Bonneagar Iompair Éireann
Transport Infrastructure Ireland

NTA
Údarás Náisiúnta Iompair
National Transport Authority

Luas Finglas

Environmental Impact Assessment Report 2024

Chapter 9: Biodiversity

BARRY TRANSPORTATION
egis GROUP
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Project Ireland 2040
Building Ireland's Future

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GLOSSARY OF FREQUENTLY USED TERM

Acronym	Term
BCI	Bat Conservation Ireland
BCT	Bat Conservation Trust
BoCCI	Birds of Conservation Concern in Ireland
BWI	BirdWatch Ireland
BSBI	Botanical Society of Britain & Ireland
CIEEM	Chartered Institute of Ecology and Environmental Management
CSZ	Core Sustenance Zone
DCC	Dublin City Council
DHLGH	Department of Housing, Local Government and Heritage
ECoW	Ecological Clerks of Works
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FCC	Fingal County Council
ICW	Integrated Constructed Wetland
INNS	Invasive Non-native Species
IUCN	International Union for Conservation of Nature
KER	Key Ecological Receptor
LRT	Light Rail Transit
LRV	Light Rail Vehicle
NBDC	National Biodiversity Data Centre
NHA	Natural Heritage Area
NPWS	National Parks and Wildlife Service
NTA	National Transport Authority
OCS	Overhead Catenary System
OPR	Office of Planning Regulator
pNHA	Proposed Natural Heritage Areas
PRF	Potential Roost Feature
QI	Qualifying Interest
RO	Railway Order
SAAO	Special Amenity Area Order
SAC	Special Area of Conservation
SPA	Special Protection Area
SSRS	Small Steam Risk Score
SuDS	Sustainable Drainage Systems
TII	Transport Infrastructure Ireland

Acronym	Term
WFD	Water Framework Directive
ZoI	Zone of Influence

SECTION 9: BIODIVERSITY

9.1 Introduction

9.1.1 Purpose of this Report

This chapter assesses the impact of the proposed Luas Finglas (hereafter referred to as 'the proposed Scheme') on biodiversity during the Construction and Operation Phases.

This chapter provides an overview of the assessment and field methodologies; receiving ecological environment; a description of the nature and scale of any potential significant direct or indirect impacts; and any necessary mitigation and biodiversity enhancement measures recommended as part of this EIAR, which helped inform the planting proposals detailed in Chapter 21 (Landscape and Visual Amenity).

The design of the proposed Scheme has evolved through comprehensive design iteration, with particular emphasis on minimising the potential for environmental impacts, where practicable, whilst ensuring the objectives of the proposed Scheme are attained. In addition, feedback received from the comprehensive consultation programme undertaken throughout the option selection and design development process have been incorporated, where appropriate.

This Biodiversity Chapter requires one also read in conjunction, the below chapters and their respective appendices, which provide further detail on related impacts and the proposed mitigation measures for topics discussed within this chapter:

- Chapter 10 (Water);
- Chapter 11 (Land and Soils: Soils, Geology and Hydrogeology);
- Chapter 12 (Land Take);
- Chapter 13 (Air Quality);
- Chapter 15 (Noise and Vibration);
- Chapter 17 (Material Assets: Infrastructure and Utilities);
- Chapter 19 (Material Assets: Resource and Waste Management); and
- Chapter 21 (Landscape and Visual Amenity).

9.1.2 Outline Scheme Description

The proposed Scheme comprises a high-capacity, high-frequency light rail running from Broombridge to Charlestown, connecting Finglas and the surrounding areas with Dublin's wider public transport network by providing a reliable, and efficient public transport service to the city centre via Broombridge.

As shown in Volume 4 - Map Figure 1-1, starting from Broombridge, the proposed Scheme travels northwards, crossing the Royal Canal and the Maynooth railway line adjacent to Broome Bridge. It then runs adjacent to the east of Broombridge Road and the Dublin Industrial Estate. It then crosses the Tolka Valley Park before reaching the proposed St Helena's Stop and then proceeds northwards towards the proposed Luas Finglas Village Stop. From here, the route passes through a new corridor created within the Finglas Garda Station car park, making its eastern turn onto Mellowes Road. The route then proceeds through Mellowes Park, crossing Finglas Road, towards the proposed St Margaret's Road Stop. Thereafter, the proposed line continues along St Margaret's Road before reaching the terminus Stop proposed at Charlestown.

The proposed Scheme has been designed to interchange with existing and future elements of the transport network including interchange opportunities with bus networks at all the new Stops and with mainline rail services at Broombridge, and a Park and Ride facility to intercept traffic on the N/M2. In addition, the proposed Scheme through the inclusion of integrated cycle lanes and cycling infrastructure sets out to facilitate multimodal "cycle-LRT trips" as a key aspect of the Luas Finglas scheme.

The proposed Scheme will comprise a number of principal elements as outlined in Table 9-1 and Table 9-2. A full description of the proposed Scheme is provided in the following chapters of this EIAR:

- Chapter 1 (Introduction);
- Chapter 5 (Description of the proposed Scheme); and
- Chapter 6 (Construction Activities).

Table 9-1: Overview of the Key Features of the proposed Scheme

Scheme Key Features	Outline Description
Permanent Scheme Elements	
Light Rail Track	3.9km extension to the Luas Green Line track from Broombridge to Finglas (2.8km of grass track, 700m of embedded track and 360m of structure track)
Depot Stabling Facility	A new stabling facility (with stabling for eight additional LRVs) will be located just south of the existing Broombridge terminus, as an extension of the Hamilton depot area.
Luas Stops	Four Stops located at: St Helena's, Finglas Village, St Margaret's Road and Charlestown to maximise access from the catchment area including the recently re-zoned Jamestown Industrial Estate.
Main Structures	Two new Light Rail Transit (LRT) bridges will be constructed as part of the proposed Scheme - a bridge over the River Tolka within the Tolka Valley Park and a bridge over the Royal Canal and the Iarnród Éireann (IÉ) railway line at Broombridge. A number of existing non-residential buildings shall be demolished to facilitate the proposed Scheme. In addition, the existing overbridge at Mellowes Park will be demolished.
At Grade Signalised Junctions	10 at grade signalised junctions will be created at: Lagan Road, Ballyboggin Road, Tolka Valley Road, St. Helena's Road, Wellmount Road, Cappagh Road, Mellowes Road, North Road (N2), McKee Avenue, Jamestown Business Park entrance. Note: The junction at Charlestown will be reconfigured but does not have a LRT crossing.
Uncontrolled Crossings	13 at grade uncontrolled crossings (11 pedestrian / cycle crossings and two local accesses located at: Tolka Valley Park, St Helena's, Farnham pitches, Patrickswell Place, Cardiff Castle Road, Mellowes Park, St Margarets Road, and ESB Networks.
Cycle Facilities	Cycle lanes are a core part of the proposed Scheme in order to facilitate multimodal "cycle-LRV trips". Approximately 3km of segregated cycle lanes and 100m of non-segregated cycle lanes along the route. Covered cycle storage facilities will be provided at Broombridge Terminus, Finglas Village Stop and St Margaret's Road Stop and within the Park & Ride facility. "Sheffield" type cycle stands will be provided at all stop locations.
Power Substations	Two new traction power substations for the proposed Scheme will be located near Finglas Village Stop behind the existing Fire Station, and near the N2 junction before St Margaret's Road Stop where the current spiral access ramp to the pedestrian overbridge is located. A third substation is required for the Park & Ride facility.
Park & Ride Facility	A new Park & Ride facility, with e-charging substation, located just off the M50 at St Margaret's Stop will be provided with provision for 350 parking spaces and secure cycle storage. The building will feature photovoltaic (PV) panel roofing and is the location for an additional radio antenna. This strategic Park & Ride connecting the N2/M50 to the city centre will increase the catchment area of the proposed Scheme.

Scheme Key Features	Outline Description
Temporary Scheme Elements	
Construction compounds	There will be three principal construction compounds, two located west of Broombridge Road and one located at the northern extents of Mellowes Park. In addition, there are other secondary site compound locations for small works/storage. Details can be found in Chapter 6 (Construction Activities) of this EIAR.

Table 9-2: Summary of New Bridges of the proposed Scheme

Identity	Location	Description
Royal Canal and Rail Bridge	Approximately 10m east of the existing Broome Bridge and then continuing north, parallel with Broombridge Road on its east side	The proposed bridge is an eight-span structure consisting of two main parts: a variable depth weathering steel composite box girder followed by a constant depth solid concrete slab. The bridge has the following span arrangement: 35 + 47.5 + 30 + 17 + 3x22 + 17m. Steel superstructure extends over the first three spans. The bridge deck is continuous over the full length of 212.5m and has solid approach ramps at both ends.
Tolka Valley Park Bridge	Approximately 30m west of the existing Finglaswood Bridge	A three-span structure with buried end spans, thus appearing as a single span bridge. End spans as well as part of the main span consist of post-tensioned concrete variable depth girder, the central section of the main span is a suspended weathering steel composite box girder. The overall length of the bridge is 65m with spans 10m, 45m, 10m.

9.2 Methodology

9.2.1 Study Area

The study area of the proposed Scheme was defined by the findings of the desk study (presence/absence of protected habitats, flora or fauna within the Zone of Influence (ZoI) and best practice methodology referenced below for assessing effects on those ecological features. In general, surveys were conducted for each of the key ecological receptors (KERs) within specific geographical areas; and focussed on assessing potential impacts within the ZoI of the proposed Scheme. The study area for each of these KERs is included in section 9.2.3.

9.2.2 Relevant Guidelines, Policy and Legislation

The biodiversity assessment has been prepared in accordance with the relevant legislation, policies, plans, strategies and guidelines as identified in this section. These documents are listed below:

- Planning and Development Act 2000 (as amended) (DHLGH, 2024a);
- Planning and Development Regulations 2001 (as amended) (DHLGH, 2024b);
- Transport (Railway Infrastructure) Act 2001 (as amended 2021);
- Dublin Transport Authority Act 2008 (as amended 2023);
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (EC, 1999);
- Environmental Impact Assessment of Projects Guidance on Scoping, (EC, 2017a);
- Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report, (EC, 2017b);
- Advice Note Seventeen: Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects, The Planning Inspectorate UK 2015;
- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment (EU, 2014);

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as amended) (Habitats Directive) (EU, 1992);
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (as amended) (Birds Directive);
- European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) (as amended) (EC, 2011);
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (as amended) (Water Framework Directive) and European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) (as amended) (European Communities, 2003);
- OPR Practice Note PN01 Appropriate Assessment Screening for Development Management (OPR, 2021);
- OPR Practice Note PN02 Environmental Impact Assessment Screening (OPR, 2021);
- Guidelines for planning authorities and An Board Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning and Local Governments, August 2018);
- Guidelines on the information to be contained in Environmental Impact Assessment Reports Environmental Protection Agency (EPA, 2022);
- National Planning Framework: Project Ireland 2040;
- National Development Plan 2021 – 2030 (Department of Public Expenditure, NDP Delivery and Reform, 2021);
- Regional Spatial and Economic Strategy for the Eastern and Midland Region 2019 – 2031 (Eastern and Midland Regional Assembly, 2019);
- Transport Strategy for the Greater Dublin Area 2022 – 2042 (NTA, 2022);
- Climate Action Plan (DECC, 2024);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009);
- Wildlife Acts 1976 to 2024 (as amended) and Wildlife (Amendment) Act 2024 (DHPLG, 2024);
- Flora (Protection) Order, 2022 (S.I. No. 235 of 2022);
- Inland Fisheries Acts 1959 to 2017;
- Ireland's 4th National Biodiversity Action Plan 2023 – 2030 (NPWS, 2023);
- Fingal County Council Biodiversity Action Plan 2023-2030 (FCC, 2023);
- Forest of Fingal: A Tree Strategy for Fingal 2022-2032 (FCC, 2022);
- Dublin City Biodiversity Action Plan 2021-2025, (DCC, 2022);
- Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes (NRA, 2006a);
- Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes, (NRA, 2006b);
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes, (NRA, 2006c);
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes, (NRA, 2006d);
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub prior to, during and post Construction of National Road Schemes, (NRA, 2006e);
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive (EU, 2021);
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (EU, 2013);
- Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, (CIEEM, 2018a);
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition) ((Collins, 2016);
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th Edition) (Collins, 2024);
- UK Bat Mitigation Guidelines: a guide to impact assessment, mitigation and compensation for developments affecting bats. Chartered Institute of Ecology and Environmental Management, Ampfield. (Reason & Wray, 2023);
- Bat Mitigation Guidelines for Ireland (Marnell et al., 2022);
- Guidance Note 08/18. Bats and Artificial Lighting in the UK - Bats and the Built Environment series (ILP, 2018);

- Guide to Freshwater Invertebrates (Dobson et al, 2012);
- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (2008), (NRA, 2010);
- NBDC (2019): Pollinator-friendly management of: Transport Corridors. All-Ireland Pollinator Plan, Guidelines 9;
- Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads, (NRA, 2010);
- The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (GE-ENV-01105), (TII, 2020a);
- The Management of Invasive Alien Plant Species on National Roads – Standard (GE-ENV-01104), (TII, 2020b);
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters, (IFI, 2016); and
- Planning for Watercourses in the Urban Environment. A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning, (IFI, 2020a).

9.2.3 Zone of Influence (ZoI)

The Zone of Influence (ZoI) for the proposed Scheme is based on a judgement of the likely extent of the ecological impacts on key ecological receptors. This will vary for different ecological features, depending on their sensitivities to environmental change.

In relation to terrestrial habitats, impacts will be limited to the lands within the site boundary of the proposed Scheme, as well as the immediate surrounding environs (e.g. overshading and soil; root compaction and changes to local hydrological regimes).

Surface water hydrological connections (e.g. drainage ditches, canals, wetlands and rivers) are often the most far-reaching impacts due to their lotic or semi-lotic nature. It becomes increasingly difficult to precisely predict the likely significance of adverse water-borne pollutants as they travel downstream from the pollution point source, given potential dilution and retention factors along the course of the impacted watercourse. Under the precautionary principle any designated sites (South Dublin Bay and Tolka Estuary SPA; North Dublin Bay SAC; North Bull Island SPA; South Dublin Bay SAC; Rockabill to Dalkey Island SAC; North-West Irish Sea SPA; Royal Canal pNHA; North Dublin Bay pNHA; South Dublin Bay pNHA; Dolphins Dock pNHA; Booterstown Marsh pNHA; and UNESCO Dublin Bay Biosphere), protected habitats or species (flora and fauna) located downstream of the watercourse which pass through the footprint of the proposed Scheme, namely the River Tolka and Royal Canal, will be considered to be within the hydrological ZoI of this scheme.

In regard to groundwater and groundwater-to-surface water connections, the ZoI is largely determined by the site's underlying bedrock, the soil /sub-soil permeability, and the characteristics of the underlying aquifer(s). The underlying bedrock of the proposed Scheme is comprised of dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark-grey calcar. This bedrock is largely overlain with limestone till, with smaller linear pockets of limestone gravels and alluvial sediments (particularly within the Tolka Valley Park). There is generally a low sub-soil permeability throughout the boundary of the proposed Scheme (GSI, 2024). As result of the above characteristics the site's aquifer vulnerability status ranges from 'Moderate' to 'Rock at or near Surface or Karst', with the more vulnerable areas located within historic and existing river / stream valleys. The aquifer within the underlying bedrock is considered to be locally important, with moderate productivity, though only in local zones. Therefore, the aquifer has a limited and relatively poorly connected network of fractures, fissures and joints, giving a low fissure permeability which tends to decrease further with depth. Generally, the lack of connection between the limited fissures results in relatively poor aquifer storage and flow paths that may only extend a few hundred metres (GSI, 2024). Therefore, the groundwater ZoI will be set to 300m given the characteristics of underlying aquifer.

Regarding the groundwater-to-surface water impact pathway, the characteristics of the underlying aquifer means it is likely to rapidly discharge to the nearby watercourses, i.e. the River Tolka and Bachelors Stream (GSI, 2024). Additionally, while earthworks within Tolka Valley Park may lead to the disruption of potentially toxic materials within the historic landfill, which may go enter the ground--to-surface water pathway. Therefore, the groundwater-to-surface water ZoI will also be set to 300m, with the addition of downstream surface water hydrological connections.

In respect to ZoI for air pollution (emissions and dust), KERs within a 250m buffer zone of the proposed Scheme were considered as per the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2024), including ex-situ foraging habitats utilised by Qualifying Interest species (QIs) and Special Conservation Interests species (SCIs) associated with local Natura 2000 sites.

In relation to physical (vibration and clearance works); audible and visual disturbance, faunal species will be considered on a species-by-species basis. Generally, smaller mammal species (e.g. Pygmy Shrew) will be given 100m disturbance zones, which is reflective of their relatively small territories. For larger mammals, such as Otter *Lutra lutra* and Badger *Meles meles*, the ZoI is 150m given the disturbance sensitivity of their resting / breeding location, i.e. holts and setts. This 150m disturbance ZoI has been detailed within best practice guidance documents Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (NRA, 2006e) and Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes (NRA,2006b).

The ZoI for local bats species is centred around the degradation or removal of foraging and commuting habitats; lighting impacts within and adjacent to footprint of the scheme; as well as the schemes proximity of known bat roosts within the locality. Of the above impacts, the degradation of habitats will be the furthest reaching and will therefore set the ZoI for local bat species impacts. As habitat degradation can potential occur within the surface water, groundwater and air (dust) ZoIs, the ZoI for local bat species will be set to 300m, with the addition of downstream hydrological connections. This ZoI will include areas which are present within local bat species' core sustenance zones (a 3km radius around each of bat roosts) (Collins, 2024).

The ZoI for breeding bird species is linked with direct habitat loss and degradation within the footprint of the proposed Scheme. Additional adverse impacts for these breeding birds will likely arise from the disturbance from construction works, which can extend 300m, therefore the ZoI for breeding bird disturbance will be set at 400m.

This 400m ZoI disturbance buffer will also be the case for protected migrant wintering bird species (e.g. Light-bellied Brent Goose *Branta bernicla hrota*) which visit the suitable foraging habitats within and adjacent to the proposed Scheme, which may be subject to habitat loss or degradation, as well as disturbance (Cutts et al, 2013).

The ZoI for reptiles (Common Lizard *Zootoca vivipara*) is linked with direct habitat loss and degradation, as well as construction and operational disturbances. As the furthest impact pathway that can affect terrestrial habitats is 300m, this will also be the ZoI distance for reptile species.

The ZoI for amphibians (Common Frog *Rana temporaria* and Smooth Newt *Lissotriton vulgaris*) is linked to the wetland and freshwater aquatic habitats, which have the potential to be degraded as a result of the proposed Scheme. Therefore, the ZoI for these floral / faunal species will mirror that of the groundwater-to-surface water ZoI, i.e. 300m, with the addition of downstream surface water hydrological connections.

The ZoI for freshwater macrophytes, fish and aquatic invertebrates is linked to the wetland and aquatic habitats, which have the potential to be degraded as a result of the proposed Scheme. Therefore, the ZoI for these floral / faunal species will mirror that of the groundwater-to-surface water ZoI, i.e. 300m, with the addition of downstream surface water hydrological connections.

The ZoI for terrestrial invertebrates is generally linked with direct habitat loss and degradation, as well as construction and operational disturbances. As the furthest impact pathway that can affect terrestrial habitats is 300m, this will also be the ZoI distance for terrestrial invertebrate species.

9.2.4 Data Collection and Collation

This ecological assessment is based on a combination of desk-based research and a number of ecological field surveys targeting select groups (as guided by relevant species group best-practice documents) of protected flora and fauna likely to be impacted by the construction and operation of the proposed Scheme. The desk-based research includes a data search for protected and notable species using the National Biodiversity Data Centre (NBDC) Mapping System (NBDC, 2024). A customised polygon was produced to extract all the species data from the set Zone of Influence for this scheme (Refer to Volume 4 – Map Figure 9-1).

9.2.4.1 Data Sources

Reviewed data sources included relevant published biodiversity data; collation of existing information on the ecological environment; and consultation with relevant statutory bodies. Accessed data sources include:

- The Status of EU Protected Habitats and Species in Ireland Volume 1: Summary Overview, (NPWS, 2019a);
- The Status of EU Protected Habitats and Species in Ireland Volume 2: Habitats Assessment, (NPWS, 2019b);
- The Status of EU Protected Habitats and Species in Ireland Volume 3: Species Assessment, (NPWS, 2019c);
- EPA Online databases on water quality and WFD maps (Available online at https://gis.epa.ie/EPAMaps/);
- Aerial photography available from www.osi.ie and Google Maps http://maps.google.com/;
- National Biodiversity Data Centre (NBDC) - Species Distribution Maps (Available online at www.biodiversityireland.ie);
- NBDC All Ireland Red Data lists for vascular flora, mammals, butterflies, non-marine molluscs, dragonflies & damselflies, amphibians, and fish (Available online at https://www.biodiversityireland.ie/resources/irish-red-lists/);
- International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (Available online at http://www.iucnredlist.org);
- Dublin City Biodiversity Action Plan 2015 – 2020 (Available online https://www.dublincity.ie/sites/default/files/media/file-uploads/2018-08/DublinCityBiodiversityActionPlan2015-2020.pdf;
- Dublin City Biodiversity Action Plan 2021-2025 (Available online https://www.dublincity.ie/residential/parks/strategies-and-policies/biodiversity-action-plan-2021-2025);
- Online data available on Natura 2000 network of sites and on Natural Heritage Areas (NHAs) or proposed Natural Heritage Areas (pNHAs) as held by the National Parks and Wildlife Service (Available online https://www.npws.ie/);
- Records of rare and protected species located within the ZoI of the proposed Scheme, held by the NPWS;
- Habitat and species GIS datasets provided by the NPWS;
- Bat records from Bat Conservation Ireland's (BCI) database;
- Environmental Impact Statements or Environmental Impact Assessment Reports for any developments located along the alignment of the proposed Scheme;
- Environmental information/data for the area available from the EPA website;
- Records from the Botanical Society of Britain & Ireland (BSBI);
- DART+ West Scheme EIAR and appendices data; and
- Any additional existing environmental or ecological reports examining the local areas.

9.2.4.2 Consultations

The following organisations, amongst others as necessary, with relevance to biodiversity have been consulted:

- National Parks and Wildlife Service (NPWS);
  - An initial meeting with two members of National Parks and Wildlife Services' Dublin regional staff took place on the 06/06/2023, where the proposed Scheme's ecological sensitivities and survey efforts were discussed at length. Following the meeting additional baseline and update surveys were conducted at the suggestion of the NPWS to ensure full coverage of sensitive ecological features within the ZoI of the proposed Scheme. Overall, the meeting was viewed as positive by all attending parties (NPWS, TII and BTEG) given the extent and detail of the ecological surveys completed to date and that all additional ecological survey efforts would be addressed over the following year before the planning submission; and
  - A follow-up meeting with National Parks and Wildlife Services' regional staff was held on the 17/04/2024. At this follow-up meeting, the NPWS staff were presented with an update on the most recent ecological findings recorded since the 2023 meeting, including the expanded baseline surveys suggested by NPWS at the previous meeting. The derogation licences required for protected species potentially impact by the construction of the proposed Scheme were outlined and their content discussed (e.g. on-going monitoring prior to, during and post-construction), with all parties satisfied with the outcome of said discussion. Additionally, the impact of land-use changes on migrant wintering bird species, particularly Light-bellied Brent Goose, was discussed at length, highlighting to the Luas Team the necessity to ensure the continued existence / reinstatement of natural amenity grassland areas within the boundaries of the proposed Scheme during its Operational Phase. The meeting was viewed as positive by all attending parties (NPWS, TII and BTEG), with a clear outcome detailing the final steps required from the Luas Team before the EIAR planning submission.
- Inland Fisheries Ireland (IFI);
  - The IFI Senior Fisheries Environmental Officer overseeing the River Tolka catchment has reviewed and judged the proposed designs and associated mitigations (including adherence to IFI guidelines) to be sufficient (12-08-2024).
- DCC Parks, Biodiversity and Landscape Services Division: Biodiversity Officer and Tree Officer;
- Bat Conservation Ireland (BCI – data provision only as organisation does not provide comment on proposed developments);
- BirdWatch Ireland (BWI);
- Irish Brent Goose Research Group;
- Botanical Society of Britain & Ireland (BSBI) (data only); and
- Other members of the public with local knowledge/ records (e.g. relating to bird species sightings).

9.2.4.3 Field Surveys

An initial ecological site walkover was conducted on the 11/03/2021 by Luas Team ecologists to inform the ecological baseline of the site. The initial ecological walkover and the subsequent habitat mapping and species-specific surveys covered the following areas within the proposed Scheme from south-to-north:

- Stabling site north of Bannow Road;
- Broombridge Station area;
- Royal Canal at Broombridge;
- Broombridge Road and immediately adjacent areas;
- the intersection of Broombridge and Ballyboggan Road;
- Tolka Valley Park;
- Tolka Valley Road;
- St Helena's green area;

- St Helena's Road; Farnham Drive / Casement Road green area;
- Wellmount Road;
- Patrickswell Place;
- Cappagh Road / Cardiff Castle Road green area;
- Mellowes Road and adjacent north and south areas;
- Mellowes Park;
- Finglas Bypass / St Margaret's Road roundabout;
- St Margaret's Road and adjacent areas; and
- Charlestown Place / Melville Road.

An additional habitat survey was conducted by Luas Team ecologists on the 26/05/2021 when plant growth was well established within the site. Further to this, an updated habitat and invasive species survey was carried out on 20/06/2023.

Aerial photographs and site maps assisted the habitat survey. Habitats have been named and described following A Guide to Habitats in Ireland by Fossitt (2000). Identification for higher plants principally follows that given in Webb's An Irish Flora (Parnell and Curtis, 2012); while contemporary nomenclature is in line with The New Flora of the British Isles 4th Edition (Stace, 2019).

All survey methods were in accordance, with those outlined in the following documents:

- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (2008), (NRA, 2008);
- Best Practice Guidance for habitat Survey and Mapping. The Heritage Council. (Smith et al., 2011);
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition) (Collins, 2016); and
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th Edition) (Collins, 2024)

The habitat and species-specific surveys conducted on-site are outlined in Table 9-3.

Table 9-3: Ecological surveys and survey dates

Ecological Survey	Survey Date(s)
JBA - Habitats (Fossitt)	11/03/2021; 26/05/2021; 24/08/2021 and 20/06/2023
JBA - Invasive	26/05/2021; 24/08/2021 and 20/06/2023
JBA- Rare & Protected Flora	20/06/2023
JBA - Terrestrial Mammals	11/03/2021; 26/05/2021; 05/01/2022; 25/05/2022; and 28/08/2023
JBA - Preliminary bat roost and habitat suitability	11/06/2021 and 25/05/2022
JBA – Transect bat activity	19/05/2023; 15/06/2023; and 24/08/2023
JBA - Static bat activity	26/05/2021 - 28/09/2021 (x12 surveys); 29/05/2022 - 26/09/2022 (x16 surveys); and 18/05/2023 – 28/08/2023 (x15 surveys)
JBA - Breeding bird	26/05/2021: 16/06/2021; 28/06/2021; 22/05/2023 – 28/05/2024
JBA - Wintering bird	01/12/2021; 15/12/2021; 05/01/2022; 18/01/2022; 27/01/2022; 02/02/2022; 10/02/2022; 25/02/2022; 07/12/2022; 16/12/2022; 05/01/2023; 13/01/2023; 25/01/2023; 02/02/2023; 17/02/2023; 28/02/2023; 15/12/2023; 04/01/2024; 12/01/2024; 19/01/2024; 02/02/2024; 09/02/2024; 23/02/2024; and 27/02/2024
JBA - Amphibian - Common Frog spawn	17/02/2022 and 28/02/2023
JBA - Amphibian - Smooth Newt eDNA	08/09/2021 and 28/07/2023
JBA & JBB - Terrestrial Invertebrate	24/08/2021 and 28/08/2023

Ecological Survey	Survey Date(s)
JBA - Freshwater Invertebrate Kick-sampling	24/08/2021
Denyer Ecology - Royal Canal: Aquatic flora	05/05/2022 and 06/06/2022

Habitats

Habitat surveys were conducted on the 11th of March 2021, 26th of May 2021 and 24th of August 2021and 20th June 2023. In addition, detailed aquatic and bankside flora surveys were conducted on the 5th of May 2022 and 6th of June 2022, by botanical specialist Denyer Ecology (see Volume 5 - Appendix A9.1). All habitats located within the survey area of the proposed Scheme were mapped to level three of the Heritage Council's Fossitt (2000) habitat codes, and in accordance with Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2011). Floral species present that were either representative of a habitat or considered to be of conservation interest were recorded. The habitat's extent was mapped onto an aerial photograph within the QField GIS Android application, with GPS points taken where any ecological features of note were observed. Any non-native invasive plant species listed on the Third Schedule of the Birds and Habitats Regulations were noted in detail, with other invasive non-native plant species also recorded during the habitat surveys.

