineers, architects and developers. www.batconservationireland.ie
- Bealey C., Ledder E., Robertson H., Wolton R. 2009. Hedgerows – their wildlife, current state and management needs. British Wildlife Volume 20 Number 5 June 2009. pg323 – 329.
- Bullock C., Kretch C. & Candon E. 2008. The Economic and Social Aspects of Biodiversity. Stationary Office.
- CIEEM. 2016. Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland. Chartered Institute of Ecology and Environmental Management.
- Clark M. 1994. Badgers. Whittet Books.
- Council Directive 79/409/EEC on the conservation of wild birds.
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
- Council Directive 97/11/EEC of 3rd March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment
- Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy – more commonly known as the Water Framework Directive
- Council Directive 2006/113/EC of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters.
- Curran M. & Fagan S. Unknown year. Common lizard (viviparous lizard). Wildlife Leaflet no. 42. ENFO.
- Department of Arts, Heritage and the Gaeltacht. 2011. Actions for Biodiversity 2011 – 2016. Ireland's National Biodiversity Plan.
- DG Environment. 2003. Interpretation Manual of European Union Habitats. European Commission.

- Doogue D., Nash D., Parnell J., Reynolds S., & Wyse Jackson P. 1998. Flora of County Dublin. The Dublin Naturalists' Field Club.
- EPA. 2002. Guidelines on the information to be contained in Environmental Impact Statements.
- EPA, 2003. Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)
- Eastern Regional Fisheries Board. Unknown year. Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites.
- Fossitt J. 2000. A Guide to Habitats in Ireland. Heritage Council.
- Foulkes N., Fuller J., Little D., McCourt S. & Murphy P. 2013. Hedgerow Appraisal System - Best Practise Guidance on Hedgerow Survey, Data Collation and Appraisal. Woodlands of Ireland, Dublin. Unpublished Report [pdf].
- Giller P.S. & Malmqvist B. 1998. The Biology of Streams and Rivers. Oxford University Press.
- Harris S. & Yalden D.W. 2008. Mammals of the British Isles: Handbook, 4th Edition. The Mammal Society.
- Hayden T. & Harrington R. 2001. Exploring Irish Mammals. Town House Dublin.
- Hickie D. 2004. Irish Hedgerows: Networks for Nature. Networks for Nature.
- Hill M.O., Blackstock T.H., Long D.G. and Rothero G.P 2008. A Checklist and Census Catalogue of British and Irish Bryophytes. British Bryological Society.
- Inland Fisheries Ireland. 2016. Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.
- Institute of Environmental Assessment, 1995. Guidelines for Baseline Ecological Assessment'
- Lynas P., Newton S.F., & Robinson J.A. 2007. The Status of birds in Ireland: an analysis of conservation concern 2008 – 2013. Irish Birds: Volume 8; Number 2.
- Morris P. & Therivel R., 2001. Methods of Environmental Impact Assessment, Spon Press
- National Parks and Wildlife Service. 2008. The Status of EU Protected Habitats and Species in Ireland. Department of Environment, Heritage and Local Government.
- Smal C. 2009. Guidance for the treatment of Otters prior to the construction of national road schemes. National Roads Authority.
- NRA. 2009. Guidelines for Assessment of Ecological Impacts of National Road Schemes. National Roads Authority.
- O'Grady M.F. 2006. Channels & Challenges. Enhancing Salmonid Rivers. Irish Freshwater Fisheries Ecology and Management Series: Number 4. Central Fisheries Board, Dublin, Ireland.

- Preston C.D., Pearman D.A. & Dines T.D. 2002. New Atlas of the British & Irish Flora. Oxford University Press.
- Reid, N., Dingerkus, K., Montgomery, W.I., Marnell, F., Jeffrey, R., Lynn, D., Kingston, N. & McDonald, R.A. 2007. Status of hares in Ireland. Irish Wildlife Manuals, No. 30. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.
- Sargent G. & Morris P. 2003. How to Find & Identify Mammals. The Mammal Society.
- Smith G. F., O'Donoghue P., O'Hora K. and Delaney E. 2010. Best Practice Guidance for Habitat Survey and Mapping. Heritage Council.
- Stace C. 2010. New Flora of the British Isles. Cambridge University Press.
- Stone E.L., Jones G. & Harris S. 2012. Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. *Global Change Biology* (2012) 18, 2458–2465, doi: 10.1111/j.1365-2486.2012.02705.x
- Toner P., Bowman J., Clabby K., Lucey J., McGarrigle M., Concannon C., Clenaghan C., Cunningham P., Delaney J., O'Boyle S., MacCárthaigh M., Craig M. & Quinn R. 2005. Water Quality in Ireland 2001 – 2003. Appendix 1: Biological and Physico-Chemical Surveillance and Water Quality Assessment of Rivers. EPA.
- Treweek J., 1999. *Ecological Impact Assessment*, Blackwell Science.
- Webb D.A., Parnell J. & Doogue D. 1996. *An Irish Flora*. Dundalgan Press.