Terrestrial Mammals

As recent data, including records from the National Biodiversity Data Centre place Otter; Badger; Irish Stoat *Mustela erminea hibernica*; Irish Hare *Lepus timidus hibernicus*; Pine Marten *Martes martes*; Hedgehog *Erinaceus europaeus*; and Pygmy Shrew *Sorex minutus* within the surrounding vicinity of the proposed Scheme - they must be considered within the scope of the EIAR Biodiversity Chapter.

The ground-dwelling mammal surveys examined the suitable areas within the footprint of the proposed Scheme for field signs of the above including scat/ droppings, setts/ dens/ holts and any mammal tracks.

The mammal surveys involved a one-day survey by Luas Team ecologists to cover the extent of the proposed Scheme, later followed later by targeted surveys, e.g. Otter habitation along the River Tolka and Royal Canal. Field signs were mapped and photographed within the QField GIS Android application. Surveying techniques were in line with those outlined in the Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (2006); Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes (2006); and Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008).

Bats

The sections below describe the methodologies utilised to conduct various bat surveys undertaken to inform the EIAR's Biodiversity Chapter, based on guidance outlined in Bat Surveys for Professional Ecologists – Good Practice Guidelines (Collins, 2016). The methodologies utilised to conduct these surveys are also in line with the updated version of this document Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th Edition) (Collins, 2024).

Preliminary Bat Roost and Habitat Suitability Surveys

Given the presence of a number of mature trees and two structures (to be demolished) within the site boundary, there was the potential for bat roosts to be present within or adjacent to the proposed Scheme. During June 2021 and May 2022, preliminary bat roost and habitat suitability surveys were conducted during daylight hours in order to identify the location of potential roosts features (PRFs) and access points (within structures).

Transect Bat Activity Surveys

A total of three transect bat activity surveys were conducted between Tolka Valley Park and Farnham Crescent, during the months of May, June, and August 2023. The surveys were conducted by two teams of two ecologists walking set transect routes within targeted survey area. Surveyors used a combination of Magenta 5 and Elekon Batscanner listening devices to record the bats observed during the survey. The

location of individual bats and their flight paths were recorded within the QField GIS Android application. The data collected provided information on the flight paths of bat species within the proposed Scheme area.

Static Bat Activity Surveys

Static (in situ) bat detectors [Anabat Express & Anabat Chorus – Titley Scientific] were installed along the length of the proposed Scheme (five locations in total – Royal Canal, Tolka Valley Park, Farnham (north of playing pitches), Mellowes Park (South) and Mellowes Park (North)) between the months of May and September during the 2021, 2022 and 2023 summer periods. These static detectors allowed for the collection of bat echolocation information over 5+ day time periods. A total of 12 static surveys were conducted during the 2021 summer period; with a further 16 static surveys conducted during the 2022 summer period; and 15 static surveys conducted during the 2023 summer period. The data collected provided information on the frequency of use by individual bat species within the proposed Scheme area.

Breeding Birds

Breeding bird surveys were conducted across three visits during May and June 2021 and 2024. These breeding bird records were updated throughout the length of the survey schedule for the proposed Scheme, with any incidental recordings added to the baseline data from 2021 and 2024. All suitable breeding bird habitats located within c. 300m of the proposed Scheme were slowly walked in a manner allowing the ecological surveyors to come within 20m of all suitable habitats. Birds were identified by sight and song, and general location and activity were recorded within the QField GIS Android application. The conservation statuses of the bird species were recorded later as per:

- Birds of Conservation Concern in Ireland (BoCCI) lists which classify bird species into three categories: Red List – birds of high conservation concern; Amber List – birds of medium conservation concern; and Green List – birds not considered threatened (Gilbert et al, 2021);
- Bird species listed on Annex I of the EU Birds Directive (2009/147/EC); and
- KER species of designated site within the ZoI of the proposed Scheme.

Surveying techniques were consistent with those outlined in the Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008).

Wintering Birds

The standard wintering bird survey methodology set out within Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008), which draws on elements of the British Trust for Ornithology's (BTO) Wetland Bird Survey (WeBS) methodology, is based around the surveying of coastal and inland wetland sites at different tidal phases. As the desktop data for wintering bird species (e.g. Curlew *Numenius arquata*, Lapwing *Vanellus vanellus* and Light-bellied Brent Goose) only showed their past recorded presences within dry terrestrial habitats, i.e. amenity grasslands, these habitats became the focus of the wintering bird surveys. It is important to note that this did not result in the neglect of other habitats present within and adjacent to the site (e.g. Tolka Valley Park pond and woodland patches) that may be utilised by wintering bird species. Given the above, it was clear that a bespoke survey methodology was required; one that ensured both the appropriate level of monitoring of wintering bird species within the dry terrestrial habitats and adhered to the quality assurance provided within the best practice guidance documentation.

For this reason, the proposed Scheme's bespoke wintering bird surveys included selected technical survey elements (e.g. total survey effort (hours) and seasonality) from the following guidance documentation: Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008); and Scottish Natural Heritage recommended Bird Survey Methods to inform impact assessment of onshore wind farms (2017), which ensured the overall quality of the wintering bird data collected, allowing for an accurate assessment of potential impacts on species of conservation concern, as well as the required mitigation to safeguard against any such impacts.

The diurnal timing aspect of the bespoke wintering bird survey design was based around the observed inland diurnal activity patterns of wintering bird species, such as Light-bellied Brent Geese and Curlew, flying inland from the southern extent of Bull Island within Dublin Bay. Generally, migrant wintering bird species

tend to gather together in mixed flocks where their favoured food is available (Crowe et al, 2009), e.g. secured / isolated amenity grassland, which allows for greater predator / disturbance detection so species, such as Light-bellied Brent Geese and Curlew, are observed foraging within the same amenity grasslands.

The Luas Team ecologists obtained the diurnal activity patterns of the Light-bellied Brent Goose population of Bull Island from researchers involved in the Dublin Biosphere Brent Goose tagging project. Extrapolated data suggested that the population of Light-bellied Brent Goose that roost at the southern end of Bull Island use the wider urban area to the west of Bull Island, which incorporates the Tolka Valley Park and Farnham Crescent areas, which are located within the proposed Scheme boundaries.

As Luas Team ecologists were also surveying two other sites for other projects in the north Dublin city area (green areas in the greater Glasnevin area) during the 2020-2021 winter period, the surveyors combined (where relevant) survey data and information on flight paths observed from the three studies. Surveys started at dawn with an observer posted at the southern end of Bull Island, and with three other observers located at the various sites. This combined approach allowed Luas Team ecologists to track the flight paths of wintering bird species, including Light-bellied Brent Goose and Curlew, as they moved inland from Bull Island area. Flocks were then observed for a 2-hour period during the morning; and then a further 2-hour period before dusk, i.e. the 2hr before the wintering bird species flocks returned to Bull Island area to roost. Disturbance sources and flight paths following disturbance were also recorded. These wintering bird surveys were carried out across 8 days from December to February (optimum wintering bird survey period) during the 2021-2022, 2022-2023 and 2023-2024 winter periods.

The surveyed habitats were also assessed in terms of their accessibility for dogs and whether or not they are open to the public. These site characteristics were considered likely to provide an indication of the level of disturbance at these sites to birds outside of surveyed hours.

Reptiles – Common Lizard

The Broombridge railway station area is considered sub-optimal Common Lizard habitat given its limited capacity to provide foraging, basking and refuge opportunities due to the presence of the platforms and associated structures replacing the grass verge and scrub which line the railway berm, which are present to the east and west of station area. Furthermore, the southern platform and associated structures and vegetation increase the level of shading along the southern aspect of railway, and thus decrease its suitability for Common Lizard basking. Additionally, recent survey data (DART+ West Scheme, 2022) concluded that Common Lizard was absent from the Broombridge railway area. As a result, specific Common Lizard surveys were not conducted. It is important to note that in the event that surveyors operating in this area recorded signs of Common Lizard, e.g. individual sighting, observation of discarded shed skin and presence within predator scat / spraint, this would have triggered a series of Common Lizard surveys in the area. No such observations were made during multiple Otter, breeding bird, amphibian, bat (static deployment) and terrestrial invertebrate surveys in this area, and thus these potential Common Lizard surveys were not triggered. However, this does not preclude the presence of Common Lizard from the proposed Scheme's ZoI, and as such Common Lizard will be examined in relation to its inclusion with the impact assessment.

Amphibians – Spawn and eDNA surveys

Recent data, including records from the NBDC, identified amphibian species, namely Common Frog and Smooth Newt, within the locality of the proposed Scheme. During spring of 2021 and 2022, ecological surveyors examined the site for the presence of individuals, as well as suitable waterbodies and wetlands to support breeding amphibian populations. Surveying techniques were in line with those outlined in the Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008). Additionally, eDNA sampling - wherein a series of water samples are taken from a water body (following sampling methodology supplied by the equipment provider) and analysed at a laboratory to detect DNA present within the water - was conducted for Smooth Newt within the Tolka Valley Park wetlands in 2021, and the Royal Canal in 2023.

Terrestrial Invertebrates

The surveying of terrestrial invertebrates was conducted by ecological surveyors on the 24/08/2021 and 28/08/2023. Surveyors carried out walked daytime transects, identifying diurnal macro-invertebrate species along selected routes within and immediately adjacent to the site boundary of the proposed Scheme. Surveying techniques were in line with those outlined in the Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008).

Aquatic Fauna – Fish and Freshwater Macro-invertebrates

Fish – Indirect and incidental sampling

Incidental sampling via macro-invertebrate kick-samples and Otter spraint dietary analysis confirmed the presence of the five fish species predicted to be present within the River Tolka. The presence of Stone Loach *Barbatula barbatula*, Three-spined Stickleback *Gasterosteus aculeatus*, Minnow *Phoxinus phoxinus* and Brown Trout *Salmo trutta* populations was confirmed via accidental capture during macro-invertebrate kick-samples, while Atlantic Salmon *Salmo salar* and European Eel *Anguilla anguilla* were confirmed as present through the laboratory analysis of Otter spraint collected from the River Tolka within Tolka Valley Park. Additionally, Inland Fisheries Ireland's latest Lamprey *Lampetra* survey data of this stretch of the River Tolka (approx. 1km downstream of site boundary within Tolka Valley Park) confirmed the continued presence of Lamprey spp. larvae (Gallagher , et al., 2023). Therefore, given the recent desktop data from IFI and analysis of Otter spraints, all fish species of conservation concern were identified within the River Tolka, and as such it was deemed unnecessary to conduct any invasive electro-fishing within the River Tolka, as all the data required to conduct an impact assessment on these species had been obtained.

The fish species within the Royal Canal have been well documented over recent decades (Waterways Ireland, 2011; Donohue, 2000), with the canal supporting Bream *Abramis brama*; Rudd *Scardinius erythropthalmus*; Roach *Rutilus rutilus*; Pike *Esox lucius*; Perch *Perca fluviatilis*; Tench *Tinca tinca*; Carp *Cyprinus carpio*; Three-spined Stickleback; and European Eel. Given that European Eel is the only fish species of conservation concern present within the Royal Canal, and that its continued presence within the Broombridge section of the canal was confirmed via recent Otter spraint analysis, it was deemed unnecessary to conduct any invasive electro-fishing surveys within the canal.

Macro-invertebrates

Macro-invertebrate kick-samples were taken at three sites along the River Tolka (within the Tolka Valley Park) by Luas Team ecologists. All kick-samples were conducted with a standard kick sampling net (i.e. 250mm in width and with a 500µm mesh size) from riffle/glide habitat, utilising a two minute per sample approach. Large cobbles were also washed at each site where present and samples were stored fixed in methylated spirits (containing ethanol) for laboratory identification. All macro-invertebrate species were identified using Guide to Freshwater Invertebrates (Dobson et al, 2012). Macro-invertebrate samples were converted to Q-value ratings as per (Toner et al, 2005). The reference classes for Q-value rating are displayed below in Table 9-4.

Table 9-4: Description of reference classes for EPA Q-value ratings (Toner et al., 2005)

Q-value	WFD Status	Pollution Status	Condition
Q5 or 4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly Polluted	Unsatisfactory
Q3 or 2-3	Poor	Moderately Polluted	Unsatisfactory
Q2, 1-2, 1	Bad	Seriously Polluted	Unsatisfactory

9.2.5 Methodology for the Assessment of Impacts

9.2.5.1 General Approach

The KERs identified during the ecological walkover surveys and from desk-based assessments were reviewed. A summary of KERs to be examined within the impact assessment section is presented at the end of the baseline environment section to highlight the KERs that have been identified as being present within the ZoI of the proposed Scheme.

9.2.5.2 Appropriate Assessment Process

Stage 1 - Screening for Appropriate Assessment

The initial, screening stage of the Appropriate Assessment is to determine:

- Whether the proposed plan or project is directly connected with or necessary for the management of the European designated site for nature conservation
- If it is likely to have a significant effect on the European designated site, either individually or in combination with other plans or projects

For those sites where, potential likely significant effects are identified, either alone or in combination with other plans or projects, further assessment is necessary to determine if the proposals will have an adverse impact on the integrity of a European designated Natura 2000 site, in view of the site's conservation objectives (i.e. the process proceeds to Stage 2).

The AA Screening Report produced for the proposed Scheme concluded that likely significant effects via the surface water, groundwater-to-surface water and air pathways were predicted for the QIs / SCIs of the North Dublin Bay SAC, South Dublin Bay SAC and Rockabill to Dalkey Island SAC; and the SCIs of North Bull Island SPA, South Dublin Bay and Tolka Estuary SPA and North-West Irish Sea SPA, arising from the proposed Scheme, either alone or in-combination with other plans or projects (JBA, 2024a). This conclusion triggered the production of the Stage 2 NIS report.

Stage 2 - Natura Impact Statement

Stage 2 requires a more in-depth evaluation of the plan or project, and the potential direct and indirect impacts of them on the integrity and interest features of the European designated site(s), alone and in-combination with other plans and projects, taking into account the site's structure, function and conservation objectives. Where required, mitigation or avoidance measures will be suggested. The competent authority can only agree to the plan or project after having ascertained that it will not adversely affect the integrity of the site(s) concerned.

The proposed Scheme's accompanying NIS outlines detailed mitigation measures, including surface water; surface-to-groundwater; groundwater, air (dust), and disturbance mitigations ensuring that the QIs / SCIs of North Dublin Bay SAC; South Dublin Bay SAC; Rockabill to Dalkey Island SAC; North Bull Island SPA; South Dublin Bay and River Tolka Estuary SPA; and North-west Irish Sea SPA that are within the ZoI of the proposed Scheme will not suffer any likely significant effects as result of the Scheme's construction or operation. Therefore, the Luas Finglas will not adversely affect (either directly or indirectly) the integrity of any European site in view of the site's conservation objectives, either alone or in combination with other plans or projects, and there is no reasonable scientific doubt in relation to this conclusion.

9.2.5.3 Valuation of Receptors

The value of designated sites, habitats and species populations is assessed with reference to:

- Their importance in terms of 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations);
- Any social benefits that habitats and species deliver (e.g. relating to enjoyment of flora and fauna by the public); and
- Any economic benefits that they provide.

The valuation of designated sites considers different levels of statutory and non-statutory protection. Assessment of habitat depends on several factors, including the size of the habitat, its conservation status and quality. The assessment also takes account of connected off-site habitat that has the potential to increase the value of the on-site habitat through association. Valuation of species depends on a number of factors including distribution, status, rarity, vulnerability, and the population size present.

Table 9-5: Examples of criteria used to define the value of ecological features (NRA, 2009)

Level of Value	Examples of Criteria
International Importance	'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. Proposed Special Protection Area (pSPA). Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network. Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971) World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972) Biosphere Reserve (UNESCO Man & The Biosphere Programme) Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979) Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979) Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988)
National Importance	Site designated or proposed as a Natural Heritage Area (NHA) Statutory Nature Reserve Refuge for Fauna and Flora protected under the Wildlife Acts. National Park Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive
County Importance	Area of Special Amenity Area subject to a Tree Preservation Order. Area of High Amenity, or equivalent, designated under the County Development Plan.

Level of Value	Examples of Criteria
	Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (Higher value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower value)	Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.
Less than 'Local' *	Areas of heavily modified or managed vegetation of low species diversity or low value as habitat to species of nature conservation interest. Common and widespread species.
***** Not included within the original NRA table. Level of value added to address features with less than 'Local' value	

Guidance published by CIEEM (2018) recommends breaking down the importance of ecological features in a geographic context similar to the NRA guidance shown in Table 9-5 with the following frame of reference to be adapted to local circumstances.

- International and European;
- National;
- Regional;
- Metropolitan, County, vice-county or other local authority-wide area;
- River Basin District;
- Estuarine system/Coastal cell; and
- Local.

The NRA (2009) guidance is congruent with this CIEEM (2018) guidance. The NRA (2009) guidance on geographic criteria for ecological valuation, as described in Table 9-5 is utilised as the primary means of habitat valuation assessment in this chapter, as only the NRA guidance provides a split of Higher and Lower level valued local ecological features, which provides more flexibility in regard to assessment of low-valued habitats that still provide ecological services (e.g. monoculture non-native ornamental shrubbery providing nesting opportunities to local breeding bird species).

9.2.5.4 Descriptive Terminology

The EPA Guidelines (EPA, 2022) provide guidance on determining significance and type of ecological effects. Examples of relevant terms are listed in the introductory chapter (sub-section 1.7.3.2).

9.2.5.5 Significance of Impacts

The overall significance of an impact can be derived from the total description of the effect compared against the sensitivity and significance (value) of the receptor as shown in Chapter 1: Introduction – Figure 1-2, which is sourced from the EPA's EIAR Guidelines (2022). The context and character of the receptor must also be assessed, such as its position in relation to the effect and its connectivity to the effect, however, this will be determined before assessing the significance of the impact.

The total description of the effect includes the character, magnitude, probability and consequences of the effect as described in Chapter 1 (Introduction) of this EIAR, which are combined to give a general description of the effect on an ordinal scale from Negligible to High. The sensitivity and significance of the receptor is also described on an ordinal scale from Negligible to High.

The placement of the general description of the effect, and the sensitivity/significance of the receptor on this scale is determined by a Competent Person (a qualified ecologist in this case) as they interpret the qualities of the effect from the categories listed in Table 9-5 and the receptors sensitivity and significance. Level of significance, also described as value of the receptor is previously set out in section 9.2.4.2. Sensitivity of the receptor is assessed by the Competent Person based on the receptor's characteristics and how susceptible to impact they are from the type of effect.

The overall significance of an effect is then categorised into one of the following seven classifications:

- Imperceptible;
- Not Significant;
- Slight;
- Moderate;
- Significant;
- Very Significant; and
- Profound.

Furthermore, the NRA (2009) and CIEEM (2018) guidelines were followed (in conjunction with the EIA guidelines), which requires examination of the following two key elements:

- Impact on the integrity of the ecological feature; and
- Impact on its conservation status within a given geographical area.

Ecological Integrity

Ecological integrity is regarded as the coherence of ecological structure and function, across the entirety of a site that enables it to sustain all of the biodiversity or ecological resources for which it has been valued (NRA, 2009).

Ecological integrity is most often used when determining impact significance in relation to designated nature conservation areas (e.g. SACs, SPAs or pNHA / NHAs) but can often be the most appropriate method to use for non-designated areas of biodiversity value where the component habitats and/or species exist, with a defined ecosystem at a given geographic scale.

Any adverse impact on the integrity of an ecological site or ecosystem is considered to be significant if it moves the condition of the ecosystem away from a favourable condition: removing and/or changing the processes that support the sites' habitats and/or species; affects the nature, scale, structure, complexity and functioning of component habitats; and/or affects the population size and viability of the inhabiting floral and faunal species therewithin.

Conservation Status

The definitions for conservation status given in the EU Habitats Directive 92/43/EEC, in relation to habitats and species, are also used in the CIEEM (2018) and NRA (2009) guidance:

- For natural habitats, conservation status means the sum of the influences acting on the natural habitat and its typical species, that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species, at the appropriate geographical scale; and
- For species, conservation status means the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations, at the appropriate geographical scale.

An impact on the conservation status of a habitat or species is considered to be significant if it will result in a change in conservation status.

After the definitions provided in the EU Habitats Directive 92/43/EEC, the conservation status of a habitat is favourable when:

- Its natural range and areas it covers within that range are stable or increasing;
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is favourable as defined below under species.

And the conservation status of a species is favourable when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

If it is determined that the ecological integrity and/or conservation status of a key ecological feature will be impacted, then the level of significance of that impact is related to the geographical scale at which the impact will occur (i.e. local, county / regional, national, international). In some cases, an impact may not be significant at the geographic scale at which the ecological feature has been valued (e.g. national) but may be significant at a lower geographical level (e.g. local).

9.2.5.6 Residual Impacts

The initial proposed Scheme is preliminarily assessed for adverse impacts, which is then followed by the mitigation by design process. This is done where mitigation by design elements are proven to be effective and will be implemented effectively with a high degree of certainty. In the event that potential impacts are still identified following the mitigation by design process, further mitigation measures will be proposed as part of the EIA process to avoid, reduce or minimise these potential adverse impacts. Each impact assessment section assigns a final significance level to the impact described, which considers and includes the implementation of any stated mitigation measures; these are the residual impacts.

9.2.6 Cumulative Impacts

Potential sources of cumulative impacts were identified based on the ecology of valued ecological features. Potential sources of cumulative impacts were sought within an area where there is the potential for a

significant impact on a site or species. The plans and projects identified as potential sources of cumulative impacts are described in detail within Chapter 24 Cumulative Impacts of this EIAR.

9.2.7 Constraints and Limitations

This Biodiversity Chapter is based on ecological site surveys and existing data from the above-mentioned sources. The chapter is inevitably subject to some limitations as detailed below. These do not affect the conclusion, but the following points are recorded in order to ensure the basis of the assessment is clear:

- Information on the works and conditions on site are based on current knowledge at the time of writing. The site surveys have followed CIEEM (2019) Advice note on the lifespan of ecological reports and surveys.

9.3 Baseline Environment

This baseline environment section presents information gathered from existing reports and desk-based sources as detailed in section 9.2.3 and a series of ecological site visits conducted on the dates listed in section 9.2.3.2.

9.3.1 Desktop Study

The data gathered from the desktop review of the data sources outline in section 9.2.3.1 are incorporated into the sections below under the specific headings where relevant.

9.3.1.1 Local Biodiversity Areas

Dublin City Biodiversity Action Plan 2021-2025 outlines a number of areas considered to be of biodiversity value that are present within the boundaries of DCC. Biodiversity areas that are located within the ZoI of the proposed Scheme are listed below:

- North Bull Island, which is noted to support nine different Annex I habitats, a range of legally protected species under the EU Habitats Directive and six floral species afforded protection under the Flora Protection Order (2022). It is also located within the European sites of North Dublin Bay SAC and North Bull Island SPA and the UNESCO Dublin Bay Biosphere Reserve;
- The River Tolka which is noted as being a highly significant regional salmonid catchment for Brown Trout;
- The Royal Canal which supports Otter, local bat species and a range of coarse fish species, as well as the legally protected Flora Protection Order species Opposite-leaved Pondweed *Groenlandia densa* and the red-listed Tassel Stonewort *Tolypella intricata*;
- Riparian zones (along the River Tolka), which support a range of legally protected and rare species including nesting birds, small mammals and multiple invertebrates;
- A network of parks and public green spaces, such as Tolka Valley Park, and private gardens, which support a variety of species and is considered to be a valuable biodiversity resource; and
- Designated European sites, which are located downstream of the proposed Scheme in Dublin Bay.

Additionally, the Fingal Biodiversity Action Plan 2023-2030 outlines a number of areas considered to be of biodiversity value present within the boundaries of FCC. Biodiversity areas that are located within the ZoI of the proposed Scheme are detailed below:

- Habitats considered to be of importance, such as arable land, semi-natural calcareous grassland, hedgerows and woodlands, which support a range of species and serve as vital ecological corridors across the wider landscape;
- A network of rivers and streams, including the River Ward and River Tolka, both of which are crossed by the proposed Scheme. These watercourses support a range of riverine mammal, bird and fish species; and
- Parklands and gardens associated with houses, parks, playing fields, churchyards, cemeteries and brown field sites, all of which contain valuable biodiversity.

Local biodiversity areas highlighted above are considered under the relevant flora and/or fauna KERs that rely on these areas in the overall EIAR biodiversity assessment.

9.3.1.2 Designated Nature Conservation Sites

A source-pathway-receptor model was used to identify all European (Natura 2000) and Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) which are present within the ZoI, as per OPR Practice Note PN01 Appropriate Assessment Screening for Development Management (OPR, 2021).

Table 9-6 below lists a total of six European Natura 2000 sites (see Volume 4 – Map Figure 9-1) and five proposed Natural Heritage Areas (see Table 9-7 and Volume 4 – Map Figure 9-2, which were determined to be within the ZoI of the proposed Scheme using the source-pathway-receptor (surface water, groundwater, groundwater-to-surface water, land, air, and air-to-surface water) model as per OPR Practice Note PN01 Appropriate Assessment Screening for Development Management (OPR, 2021).

Table 9-6: European Designated Sites within the Scheme's ZoI

Natura 2000 Sites (Total = 6)	Location Relative to the Proposed Scheme
South Dublin Bay and River Tolka Estuary SPA [004024]	4.1km
South Dublin Bay SAC [000210]	6.4km
North Dublin Bay SAC [000206]	7.1km
North Bull Island SPA [004006]	7.1km
North-West Irish Sea SPA [004236]	9.6km
Rockabill to Dalkey Island SAC [003000]	13.2km

Table 9-7: National Designated Sites within the Scheme's ZoI

Proposed Natural Heritage Areas (Total = 5)	Location Relative to the Proposed Scheme
Royal Canal pNHA [002103]	Within site
North Dublin Bay pNHA [000206]	3.9km
South Dublin Bay pNHA [(000210]	6.4km
Dolphins, Dublin Docks pNHA [000201]	6.8km
Booterstown Marsh pNHA [001205]	8.7km

Their respective descriptive briefs, qualifying interests and project-relevant threats and pressures are listed in Table 9-8 (Natura 2000 sites) and Table 9-9 (pNHA sites) overleaf.

Table 9-8: Site briefs; QIs / SCIs; and proposed Scheme threats and their impacts and sources to the Natura 2000 sites within the ZoI

Site Name	Brief	QIs / SCIs	Scheme-relevant Threats / Pressures: Impact (Source)
North Dublin Bay SAC	The North Bull Island sand spit is a relatively recent depositional feature, formed as a result of improvements to Dublin Port during the 18th and 19th centuries. The seaward side of the island has a fine sandy beach. A substantial area of shallow marine water is included in	Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Salicornia and other annuals colonising mud and sand [1310]	Industrial or commercial areas: High impact (outside) Discharges: High impact (inside)

Site Name	Brief	QIs / SCIs	Scheme-relevant Threats / Pressures: Impact (Source)
	the site. The interior of the island is excluded from the site as it has been converted to golf courses. Nature conservation is a main land use within the site. The North Bull Island dune system is one of the most important systems on the east coast and is one of the few in Ireland that is actively accreting. It possesses extensive and mostly good quality examples of embryonic, shifting marram and fixed dunes, as well as excellent examples of humid dune slacks. Both Atlantic and Mediterranean salt marshes are well represented, and a particularly good marsh zonation is shown. The salt marshes grade into mudflats and sandflats, some of which are dominated by annual Salicornia species. Petalwort *Petalophyllum ralfsii* occurs at its only known station away from the western seaboard (NPWS, 2020a).	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Humid dune slacks [2190] Petalwort [1395] (NPWS, 2013a)	Diffuse pollution to surface waters due to other sources not listed: Medium impact (inside) Urbanised areas, human habitation: High impact (outside) Invasive non-native species: Medium impact (inside) Other point source pollution to surface water: High impact (inside) (EEA, 2020a)
South Dublin Bay SAC	This intertidal site extends from the South Wall at Dublin Port to the West Pier at Dún Laoghaire, a distance of c. 5 km. Several permanent channels exist, the largest being Cockle Lake. A small sandy beach occurs at Merrion Gates, while some bedrock shore occurs near Dún Laoghaire. A number of small streams and drains flow into the site. The designated site possesses a fine and fairly extensive example of intertidal flats. Sediment type is predominantly sand, with muddy sands in the more sheltered areas. A typical macro-invertebrate faunal assemblage exists within the SAC. The SAC has the largest stand of Dwarf Eelgrass *Zostera nolti* on the east coast (NPWS, 2020b).	Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Salicornia and other annuals colonising mud and sand [1310] Embryonic shifting dunes [2110] (NPWS, 2013b)	Urbanised areas, human habitation: High impact (outside) Roads, motorways: Low impact (outside) Discharges: Moderate impact (both) Marine water pollution: Medium impact (both) Industrial or commercial areas: High impact (outside) (EEA, 2020d)

Site Name	Brief	QIs / SCIs	Scheme-relevant Threats / Pressures: Impact (Source)
Rockabill to Dalkey Island SAC	This site includes a range of dynamic inshore and coastal waters in the western Irish Sea. Reef habitat is uncommon along the eastern seaboard of Ireland due to prevailing geology and hydrographical conditions. Expansive surveys of the Irish coast have indicated that the greatest resource of this habitat within the Irish Sea is found fringing offshore islands which are concentrated along the Dublin coast. The area selected for designation represents a key habitat for the Annex II species Harbour Porpoise *Phocoena phocoena* within the Irish Sea. Population survey data show that porpoise occurrence within the site boundary meets suitable reference values for other designated sites in Ireland. The species occurs year-round within the site and comparatively high group sizes have been recorded (NPWS, 2014a).	Reefs [1170] Harbour Porpoise [1351] (NPWS, 2013c)	Discharges: High impact (outside) (EEA, 2019)
North Bull Island SPA	The North Bull Island sand spit is a relatively recent depositional feature, formed as a result of improvements to Dublin Port. The site is among the top ten sites for wintering waterfowl in the country. It supports internationally important populations of Light-bellied Brent Goose and Bar-tailed Godwit *Limosa lapponica* and is the top site in the country for both of these species. A further 14 species have populations of national importance, with particular notable numbers of Shelduck *Tadorna tadorna*, Northern Pintail *Anas acuta*, Grey Plover *Pluvialis squatarola*, and Red Knot *Calidris canutus*. Additional species which frequent the site include Teal *Anas crecca;* Northern Shoveler *Anas*	Light-bellied Brent Goose [A046] Common Shelduck [A048] Teal [A052] Northern Pintail [A054] Northern Shoveler [A056] Oystercatcher [A130] Golden Plover [A140] Grey Plover [A141] Red Knot [A143] Sanderling [A144] Dunlin [A149] Black-tailed Godwit [A156] Bar-tailed Godwit [A157] Curlew [A160] Common Redshank [A162] Ruddy Turnstone [A169] Black-headed Gull [A179] Wetland and Waterbirds [A999] (NPWS, 2015a)	Continuous urbanisation: Medium impact (outside) Industrial or commercial areas: Medium impact (outside) Discharges: Medium impact (both) (EEA, 2020c)

Site Name	Brief	QIs / SCIs	Scheme-relevant Threats / Pressures: Impact (Source)
	clypeata; Oystercatcher *Haematopus ostralegus;* Golden Plover *Pluvialis apricaria;* Sanderling *Calidris alba;* Dunlin *Calidris alpina;* Black-tailed Godwit *Limosa limosa;* Common Redshank *Tringa totanus;* Ruddy Turnstone *Arenaria interpres;* and Black-headed Gull *Chroicocephalus ridibundus.* (NPWS, 2020c)		
South Dublin Bay and River Tolka Estuary SPA	This designated site comprises a substantial part of Dublin Bay. It includes virtually all of the intertidal area in the south bay, as well as much of the Tolka Estuary to the north of the River Liffey. The sands support the largest stand of Dwarf Eelgrass on the east coast of Ireland. Sediments in the Tolka Estuary vary from soft thixotropic muds with a high organic content in the inner estuary to exposed, well aerated sands off the Bull Wall. The site regularly has an internationally important population of Brent Geese, which feeds on Dwarf Eelgrass in the autumn. It has nationally important numbers of a further 6 species including: Oystercatcher, Ringed Plover *Charadrius hiaticula*, Red Knot, Sanderling, Dunlin and Bar-tailed Godwit. It is an important site for wintering gulls, especially Black-headed Gull and Common Gull *Larus canus*. Is a regular autumn roosting ground for significant numbers of terns, including Roseate Terns *Sterna dougallii*, Common Tern *Sterna hirundo* and Artic Tern *Sterna paradisaea* (NPWS, 2020d).	Light-bellied Brent Goose [A046] Oystercatcher [A130] Ringed Plover [A137] Grey Plover [A141] Red Knot [A143] Sanderling [A144] Dunlin [A149] Bar-tailed Godwit [A157] Common Redshank [A162] Black-headed Gull [A179] Roseate Tern [A192] Common Tern [A193] Arctic Tern [A194] Wetland and Waterbirds [A999] (NPWS, 2015b)	Urbanised areas, human habitation: High impact (outside) Industrial or commercial areas: High impact (outside) Discharges: High impact (inside) (EEA, 2020d)
North-West Irish Sea SPA	The North-west Irish Sea SPA constitutes an important resource for marine birds. The estuaries and bays that open into it along with connecting coastal stretches	Common Scoter [A065] Red-throated Diver [A001] Great Northern Diver [A003] Fulmar [A009]	Not currently listed by the European Environment Agency website given that the site has only recently confirmed its status as a

Site Name	Brief	QIs / SCIs	Scheme-relevant Threats / Pressures: Impact (Source)
	of intertidal and shallow subtidal habitats, provide safe feeding and roosting habitats for waterbirds throughout the winter and migration periods. These areas, along with more pelagic marine waters further offshore, provide additional supporting habitats (for foraging and other maintenance behaviours) for those seabirds that breed at colonies on the north-west Irish Sea's islands and coastal headlands. These marine areas are also important for seabirds outside the breeding period. This SPA extends offshore along the coasts of counties Louth, Meath and Dublin, and is approximately 2,333km2 in area. This SPA supports a range species including Common Scoter *Melanitta nigra*; Red-throated Diver *Gavia stellata*; Great Northern Diver *Gavia immer*; Fulmar *Fulmarus glacialis*; Manx Shearwater *Puffinus puffinus*; Shag *Phalacrocorax aristotelis*; Cormorant *Phalacrocorax carbo*; Little Gull *Larus minutus*; Kittiwake *Rissa tridactyla*; Black-headed Gull; Common Gull; Lesser Black-backed Gull *Larus fuscus*; Herring Gull *Larus argentatus*; Great Black-backed Gull *Larus marinus*; Little Tern *Sterna albifrons*; Roseate Tern; Common Tern; Arctic Tern; Puffin *Fratercula arctica*; Razorbill *Alca torda*; and Guillemot *Uria aalge*. (NPWS, 2023)	Manx Shearwater [A013] Shag [A018] Cormorant [A017] Little Gull [A177] Kittiwake [A188] Black-headed Gull [A179] Common Gull [A182] Lesser Black-backed Gull [A183] Herring Gull [A184] Great Black-backed Gull [A187] Little Tern [A195] Roseate Tern [A192] Common Tern [A193] Arctic Tern [A194] Puffin [A204] Razorbill [A200] Guillemot [A199]	fully designated Natura 2000 site.

Table 9-9: Site briefs and ecological features of conservation concern of proposed Natural Heritage Areas within the ZoI

Site Name	Brief	KER Species
Royal Canal pNHA	The Royal Canal is a human-made waterway linking the River Liffey at Dublin to the River Shannon near Tarmonbarry. A number of different habitats are found within the canal boundaries - hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub	Otter Opposite-leaved Pondweed Tassel Stonewort Glutinous Snail

Site Name	Brief	KER Species
	and woodland. The hedgerow, although diverse, is dominated by Hawthorn *Crataegus monogyna*. The vegetation of the towpath is usually dominated by grass species. Otter spraints are found along the towpath, particularly where the canal passes over a river or stream. The rare and legally protected Opposite-leaved Pondweed (Flora Protection Order 2022) is present at one site in Dublin, between Locks 4 and 5. Tassel Stonewort is also in the Royal Canal in Dublin, the only site in Ireland where it is now found. The ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. It also host the red-listed Glutinous Snail *Myxas glutinosa* (NPWS, 2009).	
North Dublin Bay pNHA	As per the North Dublin Bay SAC, North Bull Island SPA and South Dublin Bay and River Tolka Estuary SPA descriptions are provided in Table 9-7.	As per those outlined in North Dublin Bay SAC and North Bull Island SPA descriptions, with the addition of the following species: Lesser Centaury *Centaurium pulchellum* Red Hemp-nettle *Galeopsis angustifolia* Meadow Saxifrage *Saxifraga granulata* Irish Hare Grey Seal *Halichoerus grypus* Harbour Seal *Phoca vitulina* Ringed Plover Meadow Pipit *Anthus pratensis* Skylark *Alauda arvensis* Little Egret *Egretta garzetta* Cormorant Wigeon *Mareca penelope* Goldeneye *Bucephala clangula* Red-breasted Merganser *Mergus serrator* Common Gull Herring Gull Short-eared Owl *Asio flammeus*
South Dublin Bay pNHA	As per the South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA descriptions are provided in Table 9-7.	As per those outlined in South Dublin Bay SAC and South Dublin Bay and River Tolka Estuary SPA descriptions, with the addition of the following species: Common Gull Herring Gull Mediterranean Gull *Ichthyaetus melanocephalus* Curlew Great-crested Grebe *Podiceps cristatus* Ruddy Turnstone

Site Name	Brief	KER Species
		Little Egret
Dolphins, Dublin Docks pNHA	As per the South Dublin Bay and River Tolka Estuary SPA descriptions in relation to the human-made mooring within the River Liffey Estuary in Table 9-7.	As per those outlined in South Dublin Bay and River Tolka Estuary SPA descriptions.
Booterstown Marsh pNHA	Booterstown Marsh lies approximately 5km south of Dublin City. Two streams run through the site; the Trimleston Stream runs along the northern edge of the site and is culverted, while the Nutley Stream runs parallel to the railway along the eastern side of the site. Sea water incursions into the marsh occur along this stream at high tide. Almost the entire marsh may be flooded at irregular intervals and salinity fluctuates throughout the site under the influence of rainfall and tidal cycles. Consequently, the site exhibits an interesting gradient from freshwater plant communities in the northwest to a more saline-tolerant flora in the south-east. The protected plant Borrer's Saltmarsh-grass *Puccinellia fasciculata*, known only from a few locations in Ireland, is found here. Booterstown Marsh is also a site of local/regional ornithological importance.	As per those outlined in the South Dublin Bay and River Tolka Estuary SPA description, with the addition of the following species: Borrer's Saltmarsh-grass Snipe *Gallinago gallinago* Mallard *Anas platyrhynchos* Teal Kingfisher *Alcedo atthis* Little Egret Yellow Wagtail *Motacilla flava*

Other Designated Sites

A number of other designated sites are present within the ZoI of the proposed Scheme, including two Ramsar wetland sites, one Special Amenity Area Order (SAAO) site and the UNESCO Dublin Bay Biosphere. As the Ramsar and Special Amenity Area Order (SAAO) sites are encompassed within the boundaries of the European and nationally designated sites, and as such share the same biodiversity receptors (i.e. KERs). Therefore, the impact assessment examining the Natura 2000 and pNHA sites will also take into account the KERs present within Ramsar and Special Amenity Area Order (SAAO) sites. As the UNESCO Dublin Bay Biosphere contains areas within the ZoI that are outside of the boundaries of the other designated sites, it will contain additional KERs, as identified in UNESCO Dublin Bay Biosphere section below.

Ramsar Sites

The two Ramsar sites located within the proposed Scheme's ZoI are as follows:

- Sandymount Strand/Tolka Estuary [Site code: 832]; and
- North Bull Island [Site code: 406].

The impact assessment of the Ramsar sites, which are located within Natura 2000 sites and pNHAs, is examined thoroughly under the assessment of Natura 2000 sites and pNHAs in the impact assessment section, and therefore will share the same KERs as the Natura 2000 and pNHA sites.

Special Amenity Area Order (SAAO)

North Bull Island is the only SAAO site present within the ZoI of the proposed Scheme. The SAAO looks to protect areas with noteworthy landscapes, nature and amenity. These areas were placed on a statutory footing under the Local Government (Planning and Development) Act 1963 [including amendments]; and re-enacted under section 202 of the Planning and Development Act 2000. These areas have been designated as a result of the remarkable aesthetics they present, as well as the need to conserve the nature contained within them.

The impact assessment of the SAAO area, which is located within Natura 2000 sites and pNHAs, is examined thoroughly under the assessment of Natura 2000 sites and pNHAs in the impact assessment section, and therefore share the same KERs as the Natura 2000 and pNHA sites.

UNESCO Dublin Bay Biosphere

The UNESCO Dublin Bay Biosphere extends to over 300km^2 of marine and terrestrial habitat, including North Bull Island and other ecologically significant habitats, such as the Tolka and Baldoyle Estuaries, Howth Head, Dalkey Island, Killiney Hill and Booterstown Marsh. KERs identified within the UNESCO Dublin Bay Biosphere (and the ZoI), which have been recorded outside of the boundaries of the other designated sites (NDBC, 2022), are listed below:

- Bottle-nosed Dolphin *Tursiops truncatus*;
- Harbour Porpoise;
- Kittiwake;
- Manx Shearwater;
- Sandwich Tern *Thalasseus sandvicensis*;
- Lesser Black-backed Gull; and
- Black-headed Gull.

The impact assessment of the UNESCO Dublin Bay Biosphere will examine the KERs above, in addition to overlapping KERs present within the other designated sites.

9.3.2 Ecological Baseline Surveying

The initial ecological walkover was conducted on the 26th of May 2021 by Luas Team ecologists, with an updated survey carried out on the 20th of June 2023. Descriptions of habitats and associated species are provided in the sections below.

9.3.2.1 Habitats

The habitats recorded during the ecological habitat survey are listed in Table 9-10 below and are presented in detail in the following sections, as well as any species recorded within the habitat. Habitat maps are provided in Volume 4 – Map Figure 9-3. The table below also contains a heading section for KERs, which are linked to these habitats through their presence (designated site and floral KERs) within / or adjacent to site boundary; habitat utilisation in the case of faunal KERs; and hydrological linkages downstream (designated site, floral and faunal KERs).

Table 9-10: List of habitats (Fossitt Classification) recorded on site, with linked KERs from site observations and desktop databases

Fossitt Habitat	Fossitt Code	Linked KERs (Presence / Utilisation / Hydrological Link)	
Stone walls and other stonework	BL1	-	
Buildings and artificial surfaces	BL3	House Sparrow *Passer domesticus* (Utilisation)	
Other artificial lakes and ponds	FL8	Soprano Pipistrelle *Pipistrellus pygmaeus* (Utilisation) Leisler's Bat *Nyctalus leisleri* (Utilisation) Mute Swan *Cygnus olor* (Utilisation) Tufted Duck *Aythya fuligula* (Utilisation)	Mallard (Utilisation) Cormorant (Utilisation) Black-headed Gull (Utilisation) Herring Gull (Utilisation) Common Frog (Utilisation)
Reed and large sedge swamps	FS1	Common Frog (Utilisation)	
Tall-herb swamps	FS2	Common Pipistrelle *Pipistrellus pipistrellus* (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation)	Potential Annex I habitat: 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430) (Presence)

Fossitt Habitat	Fossitt Code	Linked KERs (Presence / Utilisation / Hydrological Link)	
		House Sparrow (Utilisation)	
Depositing / lowland rivers	FW2	Otter (Utilisation) Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation) Brown Long-eared Bat *Plecotus auritus* (Utilisation) Whiskered Bat *Myotis mystacinus* and/or Brandt's Bat *Myotis brandti* (Utilisation) Daubenton's Bat *Myotis daubentonii* (Utilisation) Mallard (Utilisation) House Martin *Delichon urbicum* (Utilisation) Grey Wagtail *Motacilla cinerea* (Utilisation) Kingfisher (Utilisation) Atlantic Salmon (Utilisation) European Eel (Utilisation) Lamprey spp. (Utilisation) Grey Seal (Hydrological) Harbour Seal (Hydrological) Common Dolphin *Delphinus delphis* (Hydrological) Fin Whale *Balaenoptera physalus* (Hydrological)	South Dublin Bay and River Tolka Estuary SPA - SCI bird species (Hydrological) North Bull Island SPA - SCI bird species (Hydrological) South Dublin Bay SAC – QI Habitats (Hydrological) North Dublin Bay SAC – QI Habitats and Flora (Hydrological) Rockabill to Dalkey Island SAC - QI Habitat and Fauna (Hydrological) North-West Irish Sea SPA - SCI bird species (Hydrological) North Dublin Bay pNHA – KER species (Hydrological) South Dublin Bay pNHA – KER species (Hydrological) Dolphins, Dublin Docks pNHA – KER species (Hydrological) Booterstown Marsh pNHA – KER species (Hydrological) UNESCO Dublin Bay Biosphere – KER species (Hydrological)
Canals	FW3	Royal Canal pNHA (Presence) Tassel Stonewort (Presence) Otter (Utilisation) Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation) Nathusius Pipistrelle *Pipistrellus nathusii* (Utilisation) Grey Wagtail (Utilisation) Mallard (Utilisation) Mute Swan (Utilisation) Black-headed Gull (Utilisation) Tufted Duck (Utilisation) European Eel (Utilisation) Opposite-leaved Pondweed (Hydrological) Pointed Stonewort *Nitella mucronata* (Hydrological) Clustered Stonewort *Tolypella glomerata* (Hydrological)	South Dublin Bay and River Tolka Estuary SPA - SCI bird species (Hydrological) North Bull Island SPA - SCI bird species (Hydrological) South Dublin Bay SAC – QI Habitats (Hydrological) North Dublin Bay SAC – QI Habitats and Flora (Hydrological) Rockabill to Dalkey Island SAC - QI Habitat and Fauna (Hydrological) North-West Irish Sea SPA - SCI bird species (Hydrological) North Dublin Bay pNHA – KER species (Hydrological) South Dublin Bay pNHA – KER species (Hydrological) Dolphins, Dublin Docks pNHA – KER species (Hydrological) Booterstown Marsh pNHA – KER species (Hydrological)

Fossitt Habitat	Fossitt Code	Linked KERs (Presence / Utilisation / Hydrological Link)	
		Atlantic Salmon (Hydrological) Grey Seal (Hydrological) Harbour Seal (Hydrological) Common Dolphin (Hydrological) Fin Whale (Hydrological) Glutinous Snail (Hydrological)	UNESCO Dublin Bay Biosphere – KER species (Hydrological)
Amenity grassland (improved)	GA2	Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation) Light-bellied Brent Goose (Utilisation) Curlew (Utilisation) Black-headed Gull (Utilisation) Common Gull (Utilisation) Lesser Black-backed Gull (Utilisation)	Herring Gull (Utilisation) Barnacle Goose *Branta leucopsis* (Utilisation) Wood Pigeon *Columba palumbus* (Utilisation) House Martin (Utilisation) Starling *Sturnus vulgaris* (Utilisation) Large Red-tailed Bumblebee *Bombus lapidarius* (Utilisation)
Marsh	GM1	Soprano Pipistrelle (Utilisation)	
Dry calcareous and neutral grassland	GS1	Pyramidal Orchid *Anacamptis pyramidalis* (Presence) Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation) House Sparrow (Utilisation) Wood Pigeon (Utilisation)	Herring Gull (Utilisation) Starling (Utilisation) Moss Carder-bee *Bombus muscorum* (Utilisation) Large Red-tailed Bumblebee (Utilisation)
Dry meadows and grassy verges	GS2	Bee Orchid *Ophrys apifera* (Presence) Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation)	House Sparrow (Utilisation) Wood Pigeon (Utilisation) Meadow Pipit (Utilisation)
(Mixed) broadleaved woodland	WD1	Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation)	Wood Pigeon (Utilisation) Goldcrest *Regulus regulus* (Utilisation)
Scattered trees and parkland	WD5	Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation) Black-headed Gull (Utilisation)	Herring Gull (Utilisation) Wood Pigeon (Utilisation) Greenfinch *Chloris chloris* (Utilisation)
Hedgerows	WL1	Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation)	Nathusius Pipistrelle (Utilisation) House Sparrow (Utilisation)
Treelines	WL2	Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation)	Leisler's Bat (Utilisation)
Wet willow-alder-ash woodland	WN6	Soprano Pipistrelle (Utilisation) Leisler's Bat (Utilisation) Brown Long-eared Bat (Utilisation) Whiskered and/or Brandt's Bat (Utilisation)	Daubenton's Bat (Utilisation) Willow Warbler *Phylloscopus trochilus* (Utilisation) Spotted Flycatcher *Muscicapa striata* (Utilisation)

Fossitt Habitat	Fossitt Code	Linked KERs (Presence / Utilisation / Hydrological Link)	
Scrub	WS1	Common Pipistrelle (Utilisation) Soprano Pipistrelle (Utilisation)	Leisler's Bat (Utilisation) House Sparrow (Utilisation) Linnet *Linaria cannabina* (Utilisation)
Ornamental/non-native shrub	WS3	-	

There are six KERs that occur within the ZoI of the proposed Scheme, which are not directly linked (not present / no evidence of habitation) with any of above habitats that occur within or adjacent to the Scheme's site boundary. These KERs are listed below along with their rationale for inclusion within the chapter assessment:

- Badger – Recent NBDC data places Badger in the locality of the proposed Scheme. Species to be included in the assessment under the precautionary principle as the local Badger population may extend their territory into woodland and scrub habitats within the Tolka Valley Park;
- Irish Hare – Recent NBDC data places Badger in the locality of the proposed Scheme. Species to be included in the assessment under the precautionary principle as the local Irish Hare population may extend their territory into the grassland habitats within the Tolka Valley Park;
- Pine Marten – Recently sighted in the locality, Drumcondra area (NPWS – Regional Staff, personal communications.). Included in assessment under the precautionary principle as the local Pine Marten population may extend their territory into the woodland and scrub habitats within the Tolka Valley Park;
- Hedgehog – Recent NBDC data places Hedgehog in the locality of the proposed Scheme. Species to be included in the assessment under the precautionary principle as the local Hedgehog population may extend their territory into the grassland, woodland and scrub habitats within the Tolka Valley Park;
- Irish Stoat – Recent NBDC data places Irish Stoat in the locality of the proposed Scheme. Species to be included in the assessment under the precautionary principle as the local Irish Stoat population may extend their territory into the grassland, woodland and scrub habitats within the Tolka Valley Park; and
- Pygmy Shrew – Recent NBDC data places Pygmy Shrew in the locality of proposed Scheme. Species to be included in the assessment under the precautionary principle as the local Pygmy Shrew population may extend their territory into the grassland, woodland and scrub habitats within the Tolka Valley Park.

Stone walls and other stonework (BL1)

Linear stonewall habitats are present as part of the stone bridge within Tolka Valley Park. These habitats have a limited floral diversity, only supporting Ivy *Hedera hibernica*; Herb-Robert *Geranium robertianum* and the invasive non-native Butterfly-bush *Buddleja davidii*.

This semi-artificial habitat type is of Lower Local ecological importance, given its limited botanical diversity and capacity to support local fauna.

Buildings and artificial surfaces (BL3)

This habitat refers to the human-made structures and surfaces which occur throughout the proposed Scheme area, such as pedestrian footpaths and bridges, cycleways, roads, car parks, buildings and the Broombridge Luas Stop area.

Feral Pigeon *Columba livia domestica*; Rook *Corvus frugilegus* and House Sparrow utilising structure / buildings for perching, were recorded by ecological surveyors.

This artificial habitat type is of Less than Local ecological importance, due to its lack of floral and faunal community assemblages.

Other artificial lakes and ponds (FL8)

This aquatic habitat refers to the artificial pond within Tolka Valley Park, located 40m south-west of the proposed Scheme's site boundary. Located within this pond is a small, wooded islet, which supports nesting waterfowl such as Mute Swan (Figure 9-1). The pond supports White Water-lily *Nymphaea alba*, as well as

some fringed by fragmented reedbeds. The species of the fringing reedbeds and wooded islet are listed in their respective sections (Reed and large sedge swamps (FS1) & Wet willow-alder-ash woodland (WN6)).

Ecological surveyors noted the following fauna utilising this aquatic habitat – Soprano Pipistrelle; Leisler's Bat; Mute Swan; Cormorant; Black-headed Gull; Herring Gull; Tufted Duck; Mallard; Little Grebe *Tachybaptus ruficollis*; Grey Heron *Ardea cinerea*; Moorhen *Gallinula chloropus*; and Common Frog.

This aquatic habitat type is of County level ecological importance given its links downstream to the South Dublin Bay and Tolka Estuary SPA; North Dublin Bay SAC; North Bull Island SPA; and South Dublin Bay SAC, as well as its ability to support a range of faunal species (as listed above), which also includes breeding Mute Swan and spawning Common Frog.

Figure 9-1: Resident Mute Swans - Tolka Valley Park pond (40m south-west of the site boundary)

Reed and large sedge swamps (FS1)

The reed and large sedge swamp habitats within the Tolka Valley Park, namely the integrated wetland areas and the fringes of the pond, were largely dominated by Common Reed *Phragmites australis*; with occasional Bulrush *Scirpoides holoschoenus*; Greater Pond Sedge *Carex riparia*; Club Rush *Schoenoplectus lacustris*; Reed Canary-grass *Phalaris arundinacea*; Reed Sweet-grass *Glyceria maxima*; Yellow Iris *Iris pseudacorus*; Branched Bur-reed *Sparganium erectum*; Wild Angelica *Angelica sylvestris*; Soft Rush *Juncus effusus*; Purple Loosestrife *Lythrum salicaria*; Great Willowherb *Epilobium hirsutum;* and Hedge Bindweed *Calystegia sepium*. This habitat also fringes sections of the Tolka Valley Park pond.

Chaffinch *Fringilla coelebs*; Reed Bunting *Emberiza schoeniclus* and Bullfinch *Pyrrhula pyrrhula*; and the dragonfly species Brown Hawker *Aeshna grandis* were also recorded utilising this wetland habitat. Additionally, the local Common Frog population spawns at the edge of wetland habitat within the Tolka Valley Park pond.

This wetland habitat type is of Higher Local ecological importance, as a result of its capacity to support a range of bird and invertebrate species, as well as functioning as surface water run-off filtration system for the outflow of the culverted Finglas Wood Stream.

Tall herb swamp (FS2)

The northern bank of the Royal Canal supports a strip of high-quality, tall herb swamp habitat (Figure 9-2). The floral community of this habitat was typically comprised of Meadowsweet *Filipendula ulmaria*; Yellow Iris; Hedge Bindweed; Nettle *Urtica dioica*; Creeping Bent *Agrostis stolonifera*; Cow Parsley *Anthriscus sylvestris*; False Oat-grass *Arrhenatherum elatius*; Cuckooflower *Cardamine pratensis*; Remote Sedge *Carex remota*; Cock's-foot *Dactylis glomerata*; Great Willowherb; Field Horsetail *Equisetum arvense*; Red Fescue *Festuca rubra*; Hard Rush *Juncus inflexus*; Water Forget-me-not *Myosotis scorpioides*; Hemlock Water-dropwort *Oenanthe crocata*; Amphibious Bistort *Persicaria amphibia*; Ribwort Plantain *Plantago lanceolata*; Meadow Buttercup *Ranunculus acris*; Creeping Buttercup *Ranunculus repens*; Broad-leaved Dock *Rumex obtusifolius*; Rusty Willow *Salix cinerea* subsp. *oleifolia*; Alexanders *Smyrnium olusatrum*; Common Valerian *Valeriana officinalis*; and Bush Vetch *Vicia sepium*.

Ecological surveyors noted the following fauna utilising this habitat – Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; House Sparrow; Moorhen; Goldfinch *Carduelis carduelis*; Wren *Troglodytes troglodytes*; Brown Hawker; Common Hawker *Aeshna juncea*; Emperor Dragonfly *Anax imperator*; and Common DARTer *Sympetrum striolatum* dragonflies; Small White *Pieris rapae*; Speckled Wood *Pararge aegeria*; Peacock *Aglais io*; Small Tortoiseshell *Aglais urticae*; and Large White *Pieris brassicae* butterflies; and Honeybee *Apis mellifera*.

The quality of this wetland habitat links it with the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430).

This wetland habitat type is of National ecological importance given its flora diversity potentially grading as a potential Annex I habitat, it's capacity to support local fauna, as well as its presence within the Royal Canal pNHA.

Figure 9-2: Tall-herb swamp along the northern bank of the Royal Canal at Broombridge

Depositing / lowland rivers (FW2)

This habitat classification refers to the River Tolka as it flows through the Tolka Valley Park (Figure 9-3) and includes a cross-section of the proposed Scheme. The river does not support a particularly wide range of emergent flora, with Common Reed, Reed Canary-grass and Watercress *Nasturtium officinale* appearing infrequently in small, bankside stands; while Bur-reed *Sparganium* spp. individuals are rare. There is no instream flora present. The lower banks of the River Tolka are dominated by Bramble *Rubus fructicosus agg.*; Hedge Bindweed; Yorkshire Fog *Holcus lanatus*; and Nettle. Additionally, the high-impact invasive non-native Himalayan Balsam *Impatiens glandulifera* and Japanese Knotweed *Reynoutria japonica* are present on the river banks adjacent to the existing and proposed bridge.

Luas Team ecologists recorded a range of fauna within this aquatic habitat including Otter (spraint); Brown Long-eared Bat; Whiskered Bat and/or Brandt's Bat; Daubenton's Bat; Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Mallard; House Martin; Grey Wagtail; Grey Heron; Kingfisher; Blackbird *Turdus merula*; Dipper *Cinclus cinclus*; Atlantic Salmon; Brown Trout; European Eel; Three-spined Stickleback; Minnow; Stone Loach; and Brown Hawker dragonfly.

Additionally, sampling of this habitat revealed the presence of numerous freshwater invertebrates including families / genera of mayfly, caddisfly, amphipod, gastropod, bivalve, beetles, true flies, true worms, and leeches.

This aquatic habitat type is of County level ecological importance given its links downstream to the South Dublin Bay and Tolka Estuary SPA; North Dublin Bay SAC; North Bull Island SPA; and South Dublin Bay SAC, as well as its ability to support local foraging bat species and a range of aquatic and semi-aquatic faunal species.

Figure 9-3: River Tolka and bridge within the Tolka Valley Park

Canals (FW3)

This aquatic habitat refers to the Royal Canal along the Broombridge section of the proposed Scheme (Figure 9-4). The following aquatic / emergent floral species were recorded within the canal - Greater Water-moss *Fontinalis antipyretica* (on stonework at edge of canal); Reed Sweet-grass; Mare's-tail *Hippuris vulgaris*; Ivy-leaved Duckweed *Lemna trisulca*; Spiked Water-milfoil *Myriophyllum spicatum*; Yellow Water-

lily *Nuphar lutea*; Amphibious Bistort; and Bur-reed (not flowering) *Sparganium* spp. The aquatic invasive non-native species, Canadian Waterweed *Elodea canadensis* and Nuttall's Waterweed *Elodea nuttallii,* were also recorded within the Royal Canal at Broombridge.

Additionally, the red-listed (Vulnerable status) Tassel Stonewort was recorded (Volume 5 – Appendix A9.1) 180m upstream of the Broombridge Bridge (also see section 9.3.2.2). In this area there was shallow water near the edge of the canal of less than 0.5m deep. In the May 2022 survey, there was abundant Tassel Stonewort within a section of c. 10m length and 1m width. Other vegetation cover was low at this time. The plant was still present in the June 2022 survey but there was slightly higher cover of filamentous algae. A small sample was removed and confirmed microscopically.

In regard to fauna, Otter; Nathusius Pipistrelle; Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Moorhen (breeding pair with chicks); Grey Wagtail; Mallard; Mute Swan; Black-headed Gull; and Tufted Duck; as well as Brown Trout; European Eel; Minnow; Three-spined Stickleback; Perch; Minnow and/or Roach via Otter spraint analysis were recorded utilising this stretch of the Royal Canal. The Triturus Environmental 2022 survey (Triturus 2024) also confirms the presence of Roach within the Royal Canal within the Phibsborough area.

This aquatic habitat type is of National ecological importance given its status under the Royal Canal pNHA, as well as its ability to support red-listed and protected aquatic and semi-aquatic faunal and botanical species.

Figure 9-4: Royal Canal - Broombridge Section

Amenity (improved) grassland (GA2)

This habitat refers to the small (e.g. maintained roadside grass verges) to large (e.g. playing pitches) amenity grassland areas present within much of the proposed Schemes' site boundary. The floral communities in these improved grassland habitats typically comprised Perennial Rye-grass *Lolium perenne*; Daisy *Bellis perennis*; Ribwort Plantain; Greater Plantain *Plantago major*; Nettle; Meadow Buttercup; Creeping Buttercup; Red Clover *Trifolium pratense*; White Clover *Trifolium repens*; Lesser Trefoil *Trifolium dubium*; Dandelion *Taraxacum* spp.; Ragwort *Jacobaea vulgaris*; Yorkshire Fog; Smooth Hawk's-beard *Crepis capillaris*; Daffodil *Narcissus* spp.; Self-heal *Prunella vulgaris;* and Dock *Rumex* spp.

Additionally, ecological surveyors recorded the following fauna utilising this grassland habitat - Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Rook; Feral Pigeon; Wood Pigeon; House Martin; Starling; Wren; Robin *Erithacus rubecula*; Black-headed Gull; Herring Gull; Curlew; Barnacle Goose; Dark-bellied Brent Goose *Branta bernicla bernicla*; Light-bellied Brent Goose; Large White and Small White butterflies; and Large Red-tailed Bumblebee.

This grassland habitat type is of County level ecological importance, although only in select areas, i.e. the Erin's Isle GAA pitches (East Farnham), and the two pitches west of Farnham Drive (West Farnham), and the eastern Tolka Valley Park pitches, given their capacity to support the foraging activities of the internationally important Light-bellied Brent Goose and other protected wintering bird species. Outside of these select areas amenity grassland habitat is considered to be of Less than Local ecological importance.

Marsh (GM1)

The marsh habitat, located within the north-east corner of the Tolka Valley wetland (Figure 9-5), was largely dominated by Yellow Iris; with frequent Nettle; and occasional Bulrush; Cow Parsley; Hogweed *Heracleum sphondylium*; Cleavers *Galium aparine*; Great Willowherb; Common Reed; and Butterbur *Petasites hybridus*.

Luas Team ecologists also recorded Soprano Pipistrelle; Goldfinch; Wren; Banded Demoiselle *Calopteryx splendens*; White-tailed Bumblebee *Bombus lucorum*; and Honeybee utilising this wetland habitat.

This wetland habitat type is of Higher Local ecological importance, as a result of its capacity to support a range of bird and invertebrate species, as well as functioning as surface water run-off filtration system for the outflow of the culverted Finglas Wood Stream.

Figure 9-5: Marsh habitat within Tolka Valley Park

Dry calcareous and neutral grassland (GS1)

This habitat classification refers to the dry calcareous / neutral meadow habitat present within the St. Helena's green area (Figure 9-6). This grassland has a diverse flora, including species such as Red Fescue;

Yorkshire Fog; Cock's-foot; Common Bent *Agrostis capillaris*; Sweet Vernal-grass *Anthoxanthum odoratum*; Soft Brome *Bromus hordeaceus*; Common Sedge *Carex nigra*; Perennial Rye-grass; Germander Speedwell *Veronica chamaedrys*; Red Clover; White Clover; Daisy; Ribwort Plantain; Common Plantain; Yarrow *Achillea millefolium*; Curly Dock *Rumex crispus*; Clustered Dock *Rumex conglomeratus*; Common Sorrel *Rumex acetosa*; Meadow Buttercup; Rough Hawkbit *Leontodon hispidus*; Chicory *Cichorium intybus*; Lesser Trefoil; Dandelion spp.; Ragwort; Hedgerow Crane's-bill *Geranium pyrenaicum*; Creeping Buttercup; Common Bird's-foot Trefoil *Lotus corniculatus*; Greater Bird's-foot Trefoil *Lotus pedunculatus*; Lady's Bedstraw *Galium verum*; Pignut *Conopodium majus*; Lesser Knapweed *Centaurea nigra*; Common Poppy *Papaver rhoeas*; Red Bartsia *Odontites vernus*; Cornflower *Centaurea cyanus*; Creeping Thistle *Cirsium arvense*; Scarlet Pimpernel *Anagallis arvensis*; Self-heal; and Pyramidal Orchid.

Ecological surveyors also recorded the following fauna utilising this dry meadow habitat - Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; House Sparrow; Domestic Horse *Equus caballus*; Feral Pigeon; Magpie *Pica pica*; Wood Pigeon; Herring Gull; Starling; Brown Hawker; Honeybee; Cranefly *Tipula* spp.; Common Grasshopper *Omocestus viridulus*; Small Tortoiseshell; Meadow Brown *Maniola jurtina*; Small White; Honeybee; Common Carder-bee *Bombus pascuorum*; Moss Carder-bee; Large Red-tailed Bumblebee and White-tailed Bumblebee.

This grassland habitat type is of County level ecological importance given the habitat's botanical diversity including uncommon species, its capacity to support local fauna including red-listed pollinators (e.g. Moss Carder-bee), and its general scarcity within the Dublin City area.

Figure 9-6: St Helena's dry grassland supporting Pyramidal Orchid

Dry meadow and grassy verges (GS2)

This habitat classification refers to the dry meadows and grassy verge/meadow strips, which are present in the northern and southern sections of the proposed Scheme (Figure 9-7). These dry grassland habitats typically contained species such as Yorkshire Fog; Perennial Rye-grass; Red Fescue; Crested Dog's-tail *Cynosurus cristatus*; Common Bent; Soft Brome; Ribwort Plantain; Common Poppy; Meadow Foxtail *Alopecurus pratensis*; White Clover; Common Plantain; Self-heal; Red Clover; Lesser Trefoil; Cornflower;

Lavender *Lavandula* spp.; False Oat-grass; Yarrow; Ox-eye Daisy *Leucanthemum vulgare*; Meadow Buttercup; Silverweed *Potentilla anserina*; Creeping Buttercup; Bush Vetch; Curly Dock; Broad-leaved Dock; Wild Teasel *Dipsacus fullonum*; Lesser Stitchwort *Stellaria holostea*; Dandelion spp.; Hogweed; Cleavers; Creeping Thistle; Spear Thistle *Cirsium vulgare*; Cock's-foot; Daisy; Smooth Sowthistle *Sonchus oleraceus*; Cut-leaved Crane's-bill *Geranium dissectum*; Creeping Cinquefoil *Potentilla reptans*; and Bee Orchid.

Ecological surveyors recorded the following faunal species utilising these dry meadow and grass verge habitats - Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Goldfinch; House Sparrow; Magpie; Meadow Pipit; Buzzard *Buteo buteo;* Wood Pigeon; Small Tortoiseshell; Meadow Brown; and Peacock butterflies; Wasp *Vespula* spp.; and Common Blue Damselfly *Enallagma cyathigerum*.

This grassland habitat type is of Higher Local ecological importance given its moderate botanical diversity and its capacity to support the foraging activities of a range of local fauna.

Figure 9-7: Dry meadow grassland strips within the Tolka Valley Park

(Mixed) broadleaved woodland (WD1)

This habitat classification refers to a woodland strip east of Mellowes Park and a small section of mixed deciduous woodland at the southern extent of the Tolka Valley Park section, by the proposed bridge crossing (Figure 9-8). These mixed woodland habitats comprised the following canopy and understorey flora - Sycamore *Acer pseudoplatanus*; Hawthorn; Hornbeam *Carpinus betulus*; Purple Sycamore *Acer pseudoplatanus f. purpureum*; Field Maple *Acer campestre*; Scots Pine *Pinus sylvestris*; Silver Birch *Betula pendula*; Black Poplar *Populus nigra*; Alder *Alnus glutinosa*; Goat Willow *Salix caprea*; Bramble; Nettle; Cleavers; Ivy; Yorkshire Fog; and Cow Parsley; and the invasive non-native Cherry Laurel *Prunus laurocerasus*.

Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Jackdaw *Corvus monedula*; Wood Pigeon; Goldcrest; and Orange Tip butterfly *Anthocharis cardamines* were all noted by surveyors to be utilising this woodland habitat.

This woodland habitat type is of Higher Local ecological importance given its moderate floral diversity and its capacity to support the foraging and breeding activities of a range of local fauna.

Figure 9-8: A small mixed broad-leaved woodland patch adjacent to the Tolka Valley Park bridge

Scattered trees and parkland (WD5)

This habitat type refers to the areas with scattered tree / canopy cover within the green amenity areas present with the proposed Scheme (Figure 9-9). Juvenile and mature tree species recorded in this habitat included Small-leaved Lime; Ash; Purple Sycamore; Sycamore; Goat Willow; Rowan *Sorbus aucuparia*; Silver Birch; Field Maple; Hazel; Whitebeam *Sorbus aria*; Hawthorn; Wild Cherry; Beech; Horse Chestnut *Aesculus hippocastanum*; and the invasive non-native Cherry Laurel. The ground flora typically comprised Perennial Rye-grass; Daisy; White Clover; Red Clover; Sheperd's Purse *Capsella bursa-pastoris*; Cock's-foot; Dandelion spp.; Ragwort; Creeping Buttercup; Groundsel *Senecio vulgaris*; Common Mouse-ear *Cerastium fontanum*; Silverweed; Ribwort Plantain; Bush Vetch; Cut-leaved Crane's-bill; Yarrow and Germander Speedwell.

Ecological surveyors also recorded Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Herring Gull; Black-headed Gull; Wood Pigeon; Magpie; Jackdaw; Collared Dove; Greenfinch; Chiffchaff *Phylloscopus collybita*; Blue Tit; Blackcap *Sylvia atricapilla*; Blackbird; Treecreeper *Certhia familiaris*; and Hooded Crow; Large White; Small White; and Speckled Wood butterflies; and Wasp spp. inhabiting this mixed tree and grassland habitat.

This mixed grassland and woodland habitat type is of Higher Local ecological importance given its moderate floral diversity and its capacity to support the foraging and breeding activities of a range of local fauna.

Figure 9-9: Scattered trees and parkland within Mellowes Park

Hedgerows (WL1)

A hedgerow runs along the northern boundary of the Royal Canal east of the Broombridge Road bridge. This linear habitat's floral composition was made up of Alder; Ash; Sycamore; Elder; Bramble; Great Willowherb; Creeping Thistle; Hedge Bindweed; Ivy; and the invasive non-native Butterfly-bush.

The following fauna were recorded within these linear habitats - Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Nathusius' Pipistrelle; House Sparrow; and White-tailed Bumblebee.

This linear habitat type is of Higher Local ecological importance given its moderate floral diversity and its capacity to support the foraging and breeding activities of a range of local fauna.

Treelines (WL2)

A number of urban street and parkland treelines were recorded within and along the boundaries of the proposed Scheme (Figure 9-10). These habitats included species such as Small-leaved Lime *Tilia cordata*; Wild Cherry *Prunus avium*; Hornbeam; Purple Sycamore; Hawthorn; Pedunculate Oak *Quercus robur*; Ash *Fraxinus excelsior*; Beech *Fagus sylvatica*; Black Poplar; and Hazel *Corylus avellana*; while the understorey species included Perennial Rye-grass; Daisy; Ribwort Plantain; Creeping Buttercup; White Clover; Dandelion spp.; Yorkshire Fog; and Dock spp.

The following fauna were recorded within these linear habitats - Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Wood Pigeon; Collared Dove *Streptopelia decaocto*; Hooded Crow *Corvus cornix*; and Blue Tit *Cyanistes caeruleus*.

This linear habitat type is of Higher Local ecological importance given its moderate floral diversity and its capacity to support the foraging and breeding activities of a range of local fauna.

Figure 9-10: Semi-mature treeline habitat running along Patrickswell Place

Wet willow-alder-ash woodland (WN6)

A small strip of wet willow-alder-ash woodland lines the northern bank of the section of the River Tolka contained within the boundaries of the proposed Scheme (Figure 9-11). Additionally, a short section of a woodland strip on the south bank is also maturing into a wet willow-alder-ash woodland. This wet woodland habitat comprises the following canopy and understorey flora - Alder; Ash; Grey Willow; Osier *Salix viminalis*; Silver Birch; Cow Parsley; Bramble; Yorkshire Fog; Creeping Buttercup; Hogweed; Cleavers; Nettle; Ivy; Dock spp.; Hedge Bindweed; and Butterbur. A small stand of the high-impact invasive non-native species, Himalayan Balsam, was recorded within this habitat.

Ecological surveyors recorded as utilising this wet woodland habitat: Brown Long-eared Bat; Whiskered and/or Brandt's Bat; Daubenton's Bat; Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Dunnock *Prunella modularis*; Long-tailed Tit *Aegithalos caudatus*; Blackcap; Song Thrush *Turdus philomelos*; Willow Warbler; Spotted Flycatcher; Bullfinch; Speckled Wood butterfly; and Common Hawker dragonfly.

This woodland habitat type is of Higher Local ecological importance given its moderate floral diversity and its capacity to support the foraging and breeding activities of a range of local fauna.

Figure 9-11: Semi-established wet willow-alder-ash woodland strips line the banks of the River Tolka

Scrub (WS1)

Scrub habitat mainly exists in sporadic strips and patches within the Stabling area, Broombridge (east of the station area) and Tolka Valley Park areas of the proposed Scheme. The floral community of this habitat comprises of Bramble; Hawthorn; Dock spp.; Dandelion spp.; Bush Vetch; Nettle; Hedge Bindweed; Dogwood *Cornus* spp.; Ribwort Plantain; False Oat-grass; Cock's-foot; Field Mustard *Brassica rapa*; Yorkshire Fog; and the invasive non-native Butterfly-bush; as well as Willow spp., Silver Birch, Ash, Alder and Sycamore (invasive) saplings.

Species recorded as utilising this habitat type: Common Pipistrelle; Soprano Pipistrelle; Leisler's Bat; Dunnock; Wren; Great Tit *Parus major*; Linnet and House Sparrow.

This scrub habitat type is of Higher Local ecological importance given its moderate floral diversity and its capacity to support the foraging and breeding activities of a range of local fauna.

Ornamental / non-native shrub (WS3)

This habitat classification refers to a small, roadside section dominated by non-native ornamental shrub planting along the western footpath of St. Margaret's Road, which contains invasive Cherry Laurel; Sycamore saplings; *Cotoneaster* spp.; and other non-native ornamental flora, as well as the following native species: Dogwood; St. John's-wort *Hypericum* spp.; immature Elder *Sambucus nigra;* and Rowan.

This shrub habitat type is of Lower Local ecological importance given its limited floral diversity, though it still has the ability to support the foraging and breeding activities of a range of local fauna.

9.3.2.2 Rare & Protected Flora

Given the potential for the protected (Flora Protection Order, 2022) Opposite-leaved Pondweed (Flora Protection Order, 2022) and the red-listed Tassel Stonewort ('Vulnerable') to be present within the

Broombridge Royal Canal section, an aquatic botanic specialist from Denyer Ecology was engaged to survey the canal for the above species (Denyer, 2022). The results of two summer surveys (May and June 2022) are presented in the following sections. Additionally, the results of a 2023 macrophyte survey of the Royal Canal (1st to 16th lock) conducted by Triturus Environmental Ltd (2024) are also outlined within the following sections.

Opposite-leaved Pondweed

Despite the presence of suitable habitat (early successional vegetation with good water clarity) within the Broombridge section of the Royal Canal, Opposite-leaved Pondweed was not observed within the survey area (400m) either side of the bridge area during the 2022 survey. However, a macrophyte survey of the Royal Canal (1st to 16th lock), conducted during 2023, highlighted the presence of Opposite-leaved Pondweed between the 1st and 3rd locks (Volume 4 – Map Figure 9-4) of the Royal Canal (Triturus, 2024).

Given the presence of Opposite-leaved Pondweed 2.5km downstream of the Royal Canal Broombridge section Royal Canal, this species is of National ecological importance given its rarity and its association with the Royal Canal pNHA site.

Tassel Stonewort

Tassel Stonewort was recorded 180m upstream of Broombridge Bridge (Volume 4 – Map Figure 9-4). In this area there was shallow water near the edge of the canal of less than 0.5m deep. In the May 2022 survey, there was abundant Tassel Stonewort within a section of c. 10m length and 1m width. Other vegetation cover was low at this time. The plant was still present in the June 2022 survey but there was slightly higher cover of filamentous algae. A small sample was removed and checked microscopically to confirm species identification.

Tassel Stonewort is considered to be of National ecological importance given its red-listed status as Vulnerable and its association with the Royal Canal pNHA site.

Pointed Stonewort

Pointed Stonewort was recorded by Triturus during the 2023 macrophyte survey of the Royal Canal (Triturus, 2024), between the 2nd and 3rd canal locks (Volume 4 – Map Figure 9-4). Pointed Stonewort is listed as Rare on the Irish Red List: Stoneworts (Stewart and Church, 1992).

Pointed Stonewort is of County level ecological importance given its rarity and its association with the Royal Canal pNHA site.

Rare / Uncommon Freshwater Macrophytes

Clustered Stonewort was also recorded during the 2023 Triturus macrophyte survey (Triturus, 2024) of the Royal Canal (Volume 4 – Map Figure 9-4). This species was record between the 1st and 2nd, and the 6th and 7th canal locks. While this floral species is not afforded any legal protections, it is considered to be nationally rare.

Clustered Stonewort is considered to be of Higher Local ecological importance given its scarcity and its association with the Royal Canal pNHA.

Rare / Uncommon (Non-protected) Terrestrial Flora

Luas Team ecologists recorded two species of orchid, namely Bee Orchid and Pyramidal Orchid, which are not commonly found within the locality of the proposed Scheme.

An individual Bee Orchid was noted within an additional rare and protected survey buffer area (as requested by NPWS staff as part of consultation process) located east of the Stabling site, just beyond the northern Royal Canal footpath (See location in Volume 4 – Map Figure 9-5. The Bee Orchid is located within the ZoI of the proposed Scheme as it is located within the air pollution buffer zone.

Additionally, three Bee Orchids were recorded (17/06/2024) within the north-western corner of Mellowes Park (south of roundabout) (see location in Volume 4 – Map Figure 9-6) within a newly formed area of dry meadow, which is located within the red line boundary of the proposed Scheme, and therefore within the ZoI.

As noted within section 9.3.2.1, dry calcareous and neutral grassland, a two-spike Pyramidal Orchid has established in the south-east corner of the St Helena's grassland (See location in Volume 4 – Map Figure 9-7). The low-grazing pressure (two Domestic Horses present seasonally) applied to this grassland has reduced grass species dominance; which has allowed for species such as the Pyramidal Orchid to establish. This orchid species will continue to spread within this section of grassland provided future grassland maintenance / grazing changes are not increased.

These two species are of Higher Local ecological importance, given their rarity within the locality of the proposed Scheme.

Figure 9-12: Bee Orchid located east of the stabling site, and north of Royal Canal

9.3.2.3 Protected Fauna / Fauna of Conservation Concern

Otter

Evidence (spraints, latrines and holt) of Otter habitation was recorded along both the Broombridge Royal Canal section and the River Tolka within Tolka Valley Park (see Figure 9-13, and location in Volume 4 – Map Figure 9-8). Multiple spraints were recorded during 2021, 2022 and 2023 at an Otter latrine located along the northern bank of the Royal Canal, under Broombridge pedestrian / roadway bridge. Additionally, an Otter holt was recorded (January 2023) along the south bank of the Royal Canal, located approximately 35m east of the existing pedestrian bridge over the railway. Follow-up activity checks on the holt were conducted during the summer and autumn of 2023, which concluded that the holt was inactive during the summer, autumn and winter months (May to September inclusive), inferring that this holt is not a core or breeding holt used regularly by the resident male and female Otter which control this territory.

Within the Tolka Valley Park, two Otter latrines were noted upstream of the pedestrian / roadway bridge along the River Tolka. Both latrines were located on instream boulders, the first of which was located 40m upstream of the proposed Scheme's site boundary, while the second latrine was located 440m upstream of this boundary.

Given the above findings and desktop-based data (NBDC 2024), the Otter sub-populations present with the proposed Scheme's ZoI, include the Royal Canal, River Tolka catchment and the downstream Dublin Bay sub-populations. These sub-population labels have been assigned given the stark differences between these types of waterbodies, i.e. lentic freshwater vs. lotic freshwater vs. tidal estuarine / coastal. Each aquatic environment requires specialised hunting techniques in order to obtain optimal foraging and maximise species fecundity within each aquatic environment type. For an Otter to establish itself within a different aquatic environment to which it was reared, it would have to notably adjust its hunting techniques, and during this period it would be subject to sub-optimal prey intake, reducing growth / body mass. This would be particularly impactful for males (the most likely sex to travel further to establish a territory) competing for territory with other established males originally from the aquatic environment in question. Therefore, in theory, mixing between such sub-populations would be quite limited.

The local Otter sub-populations that inhabits these waterways are considered to be of International ecological importance given the level of protection afforded to them under Annexes II and IV of the EU Habitats Directive, as well as their association with Royal Canal pNHA.

Figure 9-13: Otter holt along the southern bank of the Royal Canal

Bats

Ireland's bat species, and their breeding, hibernation and resting roosts, are protected under the Wildlife Act 1976 (and subsequent amendments). Additionally, all of these bat species are listed on Annex IV of the EU Habitats Directive; with Lesser Horseshoe Bat *Rhinolophus hipposideros* populations also afforded protection under Annex II. Moreover, these bat species are also afforded legal protections under the European Communities (Birds and Natural Habitats) Regulations, 2011-2021.

Bat roost, habitat suitability and activity surveys were conducted for purposes of best informing the potential impacts to local bat species as a result of the construction and operations of the proposed Scheme.

Bat Roosts Survey

Luas Team ecologists surveyed the mature trees and structures within and adjacent to the proposed Scheme and recorded no potential roost features (PRFs) higher than Negligible status, i.e. any PRFs present had one or more flaws, e.g. not water-tight or lacking in insulative properties.

Local Bat Roost Data & Core Sustenance Zones (CSZs)

The UK-based Bat Conservation Trust (BCT) has published guidance in relation to the identification of Core Sustenance Zones (CSZs) for different bat species (Table 9-11). The guidance states that CSZs refer to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. The 2023 guidance states that:

"With reference to development, the CSZ could be used to indicate:

- *The area surrounding a communal roost within which development work may impact the flight-paths and foraging habitat of bats using that roost.*
- *The area within which it may be necessary to ensure no net reduction in the quality of foraging habitat for the colony."*

Table 9-11: CSZs for Irish bat species located within the ZoI

Bat Species	CSZ Radius (km)	No. Bats Studied	No. Studies	Confidence in Zone Size*
Common Pipistrelle	2	23	1	Poor (limited studies undertaken)
Soprano Pipistrelle	3	91	3	Good
Leisler's Bat	3	20	2	Moderate
Daubenton's Bat	2	7	2	Poor (limited studies undertaken)
Brown Long-eared Bat	3	38	1	Poor (limited studies undertaken)
Whiskered / Brandt's Bat	1	24	1	Poor (limited studies undertaken)
*Confidence in Zone Size is based on the number of bats and number of studies used to inform the calculation of their respective CSZs. All CSZ confidences are considered to be adequately robust, hence their inclusion within best practice guidance documentation.				

Table 9-12 below lists the number and location of bat species roosts within the locality of the proposed Scheme, along with their respective CSZs and the habitat types (present within the proposed Scheme's site boundary), contained within them. These habitats have been given foraging suitability statuses and measured to calculate what percentage of the individual CSZs they represent.

Table 9-12: Extent of habitat within the local bats' roosts (BCI data) respective CSZs, within the boundaries of the proposed Scheme

Bat Species (Roost No.)	Location	Area of CSZ within proposed Scheme boundary	Habitat Type(s) & Foraging Suitability
Leisler's Bat (1 roost)	Finglas West, Dublin (Private Dwelling)	0.28923km^2 (1.02% of CSZ)	All habitat types listed in section 9.3.2.1 are present within this CDZ, with suitability ranging from negligible to high.
Soprano Pipistrelle (1 roost)	Phoenix Park, Dublin 8	0.164854km^2 (0.58% of CSZ)	All habitat types listed in section 9.3.2.1 are present within this CDZ, with suitability ranging from negligible to high.

Bat Species (Roost No.)	Location	Area of CSZ within proposed Scheme boundary	Habitat Type(s) & Foraging Suitability
Leisler's Bat (1 roost)	Ratra House, Phoenix Park, Dublin 8	0.164854km^2 (0.58% of CSZ)	All habitat types listed in section 9.3.2.1 are present within this CDZ, with suitability ranging from negligible to high.
Brown Long-eared Bat (1 roost)	Áras an Uachtarain Phoenix Park, Dublin 8	0.132170km^2 (0.46% of CSZ)	All habitat types listed in section 9.3.2.1 are present within this CDZ, with suitability ranging from negligible to high.
Leisler's Bat (1 roost)	Phoenix Park, Dublin 8	0.066116km^2 (0.23% of CDZ)	All habitat types listed in section 9.3.2.1 are present within this CDZ, with suitability ranging from negligible to high.
Brown Long-eared Bat (1 roost)	Phoenix Park, Dublin 8	0.027077km^2 (0.09 % of CDZ)	All aquatic and associated wetland habitats; artificial surfaces (including buildings); parkland; mixed woodland, amenity grassland; dry meadow; and scrub, with suitability ranging from negligible to high.

In summary, it is clear from the above table that habitats within the boundaries of the proposed Scheme form a relatively insignificant percentage of these bat species' CSZs. However, one must bear in mind the impact elements of continuous on-going urbanisation within the north Dublin area, therefore, the above data will be considered within the impact assessment section.

Transect Bat Activity Surveys

Luas Team ecologists conducted a total of three transect activity surveys during the 2023 bat activity season. The transect surveys and their routes covered three large sections (Tolka Valley Park, St Helena's and Farnham green areas) within and adjacent to the boundaries of the proposed scheme. The Royal Canal section of the site was excluded from the transect survey given its linear character, which only provides a limited east-west bat flight path, with minute variations within the canal area. This east-west flight path limitation is further compounded by the lit urban areas north and south of the canal, which result in the local bats actively avoiding these areas and favouring the east-west flight path along the canal.

Surveyors recorded three species, namely Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat, across the Tolka Valley Park, St Helena's and Farnham green areas (Volume 4 – Map Figure 9-9). The frequency of each species occurrence across the transect surveys is summarised in Table 9-13 below.

Table 9-13: Bat transect survey data summary (2023)

Transect Route 1 – Tolka Valley Park	Dates		
Bat Species (Total passes)	**15th June 2023**	**13th July 2023**	**24th August 2023**
Common Pipistrelle	1	1	5
Soprano Pipistrelle	2	13	10
Leisler's Bat	3	4	3
Transect Route 2 – St Helena's (grassland)			
Bat Species (Total passes)	**15th June 2023**	**13th July 2023**	**24th August 2023**
Common Pipistrelle	2	0	0
Soprano Pipistrelle	0	0	1
Leisler's Bat	2	0	0

Transect Route 2 – Farnham (amenity area)			
Bat Species (Total passes)	**15th June 2023**	**13th July 2023**	**24th August 2023**
Common Pipistrelle	0	3	0
Soprano Pipistrelle	0	4	0
Leisler's Bat	1	13	0

Static Bat Activity Surveys

The static bat activity surveys recorded more species than the transect surveys. In summary, a total of eight bat species were recorded utilising the habitats within the proposed Scheme's boundaries, namely Common Pipistrelle; Soprano Pipistrelle; Nathusius' Pipistrelle; Leisler's Bat; Brown Long-eared Bat; Daubenton's Bat; and Whiskered and Brandt's Bat.

The detailed results of the 2021, 2022 and 2023 static bat activity surveys are presented in Table 9-14, Table 9-15 and Table 9-16, respectively.

Table 9-14: Calls of bat species at select locations within the proposed Scheme (2021)

Location		**Royal Canal**			
Bat Species (Total passes)	**Date**	**30th May - 3rd Jun 2021**	**20th - 27th Jul 2021**	**16th - 22nd Aug 2021**	**21st - 28th Sep 2021**
Common Pipistrelle		303	1,143	46	86
Soprano Pipistrelle		47	26	117	0
Leisler's Bat		169	75	120	3
Location		**Tolka Valley Park (River Tolka)**			
Bat Species (Total passes)	**Date**	**26th - 31st May 2021**	**15th - 20th Jul 2021**	**11th - 16th Aug 2021**	**21st - 28th Sep 2021**
Common Pipistrelle		340	12	69	252
Soprano Pipistrelle		2,275	243	1,274	754
Leisler's Bat		25	7	6	2
Daubenton's Bat		56	1	0	78
Nathusius' Pipistrelle		0	0	0	4
Location		**Mellowes Park (South)**			
Bat Species (Total passes)	**Date**	**15th - 21st Jun 2021**	**5th – 9th Jul 2021**	**11th – 16th Aug 2021**	**21st – 28th Sep 2021**
Common Pipistrelle		140	240	349	0
Soprano Pipistrelle		9	30	31	0
Leisler's Bat		4	64	48	0
Myotis spp.		0	8	1	0

Table 9-15: Calls of bat species at select locations within the proposed Scheme (2022)

Location		**Royal Canal**		
Bat Species (Total passes)	**Date**	**30th May - 7th Jun 2022**	**20th - 27th Jul 2022**	**21st - 25th Sep 2022**
Common Pipistrelle		481	82	32
Soprano Pipistrelle		343	566	12
Leisler's Bat		186	9	13
Location		**Tolka Valley Park (River Tolka)**		
Bat Species (Total passes)	**Date**	**26th May - 7th Jun 2022**	**22nd - 26th Jul 2022**	**21st - 28th Sep 2022**
Common Pipistrelle		1,056	196	Equipment malfunction
Soprano Pipistrelle		1,825	4,279	
Leisler's Bat		265	84	
Daubenton's Bat		80	129	
Brown Long-eared Bat		3	9	
Whiskered and/or Brandt's Bat		21	51	
Location		**Mellowes Park (South)**		
Bat Species (Total passes)	**Date**	**8th - 14stJun 2022**	**27th Jul - 4th Aug 2022**	**7th - 13th Sep 2022**
Common Pipistrelle		0	82	58
Soprano Pipistrelle		0	21	13
Leisler's Bat		2	7	66
Nathusius' Pipistrelle		0	0	1
Location		**Mellowes Park (North)**		
Bat Species (Total passes)	**Date**	**8th - 14th Jun 2022**	**5th - 11th Aug 2022**	**7th - 13th Sep 2022**
Common Pipistrelle		169	11	8
Soprano Pipistrelle		0	10	2
Leisler's Bat		0	0	29

Table 9-16: Calls of bat species at select locations within the proposed Scheme (2023)

Location		Royal Canal			
Bat Species (Total passes)	**Date**	**19th - 23rd May 2023**	**14th - 19th Jun 2023**	**4th - 10th Jul 2023**	**23rd - 27th Aug 2023**
Common Pipistrelle		Equipment interference	415	21	30
Soprano Pipistrelle			649	25	121
Leisler's Bat			53	1	11
Nathusius' Pipistrelle			0	0	1
Location		**Tolka Valley Park (River Tolka)**			
Bat Species (Total passes)	**Date**	**19th - 23rd May 2023**	**14th - 19th Jun 2023**	**12th - 18th Jul 2023**	**23rd - 27th Aug 2023**
Common Pipistrelle		176	133	519	107
Soprano Pipistrelle		1106	549	5,019	648
Leisler's Bat		77	3	45	4
Daubenton's Bat		61	61	186	161
Brown Long-eared Bat		7	0	0	0
Whiskered and/or Brandt's Bat		157	79	3,312	439
Location		**Mellowes Park (South)**			
Bat Species (Total passes)	**Date**	**19th - 23rd May 2023**	**14th - 19th Jun 2023**	**12th - 18th Jul 2023**	**23rd - 27th Aug 2023**
Common Pipistrelle		408	104	156	21
Soprano Pipistrelle		12	1	11	17
Leisler's Bat		5	51	99	85
Location		**Mellowes Park (North)**			
Bat Species (Total passes)	**Date**	**19th - 23rd May 2023**	**14th - 19th Jun 2023**	**12th - 18th Jul 2023**	**23rd - 27th Aug 2023**
Common Pipistrelle		50	7	60	0
Soprano Pipistrelle		2	0	1	0
Leisler's Bat		5	10	0	0
Location		**Farnham Amenity Area (Playing pitches)**			
Bat Species (Total passes)	**Date**	**19th - 23rd May 2023**	**14th - 19th Jun 2023**	**12th - 18th Jul 2023**	**23rd - 27th Aug 2023**
Common Pipistrelle		55	27	31	235
Soprano Pipistrelle		14	8	20	47
Leisler's Bat		56	4	39	13

2021 Static Bat Activity Survey Results

During 2021, three locations were surveyed for bat activity using static recording devices: Royal Canal, Tolka Valley Park (River Tolka) and Mellowes Park (South).

At the Royal Canal site, three species of bat were recorded: Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat during the weeks of the 30th of May - 3rd June; 20th - 27th July; 16th - 22nd August; and the 21st - 28th September 2021. The lowest amount of Common Pipistrelle calls recorded at this site was 46 from the

16th - 22nd August, with the highest being 1,143 from the 20th - 27th July. Soprano Pipistrelle was least recorded from 21st - 28th September with no records, the highest number of records was from 16th - 22nd August. Leisler's Bat was also recorded the least from 21st - 28th September with three records and recorded the most between 30th May to 3rd June with 169 records.

The Tolka Valley Park (River Tolka) site was surveyed: 26th - 31st May; 15th - 20th July; 11th - 16th August; and 21st - 28th September 2021. Five species of bat were recorded at the site: Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat, Daubenton's Bat and Nathusius' Pipistrelle. Common Pipistrelle was least recorded from 15th-20th July with 12 records and most recorded from 26th - 31st May with 340 records. Soprano Pipistrelle was least recorded from 15th - 20th July with 243 records and most recorded from 26th - 31st May with 2,275 records. Leisler's Bat was least recorded from 21st - 28th September with 2 records and most recorded from 26th - 31st May with 25 records. Daubenton's Bat was least recorded from 11th - 16th August with no records and most recorded from 21st - 28th September with 78 records. Nathusius' Pipistrelle was only recorded between the 21st - 28th September with 4 records.

The Mellowes Park (South) site was surveyed: 15th - 21st June; 5th - 9th July; 11th - 16th August; and 21st - 28th September. Four species of bat were recorded at the site: Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat and a *Myotis* spp. Common Pipistrelle was most recorded from 11th -16th August with 349 records. The Soprano Pipistrelle was most recorded from 11th - 16th August with 31 records. The Leisler's Bat was most recorded from 5th - 9th July with 64 records. The *Myotis* spp. had no calls recorded from the 15th - 21st of June as well as the 21st - 28th September and was most recorded from 5th - 9th July with 8 records. The static detector did not record any calls from any of the four bat species between the 21st - 28th September.

2022 Static Bat Activity Survey Results

During the 2022 surveys, four locations were surveyed for bat activity: Royal Canal, Tolka Valley Park (River Tolka), Mellowes Park (South) and Mellowes Park (North).

At the Royal Canal site, three species of bat were recorded: Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat on the dates of 30th May - 7th June; 20th - 27th July; and 21st - 25th September. The Common Pipistrelle was least recorded from 21st - 25th of September with 32 records and was most recorded from 30th May - 7th June with 481 records. The Soprano Pipistrelle was least recorded from 21st - 25th September with 12 records and most recorded from 20th - 27th July with 566 records. Leisler's Bat was least recorded from 20th - 27th July with 9 records and most recorded from 30th May - 7th June with 186 records.

The Tolka Valley Park (River Tolka) site was surveyed on the dates of 26th May - 7th June and 22nd - 26th July; six (potentially seven) species of bat were recorded: Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat, Daubenton's Bat, Brown Long-eared Bat and Whiskered and/or Brandt's Bat. Common Pipistrelle was least recorded from 22nd - 26th July with 196 records and most recorded from 26th May - 7th June with 1,056 records. Soprano Pipistrelle was least recorded from 26th May - 7th June with 1,825 records and most recorded from 22nd - 26th July with 4,279 records. Leisler's Bat was least recorded from 22nd-26th July with 84 records and most recorded from 26th May - 7th June with 265 records. Daubenton's Bat was least recorded from 26th May - 7th June with 80 records and most recorded from 22nd - 26th July with 129 records. Brown Long-eared Bat was least recorded from 26th May - 7th June with three records and most recorded from 22nd - 26th July with 9 records. Whiskered and/or Brandt's Bat was least recorded from 26th May - 7th June with 21 records and most recorded from 22nd - 26th July with 51 records. The large increase in bat activity frequency during the week of 22nd - 26th July for Tolka Valley Park can be attributed to a patch of optimum foraging weather conditions following a period of sub-optimal (wind / rain) conditions weather leading to a notable increase in foraging from bat species in this area.

The Mellowes (South) site was recorded on the dates of 8th - 14th of June; 27th July - 4th August; and 7th - 13th September, four bat species were recorded on site: Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat and Nathusius' Pipistrelle. Nathusius' Pipistrelle was only recorded once in total, between the dates 7th - 13th September. Common and Soprano Pipistrelle were both not recorded from 8th - 14th June, both also had the most recorded 27th July - 4th August, Common Pipistrelle was recorded 82 times, Soprano Pipistrelle

was recorded 21 times. Leisler's Bat was least recorded from 8th - 14th June with two records and most recorded from 7th - 13th September with 66 records.

The Mellowes (North) site was recorded on the dates of 8th-14th June; 5th - 11th August; and 7th - 13th September, three bat species were recorded on site: Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat. Leisler's Bat was only recorded from 7th - 13th September and was recorded 29 times. Common Pipistrelle was least recorded from 7th - 13th September with eight records and most recorded from 8th-14th June with 169 records. Soprano Pipistrelle was not recorded from 8th - 14th June and was most recorded from 5th - 11th of August with 10 records.

2023 Static Bat Activity Survey Results

In 2023, five locations were surveyed for bat activity: Royal Canal, Tolka Valley Park (River Tolka), Mellowes Park (South), Mellowes Park (North) and Farnham Amenity Area (Playing pitches).

The Royal Canal site was surveyed on the dates 14th - 19th June; 4th - 10th July; and 23rd - 27th August, four species of bat were recorded: Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat and Nathusius' Pipistrelle. Common Pipistrelle was least recorded from 4th - 10th July with 21 records and most recorded from 14th - 19th June with 415 records. Soprano Pipistrelle was least recorded from 4th - 10th July with 25 records and most recorded from 14th - 19th June with 649 records. Leisler's Bat was least recorded from 4th - 10th July with one call recorded and most recorded from 14th - 19th June with 53 records. Nathusius' Pipistrelle was only recorded between 23rd - 27th with one recorded pass.

The Tolka Valley Park (River Tolka) site was surveyed on the dates 19th - 23rd May; 14th - 19th June; 12th - 18th July; and 23rd - 27th August, six (potentially seven) species were recorded: Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat, Daubenton's Bat, Brown Long-eared Bat and Whiskered and/or Brandt's Bat. Common Pipistrelle was least recorded from 23rd - 27th August with 107 records and most recorded from 12th - 18th July with 519 records. Soprano Pipistrelle was least recorded from 14th - 19th June with 549 records and most recorded from 12th - 18th July with 5,019 records. Leisler's Bat was least recorded from 14th - 19th June with three records and most recorded from 19th - 23rd May with 77 records. Daubenton's Bat was least recorded from 19th - 23rd May and 14th - 19th June with 61 records each and most recorded from 12th - 18th July with 186 records. Brown Long-eared Bat was only recorded from 19th - 23rd May with seven records. Whiskered and/or Brandt's Bat was least recorded from 14th - 19th June with 79 records and most recorded from 12th - 18th July with 3,312 records. The large increase in bat activity frequency during the week of 12th - 18th July for Tolka Valley Park can be attributed to a patch of optimum foraging weather conditions following a period of sub-optimal (wind / rain) conditions weather leading to a notable increase in foraging from bat species in this area.

Mellowes Park (South) was surveyed on the dates of 19th - 23rd May; 14th - 19th June; 12th - 18th July; and 23rd - 27th August, three species were recorded: Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat. None of the three species of bat were recorded from 23rd - 27th August. Common Pipistrelle was recorded in every other survey set and was most recorded from 12th - 18th July with 60 records. Soprano Pipistrelle was only recorded from 19th - 23rd May and 12th - 18th July with most records from 19th - 23rd May with two records. Leisler's bat was only recorded from 19th - 23rd May and 14th - 19th June with most records from 14th - 19th June with 10 records.

Farnham Amenity Area (Playing pitches) was surveyed on the dates 19th - 23rd May; 14th - 19th June; 12th - 18th July; and 23rd - 27th August, three species of bat was recorded: Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat. Common Pipistrelle was least recorded from 14th - 19th June with 27 records and most recorded from 23rd - 27th August with 235 records. Soprano Pipistrelle was least recorded from 14th - 19th June with eight records and most recorded from 23rd - 27th August with 47 records. Leisler's Bat was least recorded from 14th - 19th June with four records and most recorded from 19th - 23rd May with 56 records.

It should be noted that there were two instances where the static bat recording devices were unable to record data due to a software malfunction (Tolka Valley Park) and human interference (Royal Canal). While these two events have resulted in small data gaps within the Tolka Valley Park and Royal Canal, the Luas Team ecologists are confident that data collected across three summer activity periods is more than

adequate to assess the potential impacts on local bat species that may arise as result of proposed Scheme's construction and operation.

The local Bat populations are of County level ecological importance given the increased urban pressures faced by this mammal group, including the continuous fragmentation of the bat friendly corridors within the Dublin City limits; as well as the protections afforded to them under Annex IV of the EU Habitats Directive.

Other Terrestrial Mammals

While no direct sightings or signs of habitation were observed of Badger, Irish Hare, Irish Stoat, Hedgehog, and Pygmy Shrew were recorded within the Scheme's ZoI, recent NBDC (2024) records place these mammals species within the locality of the proposed Scheme, i.e. within 2km of the proposed Scheme's boundaries but not within the ZoI (hydrological, air and disturbance buffers). Therefore, under the precautionary principle these mammal species must be considered within the impact assessment of the proposed Scheme to ensure the well-being of their respective local populations, which may venture beyond their currently established home ranges.

Within the context of the proposed Scheme, the populations of these other mammals species are of Higher Local ecological importance given their limited distribution within the Dublin City limits, as well as the protections afforded to them under the Wildlife Act 1976 (and subsequent amendments).

Marine Mammals

Recent desktop data revealed that six marine mammal Annex species regularly frequent (barring the whale species) the Tolka Estuary and/or Dublin Bay, namely Grey Seal (Annexes II & V); Harbour Seal (Annexes II & V); Harbour Porpoise (Annexes II & IV); Common Dolphin (Annex IV); Bottle-nosed Dolphin (Annex II); and Fin Whale (Annex IV) (NBDC, 2024). Additionally, whilst tracking Light-bellied Brent Goose flocks out of the Tolka Estuary during wintering bird surveys (December 2021), Luas Team ecologists observed Harbour Seals present near the mouth of the River Tolka at Fairview.

Dublin Bay's marine mammal populations, which occur occasionally within the outer limits of the proposed Scheme's ZoI, are of County level ecological importance given their respective frequency of occurrence within the ZoI and protections afforded to them under the Wildlife Act 1976 (and subsequent amendments) and the Annexes of EU Habitats Directive.

Breeding Birds

The summary results of the breeding bird surveys, six in total, conducted between May and June 2021, and between May and July 2024, are presented below, along with subsequent incidental recordings during follow-up site visits, which took place during the breeding bird season.

Luas Team ecologists recorded a total of 45 bird species within and/or adjacent to the proposed Scheme's boundaries. This group of 45 birds includes seven species listed as KER for designated sites; four Birds Directive Annex species; two Red-listed; 16 Amber-listed (includes the KER species from designated sites); and 27 Green-listed bird species. Regarding nests present within the site of the proposed Scheme, five active nests were noted during the 2024 surveys, four of which were occupied by Wood Pigeon and the fifth by Magpie. The Wood Pigeon nests were located in an Elder within the hedgerow along the northern bank of the Royal Canal; a Sycamore in the centre of the Farnham playing pitch area; a Small-leaved Lime along Patrickswell Place; and a Small-leaved Lime along Mellowes Road; while the Magpie nest was located in a Sycamore along Patrickswell Place. The full list of bird species recorded is provided in Volume 5 - Appendix A9.2 and Appendix A9.3.

Table 9-17 provides a summary of the findings of the breeding bird surveys conducted within the proposed Scheme's boundaries, with respect to those species which are of conservation concern and are considered to be KERs.

Table 9-17: Breeding bird species of conservation concern recorded during initial breeding bird surveys; and subsequent incidental recordings

Bird Species	Annex species (EU Birds Directive)	KER of Designated Site	BoCCI – Breeding (B) & Breeding / Wintering (B/W)
Black-headed Gull	-	✓	Amber (B/W)
Cormorant	-	✓	Amber (B/W)
Greenfinch	-	-	Amber (B)
Grey Wagtail	-	-	Red (B)
Goldcrest	-	-	Amber (B)
Herring Gull	-	✓	Amber (B/W)
House Martin	-	-	Amber (B)
House Sparrow	-	-	Amber (B)
Kingfisher	✓ (Annex I)	✓	Amber (B)
Lesser Black-backed Gull	-	✓	Amber (B/W)
Mallard	✓ (Annex II & III)	✓	Amber (B/W)
Mute Swan	-	-	Amber (B/W)
Spotted Flycatcher	-	-	Amber (B)
Starling	-	-	Amber (B)
Tufted Duck	✓ (Annex II & III)	-	Amber (B/W)
Wood Pigeon	✓ (Annex II & III)	-	Green
Meadow Pipit	-	✓	Amber (B)
Linnet	-	-	Amber (B)
Willow Warbler	-	-	Amber (B)

Below Table 9-18 provides a summary of the desktop data for breeding bird species of conservation concern within the Scheme's ZoI, with respect to those species which are of conservation concern and are considered to be KERs. This group of 34 birds included 22 Birds Directive Annex species; 11 Red-listed; 22 Amber-listed (includes the KER species from designated sites); and one Green-listed bird species. The breeding bird species data from the desktop review is also displayed in Volume 5 - Appendix A9.5.

Table 9-18: Desktop recordings of additional KER breeding bird species of conservation concern present within the ZoI

Bird Species	Annex Species (EU Birds Directive)	BoCCI – Breeding (B) & Breeding / Wintering (B/W)
Ringed Plover	-	Amber (B/W)
Common Shelduck	-	Amber (B/W)
Skylark	✓ (Annex II)	Amber (B)
Wigeon	✓ (Annex II & III)	Amber (B/W)
Goldeneye	✓ (Annex II)	Red (B/W)
Red-breasted Merganser	✓ (Annex II)	Amber (B/W)

Bird Species	Annex Species (EU Birds Directive)	BoCCI – Breeding (B) & Breeding / Wintering (B/W)
Great-crested Grebe	-	Amber (B/W)
Common Shelduck	-	Amber (B/W)
Teal	✓ (Annex II & III)	Amber (B/W)
Northern Pintail	✓ (Annex II & III)	Amber (B/W)
Northern Shoveler	✓ (Annex II & III)	Red (B/W)
Oystercatcher	✓ (Annex II)	Red (B/W)
Golden Plover	✓ (Annex I, II & III)	Red (B/W)
Dunlin	-	Red (B/W)
Common Sandpiper	✓ (Annex II)	Amber (B)
Common Redshank	✓ (Annex II)	Red (B/W)
Short-eared Owl	✓ (Annex I)	Amber (B)
Yellow Wagtail	-	Amber (B)
Little Tern	✓ (Annex I)	Amber (B)
Roseate Tern	✓ (Annex I)	Amber (B)
Common Tern	✓ (Annex I)	Amber (B)
Arctic Tern	✓ (Annex I)	Amber (B)
Sandwich Tern	✓ (Annex I)	Amber (B)
Common Scoter	✓ (Annex II & III)	Red (B/W)
Red-throated Diver	✓ (Annex I)	Red (B/W)
Fulmar	-	Amber (B)
Manx Shearwater	-	Amber (B)
Shag	-	Amber (B)
Kittiwake	-	Red (B)
Great Black-backed Gull	✓ (Annex II)	Green
Puffin	-	Red (B)
Razorbill	-	Red (B)
Common Guillemot	-	Amber (B)
Mediterranean Gull	✓ (Annex I)	Amber (B)
Little Egret	✓ (Annex I)	Green

In summary, between the breeding bird species identified during the site surveys and those noted within the desktop data records, there is a total of 53 KER breeding bird species of conservation concern within the Scheme's ZoI.

Kingfisher is considered to be of Regional ecological importance given that their population is assessed at river catchment scale, its status as an Annex I species, and its regular presence along the River Tolka. The remaining local populations of KER bird species and birds of conservation concern are of County level

ecological importance; while the other green-listed bird species are of Higher Local ecological importance. It is important to note that in the context of the proposed site, the ecological importance of Black-headed Gull is lower in the breeding season as the site and adjacent lands are not directly related to known Black-headed Gull breeding sites; however, ecological importance is elevated during the wintering months as notably larger flocks are present within the boundaries of the proposed Scheme (see following section).

Wintering Birds

Desktop data and initial site visits revealed that seven SCI bird species, namely Light-bellied Brent Goose, Black-headed Gull, Curlew, Lapwing, Herring Gull, Lesser Black-backed Gull, Common Gull and Cormorant, frequented the Tolka Valley Park pond and/or the maintained amenity grassland areas within and adjacent to the boundaries of the proposed Scheme.

The results of the wintering bird surveys, 24 in total, conducted between December and February 2021-2022, 2022-2023, and 2023-2024 are presented in the summary below.

Luas Team ecologists recorded eight bird species of conservation concern within and/or adjacent to the proposed Scheme's boundaries; with the addition of the desktop data recording of the Lapwing within the Erin's Isle GAA pitches, this brings the overall total to 13 birds of conservation concern within and/or adjacent to the Scheme's boundaries. This group included five Annex species; eight species listed as KERs for designated sites; three Red-listed and 10 Amber-listed species (includes the KER species from designated sites) (see Table 9-19). The full list of bird species recorded is provided in Volume 5 - Appendix A9.4.

Table 9-19: Desktop and survey recordings of wintering bird species of conservation concern within and/or adjacent to the site boundary

Bird Species	Annex Species (EU Birds Directive)	KER of Designated Site	BoCCI – Wintering (W) & Breeding / Wintering (B/W)
Black-headed Gull	-	✓	Amber (B/W)
Barnacle Goose	✓ (Annex I)	-	Amber (W)
Common Gull	-	✓	Amber (B/W)
Cormorant	-	✓	Amber (B/W)
Curlew	✓ (Annex II)	✓	Red (W)
Herring Gull	-	✓	Amber (B/W)
Lapwing	✓ (Annex II)	-	Red (B/W)
Light-bellied Brent Goose	-	✓	Amber (W)
Mallard	✓ (Annex II & III)	✓	Amber (B/W)
Mute Swan	-	-	Amber (B/W)
Redwing *Turdus iliacus*	-	-	Red (W)
Tufted Duck	✓ (Annex II & III)	-	Amber (B/W)
Lesser Black-backed Gull	-	✓	Amber (B/W)

Table 9-20 below provides a summary of the desktop data for wintering bird species of conservation concern within the Scheme's ZoI, with respect to those species which are of conservation concern and are considered to be KERs. This group of 23 birds included 17 Birds Directive Annex species; 12 Red-listed; 10 Amber-listed (includes the KER species from designated sites); and one Green-listed bird species. The wintering bird species data from the desktop review is also displayed in Volume 5 - Appendix A9.5.

Table 9-20: Desktop and survey recordings of additional KER wintering bird species of conservation concern present within the ZoI

Bird Species	Annex Species (EU Birds Directive)	BoCCI – Wintering (W) & Breeding / Wintering (B/W)
Ringed Plover	-	Amber (B/W)
Wigeon	✓ (Annex II & III)	Amber (B/W)
Goldeneye	✓ (Annex II)	Red (B/W)
Red-breasted Merganser	✓ (Annex II)	Amber (B/W)
Great-crested Grebe	-	Amber (B/W)
Ruddy Turnstone	-	Amber (W)
Common Shelduck	-	Amber (B/W)
Teal	✓ (Annex II & III)	Amber (B/W)
Northern Pintail	✓ (Annex II & III)	Amber (B/W)
Northern Shoveler	✓ (Annex II & III)	Red (B/W)
Oystercatcher	✓ (Annex II)	Red (B/W)
Golden Plover	✓ (Annex I, II & III)	Red (B/W)
Grey Plover	✓ (Annex II)	Red (W)
Red Knot	✓ (Annex II)	Red (W)
Sanderling	-	Green
Dunlin	-	Red (B/W)
Black-tailed Godwit	✓ (Annex II)	Red (W)
Bar-tailed Godwit	✓ (Annex I & II)	Red (W)
Common Redshank	✓ (Annex II)	Red (B/W)
Common Scoter	✓ (Annex II & III)	Red (B/W)
Red-throated Diver	✓ (Annex I)	Red (B/W)
Great Northern Diver	✓ (Annex I)	Amber (W)
Little Gull	✓ (Annex I)	Amber (W)*
* Noted as an Amber-listed Passage species but is also present during the winter months		

In summary, between the wintering bird species identified during the site surveys and those noted within the desktop data records, there is a total of 36 KER wintering bird species of conservation concern within the Scheme's ZoI.

Furthermore, as a part of the desktop study, liaison with PhD researcher Dr T Handby (University of Exeter), who had monitored the Light-bellied Brent Goose flocks of the wider area of Dublin city across two winter seasons (2018/19 and 2019/20), took place. The data produced from the study (Handby, 2022) highlighted the occurrence of a Light-bellied Brent Goose population associated with the green amenity areas within and adjacent to the proposed Scheme (Volume 4 – Map Figure 9-10). This sub-population of the Light-bellied Brent Goose within the North Bull Island SPA is referred to as the southern population or south-end population in her thesis. This data allowed the Luas Team to refine their wintering bird survey efforts to green areas relevant to the proposed Scheme.

Subsequently, wintering bird surveys (8 per season) were conducted during the optimum survey months (December, January and February) for the 2021-2022 and 2022-2023 winter periods. The focused areas for these surveys are displayed in Volume 4 – Map Figure 9-11. The resulting data for the SCI bird species, which were present in notable flock sizes, are displayed below in Table 9-21, Table 9-22, Table 9-24, and Table 9-25.

Table 9-21: Flock size and location data for Light-bellied Brent Geese during winter 2021-2022

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
01/12/2021	09:20	86	5.55% / 0.24%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
15/12/2021	09:01	107	6.91% / 0.30%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
05/01/2022	09:10	~600	38.75% / 1.71%	Erin's Isle GAA Pitches (East Farnham area)
	15:30	~1,000	64.59% / 2.85%	Erin's Isle GAA Pitches (East Farnham area)
18/01/2022	09:09	~300	19.37% / 0.85%	Erin's Isle GAA Pitches (East Farnham area)
	15:36	~300	19.37% / 0.85%	Erin's Isle GAA Pitches (East Farnham area)
27/01/2022	10:08	~325	20.99% / 0.92%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
02/02/2022	09:06	~700	45.21% / 2.00%	Erin's Isle GAA Pitches (East Farnham area)
	10:01	+80 (~780)	50.38% / 2.22%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
10/02/2022	09:43	41	2.64% / 0.11%	Western pitch / grassland (West Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
25/02/2022	09:23	171	11.04% / 0.48%	Western pitch / grassland (West Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			

Table 9-22: Flock size and location data for Light-bellied Brent Geese during winter 2022-2023

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
07/12/2022	08:48	163	10.52% / 0.46%	Erin's Isle GAA Pitches (East Farnham area)

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
	Light-bellied Brent Goose flocks absent during afternoon survey period			
16/12/2022	08:54	~340	21.96% / 0.97%	Erin's Isle GAA Pitches (East Farnham area)
	14:32	~280	18.08% / 0.80%	Erin's Isle GAA Pitches (East Farnham area)
	14:40	186	12.01% / 0.53%	Western pitch / grassland (West Farnham area)
05/01/2023	09:01	118	7.62% / 0.33%	Erin's Isle GAA Pitches (East Farnham area)
	09:04	92	5.94% / 0.26%	Western pitch / grassland (West Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
13/01/2023	08:49	124	8.01% / 0.35%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
25/01/2023	09:34	75	4.84% / 0.21%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
02/02/2023	09:28	~355	22.93% / 1.01%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
17/02/2023	08:56	155	10.01% / 0.44%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
28/02/2023	09:00	86	5.55% / 0.24%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			

Table 9-23: Flock size and location data for Light-bellied Brent Geese during winter 2023-2024

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
15/12/2023	09:19	~207	13.37% / 0.59%	Erin's Isle GAA Pitches (East Farnham area)
	10:35	~345	22.28% / 0.98%	Erin's Isle GAA Pitches (East Farnham area)
	14:47	121	7.81% / 0.34%	Erin's Isle GAA Pitches (East Farnham area)
04/01/2024	09:24	5	0.32% / 0.01%	Erin's Isle GAA Pitches (East Farnham area)

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
	09:35	37	2.39% / 0.10%	Erin's Isle GAA Pitches (East Farnham area)
	09:38	49	3.16% / 0.14%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			
12/01/2024	09:27	71	4.58% / 0.20%	Erin's Isle GAA Pitches (East Farnham area)
	15:10	147	9.49% / 0.42%	Erin's Isle GAA Pitches (East Farnham area)
19/01/2024	09:13	35	2.26% / 0.10%	Erin's Isle GAA Pitches (East Farnham area)
	09:19	28	1.80% / 0.08%	Western pitch / grassland (West Farnham area)
	09:33	155	10.01% / 0.44%	Erin's Isle GAA Pitches (East Farnham area)
	10:40	~255	16.47% / 0.72%	Erin's Isle GAA Pitches (East Farnham area)
	10:55	~255	16.47% / 0.72%	Western pitch / grassland (West Farnham area) *[*Flock at Erin's Isle GAA Pitches moved to this location after disturbance]*
	Light-bellied Brent Goose flocks absent during afternoon survey period			
02/02/2024	09:04	24	1.55% / 0.06%	Erin's Isle GAA Pitches (East Farnham area)
	10:34	42	2.71% / 0.12%	Erin's Isle GAA Pitches (East Farnham area)
	14:51	48	3.10% / 0.13%	Western pitch / grassland (West Farnham area)
09/02/2024	08:57	107	6.91% / 0.30%	Erin's Isle GAA Pitches (East Farnham area)
	14:36	12	0.77% / 0.03%	Eastern pitch / grassland (West Farnham area)
23/02/2024	08:45	~250	16.14% / 0.71%	Erin's Isle GAA Pitches (East Farnham area)
	09:00	~300	19.37% / 0.85%	Erin's Isle GAA Pitches (East Farnham area)
	09:05	~392	25.32% / 1.12%	Erin's Isle GAA Pitches (East Farnham area)
	10:32	~446	28.81% / 1.27%	Eastern pitch / grassland (West Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
27/02/2024	09:01	~238	15.37% / 0.68%	Western pitch / grassland (West Farnham area)
	10:38	~275	17.76% / 0.78%	Erin's Isle GAA Pitches (East Farnham area)
	Light-bellied Brent Goose flocks absent during afternoon survey period			

Table 9-24: Flock size and location data for Black-headed Gull during winter 2021-2022

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
01/12/2021	09:00	14	0.63% / 0.08%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
	09:22	11	0.50% / 0.07%	Western pitch / grassland (West Farnham area)
	15:31	56	2.55% / 0.35%	Erin's Isle GAA Pitches (East Farnham area)
15/12/2021	08:50	15	0.68% / 0.09%	Eastern pitches- Tolka Valley Park (within 300m disturbance buffer)
	08:52	10	0.45% / 0.06%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
	08:54	4	0.18% / 0.02%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
	15:25	14	0.63% / 0.08%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
05/01/2022	08:51	20	0.91% / 0.12%	Eastern pitches- Tolka Valley Park (within 300m disturbance buffer)
	09:07	43	1.95% / 0.27%	Erin's Isle GAA Pitches (East Farnham area)
	09:11	10	0.45% / 0.06%	Western pitch / grassland (West Farnham area)
	09:14	10	0.45% / 0.06%	Patrickswell Place / Wellmount Parade green area
	09:22	4	0.18% / 0.02%	Northern section of Mellowes Park
	Black-headed Gull flocks absent during afternoon survey period			
18/01/2022	*Black-headed Gull flocks absent during morning survey period*			
	15:26	29	1.32% / 0.18%	Tolka Valley Park Pond
27/01/2022	09:39	9	0.40% / 0.05%	Eastern Tolka Valley Park grasslands (beyond 300m disturbance buffer)
	09:51	41	1.86% / 0.26%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
	09:54	10	0.45% / 0.06%	Western Tolka Valley Park grasslands

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
				(within 300m disturbance buffer)
	09:55	22	1.00% / 0.14%	Western Tolka Valley Park grasslands (beyond 300m disturbance buffer)
	09:56	9	0.40% / 0.05%	Tolka Valley Park Pond
	10:09	7	0.31% / 0.04%	Western pitch / grassland (West Farnham area)
	10:10	4	0.18% / 0.02%	Amenity grassland adjacent to Casement Road
	14:41	16	0.72% / 0.10%	Eastern pitches- Tolka Valley Park (within 300m disturbance buffer)
	14:47	11	0.50% / 0.07%	Tolka Valley Pitch and Putt
	14:56	24	1.09% / 0.15%	Tolka Valley Park Pond
02/02/2022	09:13	37	1.68% / 0.23%	Erin's Isle GAA Pitches (East Farnham area)
	09:14	11	0.50% / 0.07%	Western pitch / grassland (West Farnham area)
	09:28	131	5.96% / 0.83%	Eastern pitches - Tolka Valley Park
	09:40	32	1.45% / 0.20%	Western Tolka Valley Park grasslands (beyond 300m disturbance buffer)
	14:50	19	0.86% / 0.12%	Eastern pitches- Tolka Valley Park (within 300m disturbance buffer)
	15:04	31	1.41% / 0.19%	Tolka Valley Park Pond
10/02/2022	09:32	33	1.50% / 0.21%	Eastern pitches- Tolka Valley Park (within 300m disturbance buffer)
	09:54	7	0.31% / 0.04%	Southern section of Mellowes Park
	Black-headed Gull flocks absent during afternoon survey period			
25/02/2022	09:10	14	0.63% / 0.08%	Eastern pitches- Tolka Valley Park (within 300m disturbance buffer)
	09:24	21	0.95% / 0.13%	Western pitches / grassland (West Farnham area)
	09:48	8	0.36% / 0.05%	Northern section of Mellowes Park
	Black-headed Gull flocks absent during afternoon survey period			

Table 9-25: Flock size and location data for Black-headed Gull during winter 2022-2023

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
07/12/2022	08:49	9	0.40% / 0.05%	Western pitch / grassland (West Farnham area)
	08:51	32	1.45% / 0.20%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
	09:57	7	0.31% / 0.04%	Southern section of Mellowes Park
	14:52	4	0.18% / 0.02%	Eastern Tolka Valley Park grasslands (beyond 300m disturbance buffer)
	15:10	13	0.59% / 0.08%	Tolka Valley Park Pond
	15:17	12	0.54% / 0.07%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
16/12/2022	09:28	18	0.81% / 0.11%	Tolka Valley Park Pond
	09:55	7	0.31% / 0.04%	Western pitch / grassland (West Farnham area)
	15:11	14	0.63% / 0.08%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
05/01/2023	09:53	5	0.22% / 0.03%	Tolka Valley Park Pond
	10:12	23	1.04% / 0.14%	Erin's Isle GAA Pitches (East Farnham area)
	10:15	5	0.22% / 0.03%	Amenity grassland adjacent to Casement Road
	14:38	41	1.86% / 0.26%	Eastern Tolka Valley Park grasslands (beyond 300m disturbance buffer)
	15:35	8	0.36% / 0.05%	Western pitch / grassland (West Farnham area)
13/01/2023	08:58	32	1.45% / 0.20%	Western pitch / grassland (West Farnham area)
	09:21	64	2.91% / 0.40%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	09:49	5	0.22% / 0.03%	Tolka Valley Park Pond
	09:50	26	1.18% / 0.16%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
	10:15	12	0.54% / 0.07%	Southern section of Mellowes Park
	15:08	61	2.77% / 0.39%	Erin's Isle GAA Pitches (East Farnham area)
	15:13	5	0.22% / 0.03%	Western pitch / grassland (West Farnham area)
	15:18	12	0.54% / 0.07%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	15:39	5	0.22% / 0.03%	Tolka Valley Park Pond
	15:45	10	0.45% / 0.06%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
25/01/2023	08:46	49	2.23% / 0.31%	Erin's Isle GAA Pitches (East Farnham area)
	08:49	26	1.18% / 0.16%	Western pitch / grassland

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
				(West Farnham area)
	09:04	91	4.14% / 0.58%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	09:13	7	0.31% / 0.04%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
	09:18	5	0.22% / 0.03%	Tolka Valley Park Pond
	09:45	5	0.22% / 0.03%	Southern section of Mellowes Park
	14:57	30	1.36% / 0.19%	Western pitch / grassland (West Farnham area)
	15:22	25	1.13% / 0.16%	Tolka Valley Park Pond
02/02/2023	09:28	82	3.73% / 0.52%	Erin's Isle GAA Pitches (East Farnham area)
	09:43	43	1.95% / 0.27%	Western pitch / grassland (West Farnham area)
	09:53	90	4.09% / 0.57%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	10:05	7	0.31% / 0.04%	Tolka Valley Park Pond
	15:10	10	0.45% / 0.06%	Tolka Valley Park Pond
	15:56	5	0.22% / 0.03%	Southern section of Mellowes Park
17/02/2023	08:56	74	3.36% / 0.47%	Erin's Isle GAA Pitches (East Farnham area)
	09:16	35	1.59% / 0.22%	Western pitch / grassland (West Farnham area)
	09:56	51	2.32% / 0.32%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	10:00	26	1.18% / 0.16%	Eastern Tolka Valley Park grasslands (beyond 300m disturbance buffer)
	15:20	6	0.27% / 0.03%	Southern section of Mellowes Park
	15:28	18	0.81% / 0.11%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	15:50	5	0.22% / 0.03%	Tolka Valley Park Pond
	15:59	12	0.54% / 0.07%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
28/02/2023	09:06	62	2.82% / 0.39%	Erin's Isle GAA Pitches (East Farnham area)
	09:10	14	0.63% / 0.08%	Western pitch / grassland (West Farnham area)
	10:19	17	0.77% / 0.10%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)
	15:06	7	0.31% / 0.04%	Western pitch / grassland

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
				(West Farnham area)
	15:15	4	0.18% / 0.02%	Southern section of Mellowes Park
	15:30	22	1.00% / 0.14%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	15:39	3	0.13% / 0.01%	Tolka Valley Park Pond
	15:43	13	0.59% / 0.08%	Western Tolka Valley Park grasslands (within 300m disturbance buffer)

Table 9-26: Flock size and location data for Black-headed Gull during winter 2023-2024

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
15/12/2023	09:02	27	1.22% / 0.17%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	15:17	3	0.13% / 0.01%	Tolka Valley Park Pond
	15:50	5	0.22% / 0.03%	Southern section of Mellowes Park
04/01/2024	09:14	57	2.59% / 0.36%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	09:25	15	0.68% / 0.09%	Erin's Isle GAA Pitches (East Farnham area)
	09:26	6	0.27% / 0.03%	Eastern pitch / grassland (West Farnham area)
	09:54	6	0.27% / 0.03%	Tolka Valley Park Pond
	14:52	4	0.18% / 0.02%	Erin's Isle GAA Pitches (East Farnham area)
	15:05	3	0.13% / 0.01%	Southern section of Mellowes Park
12/01/2024	09:28	12	0.54% / 0.07%	Erin's Isle GAA Pitches (East Farnham area)
	09:29	9	0.40% / 0.05%	Western pitch / grassland (West Farnham area)
	10:02	22	1.00% / 0.14%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
19/01/2024	09:14	42	1.91% / 0.26%	Erin's Isle GAA Pitches (East Farnham area)
	09:17	3	0.13% / 0.01%	Western pitch / grassland (West Farnham area)
	09:47	10	0.45% / 0.06%	Tolka Valley Park Pond
	15:49	7	0.31% / 0.04%	Northern section of Mellowes Park
02/02/2024	09:10	11	0.50% / 0.07%	Erin's Isle GAA Pitches (East Farnham area)

Date	Time	Flock Size	Percentage of North Bull Island / National population (approx.)	Location
	09:14	22	1.00% / 0.14%	Eastern pitch / grassland (West Farnham area)
	09:50	6	0.27% / 0.03%	Tolka Valley Park Pond
	10:23	25	1.13% / 0.15%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	10:35	17	0.77% / 0.10%	Erin's Isle GAA Pitches (East Farnham area)
	15:34	9	0.40% / 0.05%	Southern section of Mellowes Park
09/02/2024	09:01	29	1.32% / 0.18%	Erin's Isle GAA Pitches (East Farnham area)
	09:20	31	1.41% / 0.19%	Eastern pitch / grassland (West Farnham area)
	15:43	23	1.04% / 0.14%	Western pitch / grassland (West Farnham area)
23/02/2024	09:02	33	1.50% / 0.21%	Western pitch / grassland (West Farnham area)
	15:27	6	0.27% / 0.03%	Tolka Valley Park Pond
	15:35	8	0.36% / 0.05%	Erin's Isle GAA Pitches (East Farnham area)
	15:40	14	0.63% / 0.08%	Tolka Valley Park Pond
27/02/2024	09:30	49	2.23% / 0.31%	Western pitch / grassland (West Farnham area)
	09:32	4	0.18% / 0.02%	Erin's Isle GAA Pitches (East Farnham area)
	09:55	3	0.13% / 0.01%	Tolka Valley Park Pond
	10:08	15	0.68% / 0.09%	Eastern Tolka Valley Park grasslands (within 300m disturbance buffer)
	15:01	3	0.13% / 0.01%	Eastern pitch / grassland (West Farnham area)
	15:15	4	0.18% / 0.02%	Tolka Valley Park Pond

Light-bellied Brent Goose

During the 2021-2022 winter period, Light-bellied Brent Goose flocks were most frequently recorded at the Erin's Isle GAA pitches (Table 9-21). Flock sizes at this location ranged from approximately 86 - 1000 (5.55% - 64.59% of the North Bull Island SPA population), peaking in early January 2022. The other less frequently utilised green amenity area, the western playing pitch within the West Farnham area (Table 9-21) was only used for foraging purposes by smaller flocks (41 - 171 individuals / 2.64% - 11.04% of the North Bull Island SPA population) of Light-bellied Brent Goose during the month of February 2022.

During the 2022-2023 winter period, Light-bellied Brent Goose flocks were once again most frequently recorded at the Erin's Isle GAA pitches (East Farnham area). Flock sizes at this location ranged from approximately 75 - 355 (4.84% - 22.93% of the North Bull Island SPA population), peaking in mid-December and early February, with peak flock sizes notably down from the 2021-2022 flocks. The other less frequently

utilised green amenity area, the western playing pitch (West Farnham area) was utilised by smaller flocks comprising of 92 – 186 individuals (5.94% - 12.01% of the North Bull Island SPA population). The peak total numbers for Light-bellied Brent Goose present within the disturbance buffer of the proposed Scheme at any one time was approximately 486 (31.39% of the North Bull Island SPA population) on the 16/12/2022, with two flocks present, one at Erin's Isle GAA pitches (East Farnham area) and another at the western playing pitches (West Farnham area).

The 2023-2024 winter period data indicated that the Light-bellied Brent Goose flocks most frequently utilised the Erin's Isle GAA pitches (East Farnham area). Flock sizes at this location approximately ranged from 5 - 392 (0.32% - 25.32% of the North Bull Island SPA population), peaking in late February 2024, with peak flock sizes notably down again from the 2021-2022 flocks. Following the Erin's Isle pitches (East Farnham area) (Figure 9-14), their next preferred grassland to forage was the western pitch (Figure 9-15) within the West Farnham area, which was then followed by the eastern pitch (West Farnham area) (Figure 9-16) in the same area. The western pitch (West Farnham area) hosted flocks of approximately 28 – 255 Light-bellied Brent Goose (1.80% - 16.47% of the North Bull Island SPA population), with flock size peaking in mid-January 2024. The eastern pitch (West Farnham area) hosted two Light-bellied Brent Goose flocks, one flock of 12 individuals and another totalling approximately 446 (0.77% - 28.81% of the North Bull Island SPA population), with flock size peaking in late February 2024.

The 2023-2024 winter period was the first recorded instance of the Light-bellied Brent Goose flocks utilising the eastern pitch in the west Farnham area. The flocks were present on this pitch on two occasions, the first of which was a small flock of 12 geese foraging after being disturbed on the adjacent western pitch (09/02/2024). The second occasion also involved the disturbance of their initial foraging area (Erin's Isle GAA), which saw the largest flock of the winter 2023-2024 period (~446 in number) forage on the eastern pitch within the West Farnham area, which had been freshly mown (23/02/2024 - Figure 9-16). Given that there were no disturbance sources at the western pitch within the West Farnham area at this time, it appears that the flock tolerated higher levels of disturbance from vehicle and pedestrian traffic in order to gain access to a higher quality foraging area. This highlights the urban disturbance tolerance of the Light-bellied Brent Goose flocks which frequent this area, an observation which is in line with the findings presented within Handby (2022) PhD thesis, which examined patterns of urban habitat use in Light-bellied Brent Goose populations within Co. Dublin.

Regarding the Tolka Valley Park and Mellowes Park survey areas, Light-bellied Brent Goose flocks were only ever recorded flying over Tolka Valley Park enroute to other grazing sites; while surveyors did not record any Light-bellied Brent Goose flocks foraging or commuting over Mellowes Park.

Figure 9-14: Light-bellied Brent Goose and Black-headed Gull flocks grazing / foraging at Erin's Isle GAA pitch (East Farnham area)

Figure 9-15: Light-bellied Brent Goose, Barnacle Goose and Black-headed Gull flocks grazing / foraging at the western pitch / amenity grassland (West Farnham area)

Figure 9-16: Light-bellied Brent Goose grazing on the freshly mown eastern pitch / amenity grassland (West Farnham area)

Black-headed Gull

During the 2021-2022 winter period, Black-headed Gull flocks were most commonly recorded within the Tolka Valley Park's amenity grasslands / playing pitches, though they were also present at the Farnham and Mellowes amenity grasslands / playing pitches, as well as small grassland areas at Casement Road, Patrickswell Place and the Tolka Valley Park pond. Individual flock sizes peaked at 131 individuals (5.96% of the North Bull Island SPA population) in Tolka Valley Park (eastern playing pitches), though flock sizes were recorded most regularly between 10 - 41 individuals (0.45% - 1.86% of the North Bull Island SPA population). Combined flock sizes within an area peaked at 163 individuals (7.42% of the North Bull Island

SPA population) in Tolka Valley Park on the 02/02/2022. Barring the single record of a 131 Black-headed Gull flock, flock sizes did not vary notably in size throughout the 2021-2022 winter period.

During the 2022-2023 winter period, Black-headed Gull flocks were most commonly recorded within the Erin's Isle GAA pitches and the Tolka Valley Park's eastern amenity grasslands / playing pitches. Small flocks were also noted in the Farnham and Mellowes amenity grasslands / playing pitches, as well as the grassland areas at Casement Road and Tolka Valley Park pond. Black-headed Gull flock sizes ranged from 3 - 91 (0.13% - 4.14% of the North Bull Island SPA population), and were not particularly variable across locations, nor were there notable monthly variations across the winter period. Combined Black-headed Gull flock sizes within an area peaked at 140 individuals (6.37% of the North Bull Island SPA population) in Tolka Valley Park on the 02/02/2023.

The 2023-2024 winter period saw Black-headed Gull flocks most commonly sighted within the Erin's Isle GAA pitches (East Farnham area) and the two pitches within the Farnham green area (West Farnham area). Other locations where flocks were noted included Mellowes Park and Tolka Valley Park (pond, and the eastern and western grasslands). Black-headed Gull flock sizes ranged from 3 – 57 (0.13% - 2.59% of the North Bull Island SPA population), and were not notably variable across locations, nor were there notable monthly variations across the 2023-2024 winter period. Combined Black-headed Gull flock sizes within an area peaked at 60 individuals (2.73% of the North Bull Island SPA population) in Farnham area (East and West areas) on the 09/02/2024.

Curlew
Curlew were recorded during the 2022-2023 winter period; three individuals were noted foraging within the Erin's Isle GAA pitches (East Farnham area) on the 16/12/2023. It is important to note that other desktop study data (Irish Birding, 2023) shows that flocks of up to 20 individuals (2.16% of the wintering North Bull Island SPA population) have been recorded within the Erin's Isle GAA pitches (East Farnham area), with flocks of up to 50 individuals observed flying within the general vicinity of the pitches as well.

Herring Gull
Herring Gull flocks were most commonly recorded within Erin's Isle GAA pitches (East Farnham area) during the 2021-2022, 2022-2023 and 2023-2024 winter periods. Herring Gull flock sizes were generally small, most commonly occurring between 2-8 individuals, with a peak occurrence peak of 18 individuals.

Mute Swan, Mallard and Tufted Duck (Tolka Valley Park Pond)
During the winter period, the breeding Mute Swan pair remain within the Tolka Valley Park Pond along with their most recent cygnets, until their offspring leave in search of their own territory. Accordingly, there are usually between 2 - 4 Mute Swans present within the pond habitat during the winter period.

Mallard numbers within the Tolka Valley Park Pond increase in the winter months with flock size ranging from 4 - 36 individuals, with the flock size peaking on the 13/01/2023.

A single pair of Tufted Duck was recorded within the Tolka Valley Park Pond during the February 2023 survey dates.

Common Gull, Lesser Black-backed Gull, Barnacle Goose and Cormorant (limited / isolated survey recordings)
Small numbers of the birds of conservation concern species, namely Common Gull (6 in number, December 2021; 3 in number, December 2023; 3 in number, January 2024); Lesser Black-backed Gull (2 in number, July 2023 – incidental recording outside of winter period); Barnacle Goose (2 in number, February 2022); Cormorant (One, February 2023) were recorded in Mellowes Park and Erin's Isle GAA (East Farnham area); the western pitch in the West Farnham area, and Tolka Valley Park pond, respectively. These individual observations were the only recording of these species.

Lapwing and Redwing (Desktop data)
A small flock of Lapwing, 15 in total, were recorded as utilising the Erin's Isle GAA pitches (East Farnham area) on the 14/12/2023 Additionally, a small flock of Redwing, comprising 12 individuals, was also recorded within Erin's Isle GAA grounds (East Farnham area) on the 14/12/2022 (Irish Birding, 2024).

Volume 4 – Map Figure 9-12 highlights the key wintering bird locations within and adjacent to the proposed Scheme (i.e. within the disturbance buffer zone).

The SCI bird species, which appear in significant number within and adjacent to the proposed Scheme, i.e. Light-bellied Brent Goose and Black-headed Gull, are of International ecological importance given their protection status and their association with Natura 2000 sites. The remaining Annex species: QI species; and the two Red-listed and five Amber-listed bird species are of County level ecological importance given their current conservation status and frequency of using habitats within and adjacent to the proposed Scheme. The other green-listed bird species recorded during the wintering bird surveys are of Higher Local ecological importance.

Reptiles

The review of the desktop data revealed that Common Lizard has been previously recorded near Cross Gun's Bridge, located 1.8km south-east of the existing Luas Broombridge Stop. The majority of the railway berm and verge habitat that runs adjacent to the 5th, 6th, 7th (Broombridge) and 8th Royal Canal locks is suitable Common Lizard basking, foraging and refuge habitat. However, the railway berm's grass / scrub verges are absent from station areas due to the presence of station platforms. This results in a significant reduction of both foraging and refuge habitat in these areas. Additionally, the southern platform and associated structures and vegetation increase the level of shading along the southern aspect of railway, and thus decrease its suitability for Common Lizard basking. Therefore, the Broombridge railway station area is considered as sub-optimal Common Lizard habitat given its limited capacity to provide foraging, basking and refuge opportunities. Ecological surveyors did not record any incidental Common Lizard sightings within or adjacent to the proposed Scheme's boundaries in the Broombridge railway area whilst conducting habitat, Otter, breeding bird, amphibian, bat (static deployment) and terrestrial invertebrate surveys within this area. Moreover, this absence of Common Lizard within the Broombridge area is also in line with findings of the DART+ West scheme's ecological surveys conducted along this stretch of railway. However, given that railway berm and verge vegetation east and west of the Broombridge station area provide optimal Common Lizard habitat, there is the potential for the local Common Lizard population to expand its current territory westward from the Cross Gun's Bridge area to Broombridge. Therefore, under the precautionary principle Common Lizard will be considered further within the impact assessment.

The local Common Lizard population is of Higher Local ecological importance given the limited distribution of the species and suitable habitats within the Dublin City limits, as well as the protection afforded to it under the Wildlife Act 1976 (and subsequent amendments).

Amphibians

The desktop study revealed that two amphibian species, namely Common Frog and Smooth Newt, have been recently recorded within the ZoI of the proposed Scheme (NBDC, 2024). Ecological surveyors did not observe any Common Frog or Smooth Newt individuals during the surveys. However, a focused amphibian spawn survey did record numbers of Common Frog spawning clusters within the Tolka Valley Park pond during the spring of 2022, 2023 and 2024 (see Figure 9-17). No other spawning sites were observed for Common Frog or Smooth Newt. Additionally, an eDNA sample survey was conducted for Smooth Newt in the Tolka Valley Park wetlands (2021) and Royal Canal (2023); with only the Royal Canal sample testing positive for the presence of Smooth Newt.

The local populations of these two amphibian species are of Higher Local ecological importance given the presence of suitable or active breeding sites within the ZoI of the proposed Scheme, as well as the protected status under the Wildlife Act 1976 (and subsequent amendments).

Figure 9-17: Common Frog spawn within Tolka Valley Park pond

Fish

Ireland's fish species are afforded protection under the Fisheries Acts as well as fishing by-laws. The desktop study revealed that of the range of Irish fish species, two Annex II species (EU Habitats Directive) Atlantic Salmon and lamprey species and the Red-listed European Eel, have historically inhabited the lower River Tolka (Matson et al. 2018; and Gallagher et al., 2023).

Salmonid species

The desktop review of existing data revealed that Atlantic Salmon were last recorded within the River Tolka in 2011 (Matson et al. 2018); and have not been recorded since, including during the most recent survey in the lower River Tolka (TII, 2022- MetroLink Environmental Impact Assessment Report). Additionally, Luas Team ecologists did not observe any Atlantic Salmon whilst conducting instream ecological surveys for the proposed Scheme. It is important to state that the absence of Atlantic Salmon from recent surveys does not definitely conclude their complete absence from the River Tolka. The population may persist in low densities and distribution frequencies throughout the Tolka catchment. Under the precautionary principle this possibility must be considered for the purposes of the impact assessment.

The River Tolka's Atlantic Salmon population is of National ecological importance as it seeks to re-establish itself throughout the catchment.

The desktop study highlighted the presence of Brown Trout within the lower River Tolka during recent IFI and independent surveys (Matson et al. 2018 and TII, 2022- MetroLink Environmental Impact Assessment Report). Most recently Brown Trout were incidentally recorded by ecological surveyors whilst conducting the freshwater invertebrate kick-sampling survey for the proposed Scheme.

The River Tolka's Brown Trout population is of Higher Local ecological importance given its position within the local food chain (e.g. prey for apex predators such as Otter, Grey Heron and Kingfisher).

Lamprey species

While recent IFI surveys (Matson et al. 2018) have recorded lamprey species in the upper reaches of the River Tolka (west of Mulhuddart), lamprey have not been observed in lower River Tolka since 2011 (Matson et al. 2018), with recent surveys failing to record adult or ammocoete stages (Matson et al. 2018 and TII,

2022- MetroLink Environmental Impact Assessment Report). Additionally, Luas Team ecologists did not observe any lamprey species whilst conducting instream ecological surveys.

Despite the apparent lack of lamprey species within the lower reaches of the River Tolka at present, their relatively recent confirmed presence upstream means that lamprey species are still present within the catchment and given their estuarine-based migration life-cycle, there is the potential for them to reoccur within the lower River Tolka. The River Tolka's lamprey species population is of National ecological importance, as the distribution of this Annex-protected population attempts to recover within the Tolka catchment.

European Eel

Recent records show that European Eel, a declining species protected under the OSPAR Convention and currently considered to be Critically Endangered, is present within the lower River Tolka (TII, 2022- MetroLink Environmental Impact Assessment Report) and the Royal Canal. Luas Team ecologists indirectly recorded the presence of European Eel through the dietary analysis of Otter spraint taken from the latrines located within Tolka Valley Park and along the northern bank of the Royal Canal (Broombridge section).

The local population of European Eel is of International ecological importance given its current conservation status within Ireland and internationally.

Other Fish species

The desk study also highlighted the presence of other fish species within the lower River Tolka (Matson et al. 2018), namely the Three-spined Stickleback, Minnow and Stone Loach. These three species were incidentally recorded by ecological surveyors whilst conducting the freshwater invertebrate kick-sampling survey (see Figure 9-18).

The local populations of these three fish species are considered to be of Higher Local ecological importance given their respective position within the local food chain (e.g. prey for salmonid species, Otter, Grey Heron and Kingfisher).

Figure 9-18: Stone Loach incidentally recorded during freshwater invertebrate sampling

Terrestrial Invertebrates

Terrestrial invertebrate surveying was conducted (24/08/2021 and 24/08/2023) via visual transects of the habitats within and adjacent to the proposed Schemes boundaries. Ecological surveyors recorded a total of 21 terrestrial invertebrate species, two of which are Red-listed species. Table 9-27 provides a summary of the findings of the invertebrate surveys with respect to those species which are of conservation concern.

Table 9-27: Terrestrial invertebrates recorded during the visual transect surveys

Terrestrial Invertebrate Groups	Species	Conservation Status within Ireland
Dragonflies and Damselflies (Odonata)	Brown Hawker	Least concern
	Common Darter	Least concern
	Emperor Dragonfly	Least concern
	Common Hawker	Least concern
	Common Blue Damselfly	Least concern
	Banded Demoiselle	Least concern
Bees and Wasps (Hymenoptera)	Honeybee	Least concern
	White-tailed Bumblebee	Least concern
	Large Red-tailed Bumblebee	Near threatened
	Common Carder-bee	Least concern
	Moss Carder-bee	Near threatened
	Wasp spp.	Least concern
Butterflies (Lepidoptera)	Small White	Least concern
	Large White	Least concern
	Meadow Brown	Least concern
	Speckled Wood	Least concern
	Peacock	Least concern
	Small Tortoiseshell	Least concern
	Orange Tip	Least concern
Craneflies (Diptera)	Cranefly spp.	Least concern
Grasshoppers (Orthoptera)	Common Grasshopper	Least concern

These populations of local terrestrial invertebrate species are of Higher Local ecological importance given their important roles within the local food chains and pollination capabilities; as well as the current conservation status of the Large Red-tailed Bumblebee and Moss Carder-bee.

Protected Freshwater Invertebrates

Glutinous Snail (Desktop data – Triturus, 2022)

Two specimens of the Red-listed 'Endangered' Glutinous Snail were recorded in the Royal Canal, between the 6th and 7th locks, by Triturus Environmental Ltd. during a macro-invertebrate sweep net survey conducted 16th June 2022 (Volume 4 – Map Figure 9-13).

The local population of Glutinous Snail is of National ecological importance given its current conservation status within Ireland.

Freshwater Indicator Invertebrate Species (Q-value Analysis)

Kick-sampling of freshwater invertebrates was conducted at three sites along the River Tolka within Tolka Valley Park (Volume 4 – Map Figure 9-14). Freshwater invertebrate specimens were identified to at least the level of Family, and to Genus or Species level where possible. All macro-invertebrate species were identified using Guide to Freshwater Invertebrates (Dobson et al. 2012). The invertebrates identified during the survey of the River Tolka are listed along with their, respectively, presence or absence for each sample, in Table 9-28.

Table 9-28: Invertebrate identification of Family, Genus and Species levels for each site sample

Family	Genus	Species	Site 1 Count Sample A / B	Site 2 Count Sample A / B	Site 3 Count Sample A / B
Baetidae	-	-	✓ / ✓	- / -	✓ / ✓
Hydropsychidae	-	-	✓ / -	- / -	- / -
Sericostomatidae	*Sericostoma*	-	- / -	- / ✓	✓ / ✓
Limnephilidae	-	-	✓ /	- / -	✓ / -
Rhyacophilidae	*Rhyacophilla*	-	- / -	- / ✓	✓ / -
Goeridae	-	-	✓ / ✓	- / ✓	✓ / ✓
Gammaridae	*Gammarus*	-	✓ / ✓	✓ / ✓	✓ / ✓
Physidae	-	-	✓ / ✓	- / -	✓ / ✓
Hydrobiidae	-	-	✓ / ✓	✓ / ✓	✓ / ✓
Planorbidae	-	-	✓ / -	- / ✓	✓ / ✓
	Ancylus	-	- / -	✓ / -	✓ / -
Valvatidae	-	-	✓ / ✓	✓ / ✓	✓ / ✓
Sphaeriidae	-	-	- / ✓	✓ / ✓	✓ / ✓
Lumbriculidae	-	-	✓ / -	✓ / ✓	✓ /
Glossiphonidae	-	-	✓ / ✓	- / -	✓ / ✓
Limoniidae	-	-	✓ / ✓	- / -	- / -
Orthocladiinae	-	-	✓ / -	✓ / -	✓ /
Chironominae	-	-	- / ✓	✓ / -	✓ /
Dytiscidae	-	-	- / ✓	- / -	- / -
Psychodidae	-	-	✓ / -	- / -	- / -
Tipulidae	-	-	✓ / ✓	- / -	✓ / ✓
Elmidae	*Elmis*	-	- / -	- / -	- / ✓
Hydrachnidae	-	-	- / ✓	- / -	✓ / ✓

Q-value and Small Stream Risk Score (SSRS)

While many biological assemblages (e.g. bacteria, algae and fish) are used for assessing the ecological conditions of rivers and streams, freshwater benthic macroinvertebrates are the most widely utilised bioindicator; given that they are sensitive to ecological impacts whilst being a relatively simple, efficient and cost-effective faunal group to sample and analyse ((Buss, et al., 2015) The above led to the development of the EPA's scheme of Biotic Indices or Quality (Q) Values to monitor environmental water quality.

Macro-invertebrate samples from River Tolka were converted to Q-value ratings as per Toner et al. (2005) (Table 9-4). The Q-value calculation is based on the relative number of Group A & B invertebrates to Group C, D & E invertebrates, with Group A being most sensitive to pollution and Group E being most tolerant of pollution. All three sites had small numbers of Group B invertebrates, but no Group A were present. Further to this, all three sites had excessive numbers of Group C and small numbers of Group D, with Group E being absent and with Filamentous Algae present throughout. Therefore, all sites were allocated a Q value of 3.

The Small Stream Risk Score enables further characterisation of catchments in terms of improving the risk assessments for river waterbodies at smaller scales than those examined under WFD. The SSRS is based on the diversity and abundance of certain freshwater macroinvertebrate groups; Group 1 consisting of the 3-tailed Ephemeropterans (mayflies); Group 2 the 2-tailed Plecopterans (stoneflies); Group 3 the Trichopterans (caddisflies); Group 4 a combination of Gastropods (snails and bivalves), Oligochaetes (worms) and Dipterans (true flies); and Group 5 the *Asellus* genus (water louse). Scores are divided into three categories - Probably not at risk (= >8); Probably at risk (= 6.5 - 8); and At risk (= <6.5). Tolka River, under the SSRS system, is a watercourse At Risk, with all three sites receiving an 'At Risk' rating (Sites 1 and 3 score: 3.2, Site 2 score: 4.8).

The freshwater invertebrate populations of the waterways that flow through the proposed Scheme are of Higher Local ecological importance for the freshwater invertebrates whose larval and adult stages form an important part of local freshwater and terrestrial food chains.

9.3.2.4 Invasive Non-native Species

Table 9-29 below provides a list of invasive non-native species (INNS) recorded during the ecological surveys. It includes species, their level of impact, and whether they are listed on the Third Schedule of the EC (Birds and Natural Habitats) Regulations 2011 S.I. No. 477/2011. The location of these invasive species, excluding Sycamore, can be viewed in Volume 4 – Map Figure 9-15 (Royal Canal at Broombridge), Volume 4 – Map Figure 9-16 (Tolka Valley Park), Volume 4 – Map Figure 9-17 (Mellowes Park) and Volume 4 – Map Figure 9-18 (Melville Road).

Table 9-29: INNS recorded within or adjacent to the proposed Scheme's boundary

Invasive Non-Native Species	Impact	Regulation S.I. 477/2011	Location
Canadian Waterweed	High	Yes	Royal Canal
Nuttall's Waterweed	High	Yes	Royal Canal
Himalayan Balsam	High	Yes	Tolka Valley Park (riparian zone)
Japanese Knotweed	High	Yes	Tolka Valley Park (riparian zone)
Giant Hogweed *Heracleum mantegazzianum*	High	Yes	Located upstream of Tolka Valley Park bridge, the presence of seeds deposited within the riverbanks by the bridge must be considered
Sycamore	Medium	No	Present within woodland, parkland and scrub habitats throughout the site of the proposed Scheme
Cherry Laurel	High	No	Mellowes Park and Charlestown area
Butterfly-bush	Medium	No	Royal Canal, Broombridge Road and Tolka Valley Park

Of the above INNS two species (and potentially a third), namely Himalayan Balsam, Japanese Knotweed and potentially Giant Hogweed, are located in a sensitive location by the proposed Tolka Valley Park Luas bridge; as such, these species will be the focus of biosecurity measures going forward. Of these above species, Japanese Knotweed and Giant Hogweed boast salinity tolerances which may allow them to colonise saltmarsh habitats, and therefore pose a threat to the South Dublin Bay and Tolka Estuary SPA; North Dublin Bay SAC; North Bull Island SPA; and South Dublin Bay SAC. As the Japanese Knotweed along the River Tolka will need to be removed to allow for the installation of the new bridge in this area, it is the most likely invasive species to be accidentally spread downstream into the Natura 2000 sites.

9.3.3 Summary of Ecological Valuation and Rationale for Inclusion within the Impact Assessment Process

The KERs identified during the desktop study and ecological surveys are listed in Table 9-30. Designated sites and ecological features excluded are not considered further within the impact assessment. Ecological features carried forward are assessed for potential impact during construction and operation in the following sections.

Table 9-30: Summary of KER valuations and rationale for inclusion within the impact assessment

Designated Sites / Habitats / Flora / Fauna (KERs)	Valuation	Rationale for KER Inclusion / Exclusion from Impact Assessment
Designated Sites		
North Dublin Bay SAC [000206]	International	Within scheme's hydrological ZoI
South Dublin Bay SAC [000210]	International	Within scheme's hydrological ZoI
Rockabill to Dalkey Island SAC [003000]	International	Within scheme's hydrological ZoI
North Bull Island SPA [004006]	International	Within scheme's hydrological ZoI SCI bird species within ZoI
South Dublin Bay and River Tolka Estuary SPA [004024]	International	Within scheme's hydrological ZoI
North-West Irish Sea SPA [004236]	International	Within scheme's hydrological ZoI SCI bird species within ZoI
Royal Canal pNHA [002103]	National	Present within the scheme's ZoI
North Dublin Bay pNHA [000206]	National	Within scheme's hydrological ZoI
South Dublin Bay pNHA [(000210]	National	Within scheme's hydrological ZoI
Booterstown Marsh pNHA [001205]	National	Within scheme's hydrological ZoI
Dolphins, Dublin Docks pNHA [000201]	National	Within scheme's hydrological ZoI
UNESCO Dublin Bay Biosphere	International	Within scheme's hydrological ZoI
Habitats		
Stone walls and other stonework	Lower Local	Ecological value / Within scheme's ZoI
Buildings and artificial surfaces	Less than Local	Lack of ecological value **(Excluded)**
Other artificial lakes and ponds	County	Ecological value / Within scheme's ZoI
Reed and large sedge swamps	Higher Local	Ecological value / Within scheme's ZoI
Tall-herb swamps (Potential Annex I habitat: 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430))	National	Ecological value / Within scheme's ZoI
Depositing / lowland rivers (River Tolka)	County	Ecological value / Within scheme's ZoI
Canals (Royal Canal)	National	Ecological value / Within scheme's ZoI
Amenity grassland (improved)	County	Ecological value (wintering bird species) Within scheme's ZoI
Marsh	Higher Local	Ecological value / Within scheme's ZoI
Dry calcareous and neutral grassland	County	Ecological value / Within scheme's ZoI
Dry meadow and grassy verges	Higher Local	Ecological value / Within scheme's ZoI

Designated Sites / Habitats / Flora / Fauna (KERs)	Valuation	Rationale for KER Inclusion / Exclusion from Impact Assessment
(Mixed) broadleaved woodland	Higher Local	Ecological value / Within scheme's ZoI
Scattered trees and parkland	Higher Local	Ecological value / Within scheme's ZoI
Hedgerows	Higher Local	Ecological value / Within scheme's ZoI
Treelines	Higher Local	Ecological value / Within scheme's ZoI
Wet willow-alder-ash woodland	Higher Local	Ecological value / Within scheme's ZoI
Scrub	Higher Local	Ecological value / Within scheme's ZoI
Ornamental / non-native shrub	Lower Local	Ecological value / Within scheme's ZoI
Flora		
Opposite-leaved Pondweed	National	Ecological value / Within scheme's ZoI
Tassel Stonewort	National	Ecological value / Within scheme's ZoI
Pointed Stonewort	County	Ecological value / Within scheme's ZoI
Rare / Uncommon Freshwater Macrophytes: Clustered Stonewort	Higher Local	Ecological value / Within scheme's ZoI
Uncommon / Rare Terrestrial Flora: Pyramidal Orchid Bee Orchid	Higher Local	Ecological value / Within scheme's ZoI
Fauna		
Otter	International	Ecological value / Within scheme's ZoI
Bats	County	Ecological value / Within scheme's ZoI
Other Terrestrial Mammals	Higher Local	Ecological value / Within scheme's ZoI
Marine Mammals	County	Ecological value / Within scheme's ZoI
Breeding birds: - Kingfisher - Other Annex, Red and Amber-listed breeding bird species - Green-listed breeding bird species	Regional County Higher Local	Ecological value / Within scheme's ZoI
Wintering birds: - Light-bellied Brent Goose - Black-headed Gull - Other Red and Amber listed wintering bird species - Green-listed wintering bird species	International International County Higher Local	Ecological value / Within scheme's ZoI
Reptiles	Higher Local	Ecological value / Within scheme's ZoI
Amphibians	Higher Local	Ecological value / Within scheme's ZoI
Fish: - Atlantic Salmon - Lamprey species - European Eel - Other fish species	National National International Higher Local	Ecological value / Within scheme's ZoI
Terrestrial Invertebrates	Higher Local	Ecological value / Within scheme's ZoI
Protected Freshwater Invertebrates:	National	Ecological value / Within scheme's ZoI

Designated Sites / Habitats / Flora / Fauna (KERs)	Valuation	Rationale for KER Inclusion / Exclusion from Impact Assessment
- Glutinous Snail Other Freshwater Invertebrates	Higher Local	
INNS		
Invasive non-native species	N/A	Must be examined for biosecurity / mitigation purposes

9.4 Potential Impacts

9.4.1 Introduction

The potential impacts on the valued designated sites and ecological features, i.e. KERs, are assessed within this section. The initial assessment considers the potential impact pathways and whether these apply to the ecological features. The impact assessment considers the Construction (see Chapter 6 (Construction Activities)) and Operational Phases of the proposed Scheme and the predicted effects in the absence of any mitigation. The descriptive terminology used to describe the characteristics (effects and significance) of these impacts is based on the terms provided within the EPA Guidelines (EPA, 2022), listed in the introductory chapter (section 1.7.3.2).

9.4.2 Do Nothing Scenario

If the proposed works were not to go ahead and the present land management continues as is, the ecological value of the site would remain largely unchanged given that the majority of the site area (existing urban areas, small amenity grassland areas and parks) is currently under the management of DCC and FCC. Furthermore, Waterways Ireland maintains the Royal Canal section of the proposed Scheme. Excepting alterations (repairs / realignment) to pedestrian (e.g. Royal Canal Greenway) and roadway infrastructure, the only changes to the habitats within the boundaries of the Scheme will be those resulting from grassland (biodiversity) management change, i.e. allowing more dry meadow habitats to grow in areas currently occupied by amenity grassland.

There are areas within the Scheme's boundaries which do not undergo regular maintenance. These are the mosaic dry meadow and scrub patches which are present in isolated allotments, namely the proposed Stabling site, the site directly north-west of Broombridge and the small site immediately to the south of St Margaret's Road (R104) roundabout. In the short-term, the dry meadow sections in these areas will develop into scrub, while the existing scrub section will grow into immature woodland where tree species are present.

Overall, these minor changes to the habitats within the proposed Scheme's boundaries will result in slight positive impacts for specific faunal groups including:

- Terrestrial Mammals – increased scrub cover provides more refuges for local mammals;
- Breeding Birds – increased scrub cover provides increased nesting opportunities for local birds; and
- Terrestrial Invertebrates – a grassland management shift which results in increased dry meadow cover and which will provide increased foraging opportunities for local terrestrial invertebrates and subsequently their predators (birds & bats).

9.4.3 Construction Phase Impacts

9.4.3.1 Designates Sites

European Sites - Natura 2000 Sites [International]

The accompanying NIS submission assesses the resulting impacts of the proposed Scheme on the Natura 2000 sites, and their respective QIs / SCIs, within the ZoI of the Scheme. The NIS examines whether the proposed Scheme will result in likely significant effects that may prevent the Natura 2000 sites' QIs / SCIs

from achieving their respective site-specific conservation objectives. The NIS assessed the following Natura 2000 sites for likely significant effects as result of the proposed Scheme:

- North Dublin Bay SAC [000206];
- South Dublin Bay SAC [000210];
- Rockabill to Dalkey Island SAC [003000];
- North Bull Island SPA [004006];
- South Dublin Bay and River Tolka Estuary SPA [004024]; and
- North-West Irish Sea SPA [004236].

The Appropriate Assessment section within the NIS considers a scenario where mitigation measures are absent from the Construction Phase of the Scheme. Under this scenario, the following potential negative impacts have the potential to arise as a result of the construction works:

- Surface water; groundwater-to-surface water; and air-to-surface water pollution: The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the six Natura 2000 sites listed above. Potential direct impacts include the degradation of overall water quality and the vegetation of Annex I habitats as a result of hydrocarbon pollution. Hydrocarbons pollutants are also known to degrade the plumage of SCI bird species. Furthermore, these hydrocarbons can be potentially ingested by SCI bird and QI mammal species (Harbour Porpoise) as they consume food items / prey, or through preening affected feathers (SCI birds). Additionally, temporary, or permanent reductions in area and/or overall health may be experienced by Annex habitats within the ZoI as a result of deleterious substances entering the habitat via surface water, groundwater-to-surface and air-to-surface water pathways. Moreover, water pollution impacts on the six Natura 2000 sites (and the supporting habitats in close proximity) have the potential to indirectly impact SCI bird and QI mammal species by negatively impacting the local food chain e.g. floral, estuarine/marine invertebrate and fish species, upon which depend the QI / SCI species of Rockabill to Dalkey Island SAC; North Bull Island SPA; South Dublin Bay and River Tolka Estuary SPA; and North-west Irish Sea SPA depend upon. In addition, the consumption of food items containing polluting elements will impact the health of QI mammal and SCI bird populations;

- Air (dust) pollution within supporting ex-situ habitats: The construction works may generate dust-based pollutants (e.g. cement-based dust) in the amenity grasslands which support SCI bird species flocks during the winter period. During long dry periods dust can coat plant foliage adversely affecting photosynthesis and other biological functions. Furthermore, cement-based dust deposited on leaves can increase the surface alkalinity, which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt. The amenity grassland habitats will be vulnerable to cement-based dust deposition impacts during the Construction Phase. This impact on the grassland flora will have a knock-on impact for SCI bird species, particularly Light-bellied Brent Goose, which are supported by these ex-situ habitats. Moreover, cement-based dust has the potential to be accidentally ingested by SCI bird species when foraging and preening, when present within the air pollution buffer;

- Visual and audible disturbance in supporting ex-situ habitats: The construction works also have the potential to visually and audibly disturb SCI bird species, such as Light-bellied Brent Goose, Black-headed Gull; Curlew; Herring Gull; Lesser Black-backed Gull; Common Gull; and Cormorant. These may be engaging in foraging, commuting and roosting (daytime / short-term) activities within or adjacent to the proposed construction works during the winter period; and

- Disruption and spread of invasive non-native species: The spread of invasive species such as Himalayan Balsam, Japanese Knotweed and Giant Hogweed, from the construction site into the North Dublin Bay SAC and South Dublin Bay SAC, via the River Tolka, may lead to a series of adverse effects on the Annex habitats within these two Natura 2000 sites. Their establishment within the saltmarsh or dune habitats has the potential to result in the displacement of native species via shading impacts and higher rates of colonisation within areas of open and/or disturbed ground.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to medium-term adverse impact of moderate significance for these designated European sites, as a result of potential pollution and disturbance events negatively impacting QI habitats, as well as associated QI mammal and SCI bird species.

Proposed Natural Heritage Areas [National]

Listed below are the pNHA sites within the proposed Scheme's ZoI, that will be vulnerable to the potential impacts of the proposed construction activities, in a scenario where mitigations measures are absent:

- Royal Canal pNHA [002103];
- North Dublin Bay pNHA [000206];
- South Dublin Bay pNHA [(000210];
- Booterstown Marsh pNHA [001205]; and
- Dolphins, Dublin Docks pNHA [000201].

The North Dublin Bay and South Dublin pNHAs and their associated fauna (including non-QI / SCI protected faunal species) will be vulnerable to all of the same negative impacts outlined above in the Natura 2000 sites section. While Dolphins, Dublin Docks pNHA will only be exposed to a sub-set of these potential negative impacts, namely that the impacts that affect the physiological health and prey-base of the Roseate, Common and Arctic Tern species associated with the pNHA.

Of the four pNHA sites, the Royal Canal pNHA is the most susceptible to potential adverse impacts given that the site is located within the boundaries of the proposed Scheme. In addition to the adverse pollution- and disturbance-based impacts outlined in the Natura 2000 sites section, the Royal Canal pNHA is vulnerable to physical degradation of its associated habitats, as well the disturbance to and accidental fatalities of associated fauna during the Construction Phase.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to medium- term adverse impact of moderate significance for these nationally designated sites, as a result of potential pollution events negatively impacting the sites' habitats and associated fauna.

UNESCO Dublin Bay Biosphere [International]

The UNESCO Dublin Bay Biosphere and its associated KER fauna (including non-QI / SCI protected faunal species) will be vulnerable to the same range of adverse impacts outlined above in the Natura 2000 sites section.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to medium-term adverse impact of moderate significance for the UNESCO Dublin Bay Biosphere, as a result of potential pollution and disturbance events negatively impacting KER habitats within the site, as well as associated KER mammal and bird species.

9.4.3.2 Habitats

Stone walls and other stonework [Lower Local]

This stone walls and other stonework habitat is to be fully retained. However, this habitat still has the potential to be physically degraded from accident damage to stone wall by hand or machinery during the adjacent works on proposed pedestrian and light rail bridge crossing the River Tolka (see Chapter 6 (Construction Activities)). Such damage has the potential to damage or remove the flora species growing on the stone wall habitat.

Additionally, this stone walls and other stonework habitat also has the potential to be impacted by dust-based pollution during construction activities within Tolka Valley Park, with cement-based dusts being of particular concern given their ability to degrade the epidermis layer of floral species.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term adverse impact of slight significance for this stone walls and other stonework habitat located within the Tolak Valley Park.

Other artificial lakes and ponds [County]

As the Tolka Valley Park pond exists outside the works area of the proposed Scheme it will be safe from any impacts which are related to physical disturbance of the habitat. However, this pond habitat will still be potentially exposed to emissions (surface water, groundwater and air-based pollutants) which are generated by construction activities within the Scheme's work area (see Chapter 6 (Construction Activities)).

The main emission impact pathway of concern is surface water, with the accidental introduction of pollutants (e.g. hydrocarbon leakages and cement leachate) and excess sediment from excavations / soil works. These polluting inputs will lead to the degradation the overall water quality of the pond and potentially degrade the associated aquatic and emergent flora within the pond.

Moreover, this pond habitat may also experience similar polluting impacts through the groundwater-to-surface water pollution pathway given that Tolka Valley Park is the site of a historic landfill. While testing has revealed the leachate to not be notably hazardous, due to the topography of the region, any leachate emerging from the subsoil will flow in the direction of the pond habitat. This leachate still has the potential to negatively impact the water quality of the pond, as well as the pond's flora and fauna. Therefore, there is the potential for groundwater-to-surface water impacts for this pond habitat.

Additionally, this pond habitat will also be potentially impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the structures of epidermal cells in floral species, which will harm the floating and emergent flora within the pond. Moreover, alkaline cement-based dusts have the potential to affect the pond's pH levels, potentially harming pH-sensitive aquatic flora and fauna.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term negative impact of moderate significance for this artificial pond habitat within the Tolka Valley Park.

Reed and large sedge swamps [Higher Local]

The reed and large sedge swamps are to be retained as part of the Scheme's Urban Integration Report (Volume 5 - Appendix A21.2); however, these wetland habitat will still be vulnerable to a series of potential negative impacts generated by construction activities within Tolka Valley Park (see Chapter 6 (Construction Activities)). Scenarios may arise where accidental spills of deleterious substances (e.g. hydrocarbons and solvents) come in contact with and negatively impact the physiological health of reed and sedge swamp floral communities, as well as soaking into the sub-surface / groundwater and degrading the root layers of these flora, potentially resulting in death, and thus lowering the overall health and biodiversity value of these wetland habitats.

Additionally, these reed and large sedge swamp habitats also have the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the structures of epidermal cells in floral species.

Furthermore, the installation of falsework on the north bank of the River Tolka to enable the construction of the light rail bridge over the river has the potential to result in the physical degradation of the reed and large sedge swamp floral species, via compaction from the temporary foundations of the falsework scaffolding, as well as trampling underfoot by the Contractor's personnel constructing the installation.

Moreover, the potential spread of invasive non-native species, in particular Himalayan Balsam, Japanese Knotweed and Giant Hogweed, from their current locations within Tolka Valley Park into adjacent habitats such as the reed and large sedge swamps, may result in the displacement of native species via shading impacts and higher rates of colonisation within areas of open and/or disturbed ground.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term adverse impact of slight significance for reed and large swamp habitat within Tolka Valley Park.

Tall-herb swamps (Potential Annex I habitat: 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430)) [National]

The tall-herb swamps to be retained along the banks of the Royal Canal will still be susceptible to a range of potential adverse impacts generated by construction activities within the Broombridge area (see Chapter 6 (Construction Activities)). For example, accidental spills of deleterious substances (e.g. hydrocarbons, solvents and cement leachate) come in contact with and negatively impact the physiological health of tall-herb swamp flora, as well as seeping into the sub-surface / groundwater and degrading the root layers of these flora, potentially resulting in death, and thus lowering the overall health and biodiversity value of these wetland habitats.

In addition, this tall-herb swamp habitat has the potential to be impacted by dust-based pollution generated during construction activities, with cement-based dusts being of particular concern given their ability to degrade the structures of epidermal cells in floral species, potentially impacting the overall health of these notably biodiverse habitats.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a significant short-term adverse impact for tall-herb swamp habitat along the Royal Canal at Broombridge.

Depositing / lowland rivers (River Tolka) [County]

The River Tolka (depositing / lowland river habitat) will be potentially exposed to a range of construction emissions via surface water, groundwater and air-based pollutant pathways (see Chapter 6 (Construction Activities)). The surface water pathway is of most concern, given that the unintended introduction of pollutants (e.g. hydrocarbon leakages and cement leachate) and excess sediment into the river have the potential to notably degrade the water quality and influence its pH levels (beyond its normal range), with knock-on impacts for local flora and fauna, as well as the designated sites located downstream.

Furthermore, this River Tolka may also experience similar polluting impacts through the groundwater-to-surface water pollution pathway given that Tolka Valley Park is the site of a historic landfill. While testing has revealed the leachate to not be notably hazardous, due to the topography of the region, any leachate emerging from the subsoil will flow in the direction of the River Tolka. This leachate still has the potential to negatively impact the water quality of the River Tolka, as well as its associated flora and fauna. Therefore, there is the potential for groundwater-to-surface water impacts for this pond habitat.

Additionally, the River Tolka will also be potentially impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the structures of epidermal cells of flora, which will damage the emergence flora within the river. Moreover, alkaline cement-based dusts have the potential to affect the river's pH levels, potentially harming pH-sensitive aquatic flora and fauna.

Moreover, the potential further spread of existing invasive non-native species, namely Himalayan Balsam, Japanese Knotweed and Giant Hogweed, along the banks of this habitat, may result in the increased displacement of native floral species via shading impacts and higher rates of colonisation within areas of open and/or disturbed ground.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term negative impact of moderate significance for the River Tolka.

Canals (Royal Canal) [National]

This canal habitat will be potentially exposed to a range of construction-based emissions (surface water, groundwater and air-based pollutants) which will be generated within the Scheme's work area at Broombridge (see Chapter 6 (Construction Activities)).

The emission impact pathway of most concern is the surface water pathway, with the unintended introduction of pollutants (e.g. hydrocarbon leakages and cement leachate) and excess sediment from excavations / soil works leading to the degradation of the overall water quality of the canal, with potential knock-on impacts for associated aquatic and emergent flora within the canal.

While there is the potential for groundwater / groundwater-to-surface water pollution for other aquatic habitats within the ZoI, the Royal Canal is entirely sealed and it is not susceptible to impacts associated with polluted groundwater recharge. Therefore, this canal habitat will not be negatively impacted via the groundwater pathways.

Additionally, this canal habitat has the potential to be adversely impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the structures of epidermal cells in floral species, which will harm the floating and emergent flora within the canal. Moreover, alkaline cement-based dusts have the potential to affect the canal's pH levels, potentially degrading the health of pH-sensitive aquatic flora and fauna.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a significant temporary to medium-term negative impact for the aquatic canal habitat at Broombridge.

Amenity grassland (improved) [County]

As a result of the proposed Scheme's pedestrian and light rail infrastructure, the amenity grassland habitat will permanently lose sections of habitat within the parkland and small green areas (approx. 4% of total area) throughout the proposed Scheme.

The retained amenity grassland will still be vulnerable to a series of potentially harmful impacts generated by construction activities within the boundaries of the proposed Scheme (see Chapter 6 (Construction Activities)). Activities leading to accidental spillages of harmful substances (e.g. hydrocarbons and solvents) may result in these substances coming in direct contact with and adversely impacting the physiological health of the dry grassland flora; as well as seeping into the sub-surface / groundwater and degrading the grassland flora's root network, resulting in further degradation and the potential death of more pollution intolerant species. Such events will lower the overall health and biodiversity value of this dry calcareous and neutral grassland habitat.

Additionally, these amenity grassland habitats have the potential to be physically degraded from excessive footfall from workers present on-site, compaction from light and heavy machinery and temporary material stock-piling. Such damage to these amenity grassland habitat have the potential to increase the frequency of disturbed bare ground within the grassland habitat, which has the potential to result in the establishment of invasive species present within the locality (e.g. Butterfly-bush).

Moreover, these amenity grassland habitats also have the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their ability to degrade the epidermis layer of floral species.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term adverse impact of slight significance for this amenity grassland habitat.

Marsh [Higher Local]

While the marsh habitat is to be retained within the site landscape, see Urban Integration Report (Volume 5 - Appendix A21.2), this wetland habitat will still be vulnerable to a range of potential adverse impacts generated by construction activities within Tolka Valley Park (see Chapter 6 (Construction Activities)). Scenarios may arise where accidental spills of deleterious substances (e.g. hydrocarbons and solvents) come in contact with and negatively impact the physiological health of floral marsh species, as well as seeping into the sub-surface / groundwater and degrading the root layers of these flora, potentially resulting in death, and thus lowering the overall health and biodiversity value of the habitat.

Additionally, this marsh habitat also has the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the structures of epidermal cells in floral species.

Moreover, installation of falsework on the north bank of the River Tolka to enable the construction of the light rail bridge over the river has the potential to result in the physical degradation of the marsh flora, via compaction from the temporary foundations of the falsework scaffolding, as well as trampling underfoot by the contractor's personnel building the installation.

Also, the potential spread of invasive non-native floral species, in particular Himalayan Balsam, Japanese Knotweed and Giant Hogweed, from their current locations within Tolka Valley Park into adjacent habitats such as the marsh habitat, has the potential to result in the displacement of native species via shading impacts and higher rates of colonisation within areas of open and/or disturbed ground.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term adverse impact of slight significance for this marsh habitat located within the Tolka Valley Park.

Dry calcareous and neutral grassland [County]

As a result of the proposed Scheme's pedestrian and light rail infrastructure, the dry calcareous and neutral grassland habitat will temporarily lose over a half of its total area, approximately 51% (2.22ha). The western and northernmost sections of this habitat will be replaced by pedestrian infrastructure, including amenity areas, light rail track and Stop area, as well as other habitat types (e.g. scattered trees and parkland).

The retained dry calcareous and neutral grassland will still be vulnerable to a series of potentially harmful impacts generated by construction activities within the St Helena's green area (see Chapter 6 (Construction Activities)). Activities leading to accidental spillages of harmful substances (e.g. hydrocarbons and solvents) may result in these substances coming in direct contact with and adversely impacting the physiological health of the dry grassland flora; as well as seeping into the sub-surface / groundwater and degrading the grassland flora's root network, resulting in further degradation and the potential death of more pollution intolerant species. Such events will lower overall health and biodiversity value of this dry calcareous and neutral grassland habitat.

Additionally, this dry calcareous and neutral grassland habitat has the potential to be physically degraded from excessive footfall from workers present on-site, compaction from light and heavy machinery and temporary material stock-piling. Such damage to this dry calcareous and neutral grassland habitat has the potential to increase the frequency of disturbed bare ground within the dry grassland habitat, which in turn has the potential to result in the establishment of invasive species present within the locality (e.g. Butterfly-bush).

Moreover, this dry calcareous and neutral grassland habitat also has the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their ability to degrade the epidermis layer of floral species.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term adverse impact of moderate significance for this dry calcareous and neutral grassland habitat located within the St Helena's green area.

Dry meadow and grassy verges [Higher Local]

As a result of the proposed Scheme's pedestrian, road and light rail infrastructure, the dry meadow and grassy verges habitat will lose linear sections of habitat along the Broombridge Road, Tolka Valley Park, Finglas Bypass (R135), and St Margaret's Road. In the case of the St Margaret's Road the dry grassy verge habitats will be completely removed during the Construction Phase. There will be a temporary 73% (0.84ha) reduction in the total dry meadow habitat.

The retained dry meadows will still be vulnerable to an array of potentially damaging impacts generated by construction activities within the Tolka Valley Park and along the Royal Canal, Broombridge Road and

Finglas Bypass (R135) (see Chapter 6 (Construction Activities)). Accidental spillages of harmful substances (e.g. hydrocarbons and solvents), which may come in direct contact with and negatively impact the physiological health of grassland flora; as well as penetrating into the sub-surface / groundwater and degrading the grassland flora's root systems, resulting in further degradation and the potential death of less resilient species, thus lowering overall health and biodiversity value of these grassland habitats.

Additionally, these dry meadow habitats have the potential to be physically damaged from excessive footfall from workers present on-site, compaction from light and heavy machinery and temporary material stock-piling. Such damage to the habitat may result in an increased frequency of disturbed bare ground within the grassland habitat, which in turn has the potential to potentially result in the establishment of invasive species present within the locality (e.g. Butterfly-bush).

Furthermore, these dry meadow and grassy verge habitats also have the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the cellular structures of floral species.

Moreover, the potential spread of invasive non-native floral species, in particular Japanese Knotweed, from its current locations within Tolka Valley Park into adjacent habitats such as the dry meadows, has the potential to result in the displacement of native flora via shading impacts and higher rates of colonisation within areas of open and/or disturbed ground.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short-term adverse impact of moderate significance for the dry meadow and grassy verge habitats located within the proposed Scheme's boundaries.

(Mixed) broadleaved woodland [Higher Local]

All mixed woodland habitat is set to be retained within the proposed Scheme's landscaping, see Urban Integration Report (Volume 5 - Appendix A21.2). These retained mixed broadleaved woodland habitats will still be exposed to a range of potentially adverse impacts generated by construction activities within the Tolka Valley Park and Mellowes Park (see Chapter 6 (Construction Activities)). Scenarios where accidental spillages of deleterious substances (e.g. hydrocarbons and solvents) come in direct contact with and negatively impact the physiological health of the trees and understorey flora; as well as seeping into the sub-surface / groundwater and degrading the root systems of these wet woodland flora, resulting in further degradation and potentially death. Such impacts will lower the overall health and biodiversity value of these broadleaved woodland habitats.

Additionally, the root systems of the woodland trees species within these habitats will be at risk of root compaction from heavy-machinery. Likewise, machinery used adjacent to the trees in these broadleaved woodland habitats may result in accidental damage of tree limbs, degrading health of these tree species.

The mixed broadleaved woodland habitats also have the potential to be adversely impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their ability to degrade the epidermis layer of floral species.

The above negative impacts, acting either alone or cumulatively, have the potential to result in the degradation and death of tree and understorey floral species within these mixed broadleaved woodland habitats, ultimately resulting in the fragmentation of these important woodland wildlife corridors, which currently provide dense understorey refuge and canopy cover within the Tolka Valley Park and alongside Mellowes Park.

Moreover, the potential spread of invasive non-native floral species, in particular Japanese Knotweed, from its current locations along the River Tolka into adjacent habitats such as the mixed broadleaved woodland, will result in the displacement of native species via shading impacts and higher rates of colonisation within areas of open and/or disturbed ground.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to long-term adverse impact of slight significance for the mixed broadleaved woodland habitats located within the proposed Scheme's boundaries.

Scattered trees and parkland [Higher Local]

Multiple groupings of scattered trees, and the immediate understorey vegetation, will be lost as result of the footprint of the pedestrian, road and light rail infrastructure. In total, 170 trees of varied maturity, mainly immature and semi-mature, will be removed from these parkland habitats present within/along Broombridge Luas Stop, Tolka Valley Park, St Helena's green area, Farnham green area, Casement Road, Wellmount Road, Patrickswell Place, Cardiff Castle Road, Mellowes Park, Finglas Bypass and St Margaret's Road.

The remaining scattered tree parkland habitats to be retained will still be vulnerable to a range of potential harmful impacts generated by construction activities throughout the length of the Scheme (see Chapter 6 (Construction Activities)). There are potential scenarios where accidental spills of deleterious substances (e.g. hydrocarbons and solvents) come in contact with and negatively impact the physiological health of tree and grassland species as well as seeping into the sub-surface / groundwater and degrading the root systems of these floral species, resulting in further degradation or even death, this in turn will lower the habitats ability to perform ecosystem function, as well as the overall biodiversity value of these habitats.

Moreover, the root systems of the immature and semi-mature trees within these parkland habitats will be vulnerable to root compaction from heavy-machinery and/or temporary material stock-piling. In addition, machinery used adjacent to the trees in these parkland habitats may lead to the accidental damage of tree limbs, degrading the health of these tree species.

These parkland habitats also have the potential to be adversely impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given that they are known to degrade the epidermis layer of floral species.

In addition to the direct habitat loss, the other adverse impacts, either alone or in-combination, have the potential to result in the degradation and death of parkland trees and understorey species. While the tree element of this habitat is already fragmented in nature, the decreased frequency of tree canopy throughout the length of proposed Scheme, especially within the more urbanised environments, will limit these habitats ability to provide safe navigable landscape features for faunal groups such as bats, birds and winged-invertebrates.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to long-term adverse impact of moderate significance for these scattered trees and parkland habitats located within the boundaries of the proposed Scheme.

Hedgerows [Higher Local]

A short section (approx. 10m) of hedgerow habitat will be lost as result of the footprint of the Royal Canal rail bridge, which is a loss of 5% of the total hedgerow habitat present within the proposed Scheme's boundaries. The retained hedgerow habitat will be vulnerable to a series of potential adverse impacts generated by construction activities along the north bank of the Royal Canal (see Chapter 6 (Construction Activities)). There is the potential for accidental spills of deleterious substances (e.g. hydrocarbons and solvents), which may come in contact with and negatively impact the physiological health of the floral species within the hedgerow habitat. If a notable volume of these deleterious substances is spilled, they have the potential to seep into the sub-surface / groundwater, leading to the degradation of the root systems of these flora, potentially resulting in death, thus lowering overall health and biodiversity value of this important wildlife corridor habitat.

Moreover, the spreading root systems of immature and semi-mature tree species, located along the edge of the hedgerow, will be vulnerable to root compaction from heavy-machinery and/or temporary material stock-piling. In addition, machinery used adjacent to the hedgerow may lead to the accidental damage of tree limbs, degrading health of hedgerow tree species.

Additionally, this hedgerow habitat also has the potential to be negatively impacted by dust-based pollution during construction activities, with cement-based dusts being of particular concern given their ability to degrade the epidermis layer of floral species.

In addition to the direct habitat loss, the other above negative impacts, acting either alone or cumulatively, have the potential to result in the degradation and death of tree and understorey floral species along the length of this hedgerow habitat, ultimately resulting in the fragmentation of this important wildlife corridor habitat, which currently provides dense understorey refuge and a linear canopy alongside the Royal Canal.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to long-term adverse impact of moderate significance for the hedgerow habitat located within the boundaries of the proposed Scheme.

Treelines [Higher Local]

Several short sections of treeline habitat will be lost as result of the footprint of the pedestrian, road and light rail infrastructure. In total, 29 trees of varied maturity, will be removed for the treeline habitats present along Wellmount Road, Patrickswell Place, Mellowes Road, Mellowes Park, Finglas Bypass and St Margaret's Road.

The treeline habitats to be retained within the proposed Scheme's boundaries will be susceptible to a range of potential negative impacts generated from the construction activities (see Chapter 6 (Construction Activities)). There is the potential for unintended spillages of deleterious substances (e.g. hydrocarbons, solvents and cement leachate) which may come in contact with and negatively impact the physiological health of the tree and understorey floral species within these treeline habitats. If sizeable volumes of these deleterious substances are split, they have the potential to seep into the sub-surface / groundwater in hazardous quantities, leading to the degradation of the root systems of these flora, potentially resulting in death, thus lowering overall health and biodiversity value of this important wildlife corridor habitat.

Additionally, the spreading root systems of these tree species will be vulnerable to root compaction from heavy-machinery and/or temporary material stock-piling. Likewise, machinery used adjacent to these treelines may result in the accidental damaging of tree limbs, degrading health of the treeline species.

Moreover, these treeline habitats also have the potential to be adversely impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their ability to degrade the epidermis layer of the leaves of tree species.

In addition to the direct habitat loss, the other above negative impacts, acting either alone or cumulatively, have the potential to result in the degradation and death of tree and understorey floral species along the length of these treelines, ultimately resulting in the fragmentation of this important wildlife corridor habitat within the urban landscape of proposed Scheme.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to long-term adverse impact of moderate significance for these treeline habitats located within the boundaries of the proposed Scheme.

Wet willow-alder-ash woodland [Higher Local]

A total of three semi-mature trees will be lost from the wet willow-alder-ash woodland habitat, as a result of the footprint of the pedestrian and light rail infrastructure, i.e. the proposed Tolka Valley LRT, pedestrian, and cycle bridge.

The retained wet willow-alder-ash woodland habitat will still be exposed to a range of potentially adverse impacts generated by construction activities within the Tolka Valley Park (see Chapter 6 (Construction Activities)). For instance, scenarios where accidental spillages of deleterious substances (e.g. hydrocarbons and solvents) come in direct contact with and negatively impact the physiological health of the trees and understorey flora; as well as seeping into the sub-surface / groundwater and degrading the root systems of

these wet woodland flora, resulting in further degradation and potentially death. Such an impact will lower the overall health and biodiversity value of this wet woodland habitat.

Additionally, the root systems of the woodland trees species along the left bank of the River Tolka will be at risk of root compaction from heavy-machinery. Likewise, machinery used adjacent to the trees in this wet woodland habitat may result in accidental damage of tree limbs, degrading the health of these tree species. Moreover, installation of falsework on the north bank of the River Tolka to enable the construction of the light rail bridge over the river has the potential to result in the physical degradation of the field and ground level flora species, via compaction from the temporary foundations of the falsework scaffolding, as well as trampling underfoot by the contractors building the installation.

This wet willow-alder-ash woodland habitat also has the potential to be negatively impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given that they are capable of degrading the epidermis layer of floral species.

The potential degradation and death of the wet woodland flora will also have a negative knock-on impact on structural integrity of the river bank where the habitat is located. This potential destabilisation of either bank of the River Tolka will put the remaining trees and understorey flora at risk of collapsing into the river during high erosion / high flow events. This in turn will result in a bare / exposed bankside, which will leave the habitat susceptible to colonisation by invasive non-native species, such as Himalayan Balsam and Giant Hogweed.

In addition to the trees that are proposed for removal, the other above negative impacts, acting either alone or cumulatively, have the potential to result in the degradation and death of tree and understorey floral species along the length of this wet woodland habitat, ultimately resulting in the fragmentation of this important riparian wildlife corridor, which currently provides dense understorey refuge and a riparian canopy alongside the River Tolka.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a short- to long-term adverse impact of moderate significance for this wet willow-alder-ash woodland habitat located within the proposed Scheme's site boundaries in the Tolka Valley Park.

Scrub [Higher Local]

The main impact for scrub habitat is direct habitat loss (approx. 82%) as a result of the physical footprint of the proposed Scheme, which is split between its removal to allow for the introduction of hard surfaces (pedestrian, road and light rail infrastructure) and conversion to different habitat types within the proposed Scheme's landscaping, see Urban Integration Report (Volume 5 - Appendix A21.2). Given that scrub habitat is relatively rare within the boundaries of proposed Scheme, this habitat loss is relatively small in regard to total area (m^2) lost but is nonetheless a significant loss for this habitat type.

The remaining scrub habitat to be retained will also be vulnerable to a range of potential adverse impacts generated by construction activities throughout the length of the Scheme (see Chapter 6 (Construction Activities)). For instance, accidental spills of deleterious substances (e.g. hydrocarbons and solvents) which may come in contact with and negatively impact the physiological health of floral scrub species, as well as seeping into the sub-surface / groundwater and degrading the root layers of these flora, potentially resulting in death, thus lowering overall health and biodiversity value of the habitat. Additionally, the spreading root systems of immature tree species, located along the edge of the scrub habitat, will be vulnerable to root compaction from heavy-machinery and/or temporary material stock-piling.

Furthermore, scrub habitats also have the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the cellular structures of floral species.

The above negative impacts, acting either alone or cumulatively, have the potential to result in the degradation and death of tree and understorey floral species along the length of scrub habitat, ultimately

resulting in the fragmentation of these important riparian wildlife corridors, particularly the scrub habitat west of the Broombridge Road bridge north of the Royal Canal walkway.

Moreover, the potential further spread of invasive non-native floral species, in particular Himalayan Balsam, Japanese Knotweed and Giant Hogweed, from their current locations within Tolka Valley Park into adjacent habitats such as the riparian scrub habitats, has the potential to result in the increased displacement of native flora via shading impacts and higher rates of colonisation within areas of open and/or disturbed ground.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a very significant, short- to long-term adverse impact on scrub habitats present within the ZoI of the proposed Scheme.

Ornamental / non-native shrub [Lower Local]

The two small linear stretches of ornamental / non-native shrub habitat along the St Margaret's Road will be removed in their entirety, in order to allow for the reconfiguration of the adjacent road and pedestrian infrastructure (see Chapter 6 (Construction Activities)).

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a permanent adverse impact of profound significance for the ornamental / non-native shrub habitat present within the site.

9.4.3.3 Rare and Protected Flora

Opposite-leaved Pondweed [National]

The Opposite-leaved Pondweed located downstream of the proposed Scheme, between the 1st and 3rd locks of the Royal Canal, will potentially be exposed to a range of construction-based emissions (surface water, groundwater and air to surface water-based pollutants) which will be generated within the proposed Scheme's work area at Broombridge (see Chapter 6 (Construction Activities)). Scenarios may arise where accidental spills of deleterious substances (e.g. hydrocarbons, solvents and/or cement leachate) come in contact with and negatively impact the Royal Canal's water quality; and potentially the Opposite-leaved Pondweed itself, degrading the plant's physiological health potentially resulting in death, resulting in a retraction of its range within the Royal Canal.

Moreover, given that Opposite-leaved Pondweed is also vulnerable to excessive nutrient-based pollution, i.e. eutrophication (bound with nitrogen and phosphorus), sediment entering the canal via spills or dust settlement, into the Royal Canal during the construction works will also prove detrimental to this protected species.

While there is the potential for groundwater / groundwater-to-surface water pollution for other aquatic habitats within the boundaries of the proposed Scheme, the Royal Canal is entirely sealed and is therefore not susceptible to impacts associated with polluted groundwater recharge. Therefore, Opposite-leaved Pondweed will not be adversely impacted via the groundwater pathways.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of moderate significance for Opposite-leaved Pondweed, as a result of potential pollution events negatively impacting the local population within the Royal Canal.

Tassel Stonewort [National]

As Tassel Stonewort is a pollution sensitive species, it will be particularly vulnerable to negative impacts on the water quality of the Royal Canal. In the event of a pollutant (e.g. hydrocarbons) entering the Royal Canal, the local Tassel Stonewort population (located 180m west of Broombridge) may be degraded, resulting in a retraction of its range within the canal.

Additionally, given that Tassel Stonewort is also vulnerable to excessive nutrient-based pollution, sediment entering the canal via spills or dust settlement, (bound with nitrogen and phosphorus), into the Royal Canal

during the construction works (see Chapter 6 (Construction Activities)) will also prove detrimental to this sensitive species.

Regarding the potential impacts via groundwater pollution, as the Royal Canal is entirely sealed, it is therefore not susceptible to pollution-based impacts via groundwater recharge. Therefore, Tassel Stonewort will not be adversely impacted via the groundwater pathways.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term negative impact of moderate significance for Tassel Stonewort, as a result of potential pollution events negatively impacting the local population within the Royal Canal.

Pointed Stonewort [County]

Pointed Stonewort located downstream of the proposed Scheme, between the 2nd and 3rd locks of the Royal Canal, will potentially be exposed to a range of construction-based emissions which will be generated within the proposed Scheme's works area at Broombridge (see Chapter 6 (Construction Activities)). For instance, in the event of a pollutant (e.g. hydrocarbons) being accidentally introduced into the Royal Canal, the local Pointed Stonewort population may be degraded, resulting in a retraction of its range within the Royal Canal.

Additionally, while Pointed Stonewort is considered to be one of the more nutrient pollutant tolerant species, it is still susceptible to degradation and death under highly eutrophication conditions. Therefore, if sediment were to enter the canal via spills or dust settlement (bound with nitrogen and phosphorus), during the construction works, it will prove detrimental to this rare species.

In relation to potential groundwater pollution impacts, given that the Royal Canal is entirely sealed, it is therefore not feasible for the species it supports to be negatively affected by polluted groundwater recharge. Therefore, Pointed Stonewort will not be adversely impacted via the groundwater pathways.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of moderate significance for Pointed Stonewort, as a result of potential pollution events negatively impacting the local population within the Royal Canal.

Rare / Uncommon Freshwater Macrophytes: Clustered Stonewort [Higher Local]

Given that the Clustered Stonewort is located downstream of Broombridge, within the 1st and 2nd, and the 6th and 7th canal locks, it will potentially be exposed to a range of construction-based emissions (see Chapter 6 (Construction Activities)). In a scenario where pollutants (e.g. hydrocarbons) were accidentally introduced into the canal, the local Clustered Stonewort population may be degraded, resulting in a retraction of its range within the Royal Canal.

As Clustered Stonewort is notably sensitive to eutrophication conditions, were sediment to enter the canal via spills or dust settlement (which is bound with nitrogen and phosphorus), during the construction works, this will prove detrimental to this rare stonewort species.

In regard to potential groundwater pollution impacts, given that the Royal Canal is entirely sealed, it is therefore not possible for polluted groundwater to penetrate this artificial waterbody, which effectively safeguards the floral communities within. Therefore, it is not predicted that Clustered Stonewort will be adversely impacted via the groundwater pathways.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term negative impact of slight significance for Clustered Stonewort, as a result of potential pollution events negatively impacting the local population within the Royal Canal.

Uncommon / Rare Terrestrial Flora: Pyramidal Orchid and Bee Orchid [Higher Local]

Both Pyramidal Orchid and Bee Orchid are present outside of the physical footprint of the proposed light rail, road and pedestrian infrastructure, i.e. no physical works are to take place within their immediate locations (Pyramidal Orchid – St Helena's retained meadow area; Bee Orchids – Mellowes Park and dry grassland / recolonising area east of the Stabling site). However, their retained status will not safeguard

them from potential accidents on-site which may result in these rare flora being trampled underfoot or compacted by machinery (see Chapter 6 (Construction Activities)).

Both species are located within the ZoI's surface water and groundwater and air pollution pathways. The single Pyramidal Orchid and group of three Bee Orchids are present within close proximity to the construction works and are vulnerable to degradation via pollutant spills (surface water run-off and groundwater sub-soil infiltration) on site within the St Helena's area and Mellowes Park, respectively.

Additionally, both the Pyramidal Orchid and Bee Orchids have the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their capacity to degrade the species' epidermal structures, degrading the health of the flora, and potentially resulting in death.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term, adverse impact of slight significance for these uncommon / rare floral species (Higher Local), as a result of potential surface water, groundwater and/or dust settlement pollution events negatively impacting the local populations within the ZoI.

9.4.3.4 Protected Fauna

Otter [International]

The local Otter population will potentially be exposed to a range of construction-based emissions (surface water, groundwater and air to surface water-based pollutants), as well as the habitat loss which will be generated within the Scheme's work area at Broombridge along the Royal Canal and within the Tolka Valley Park (see Chapter 6: Construction Activities).

Physiological and Habitat Degradation via Pollutants

In the event that hydrocarbon pollutants are accidentally introduced into the local surface water and groundwater (surface water recharge) networks, local Otters may suffer from degraded furs notably impacting the furs' insulative qualities as result of a disruption to fur's natural water-proofing oils and its capacity to trap warm air close to the body, resulting in physiological stress for any affected Otters. In addition, these hydrocarbons can potentially be ingested by Otters as they groom their affected furs, leading to haemorrhagic gastroenteropathy, which will likely result in Otter mortalities (Baker et al., 1981). Moreover, surface water and groundwater-to-surface water-based pollution impacts have the potential to indirectly impact Otter via the deterioration of prey items in the food chain for Otter. This impact also has a knock-on effect as the consumption of prey items containing polluting elements may lead to bioaccumulation of toxic substances within the local Otter population. Accumulation of such toxic substances is known to result in pulmonary distress in the lungs of mammals, in addition to the general carcinogenic effects.

Disturbance

At present there are no Otter holts or couches within the physical footprint of the proposed Scheme; however; there is one confirmed holt (utilised within the last 18 months) present within the disturbance buffer for Otter. With the holt located 35m east of the Broombridge Luas station, the local Otter population will be subject to visual and auditory disturbance impacts in the event that this holt is active during the Construction Phase. Such impacts have the potential to discourage the use of this holt, potentially resulting in a temporary restriction in territory for local male and female Otters which reside within this stretch of the Royal Canal. Additionally, it cannot be predicted whether the local Otters will establish new holts or couches (protected resting sites) in the time prior to the commencement of the Construction Phase along the Royal Canal, so there is the potential for more than one resting site to be impacted by disturbance along the 310m (approx.) stretch of the Royal Canal where construction activities will be taking place, plus the 150m disturbance buffer upstream and downstream of the works. This is also the case for the River Tolka, which currently does not host any Otter resting sites within the proposed works area, nor 150m upstream or downstream of the works; but has appropriate habitat for such resting sites to be established.

Habitat Loss and Fragmentation

The works within a section of the Royal Canal at Broombridge will result in temporary habitat loss and fragmentation for local Otters, with both their foraging and commuting activities being negatively impacted during work hours. This temporary habitat fragmentation impact will also occur as result of the construction works that will take place within the River Tolka's riparian zone; and while the river itself will still be open for foraging and commuting, the banks will undergo a degree of vegetation removal, which in turn removes the safe commuting corridor for Otter on the river banks. Additionally, work sites within the Royal Canal and River Tolka riparian corridor may lead to potential loss of life for individual Otters in the case of accidents within the construction site (e.g. accidental trappings), after failure to exclude entry.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of moderate significance for the local Otter population, given the timescales and nature of the above impacts.

Bats [County]

Roost Disturbance

Given the absence of bat roosts amongst the semi-mature / mature trees and artificial structures within and immediately adjacent to the boundaries of the proposed Scheme, adverse impacts on current bat roosting activities are not predicted during the Construction Phase; therefore, no derogation licences are required for the disturbance of bat roosts as a result of the construction works. However, the Construction Phase works (see Chapter 6 (Construction Activities)) will also result in the loss of a 202 immature / semi-mature /mature trees, plus a 5% reduction of total hedgerow habitat (mixture of semi-mature trees within scrub) within the site. This will ultimately result in a short- to medium-term loss of potential roosting features that may form within these trees in the next several years.

Within the wider local landscape (within 3km of the proposed Scheme), a total of six roosts were identified supporting three species (Soprano Pipistrelle [one], Leisler's Bat [three] and Brown Long-eared Bat [two]) were recorded as a part of the desktop study. As the CSZs of these bat roosts include habitats within works area, which may be removed or degraded during the Construction Phase, these six roosts will potentially have their core foraging grounds negatively impacted. In specific site areas, this impact is certain, as a number of habitats will need to be either temporarily or permanently removed in order to allow for the construction of the pedestrian, cycleway and light rail infrastructure; while other habitats are only at risk of potential degradation through construction-based emissions via surface water, groundwater and air impact pathways. However, given that the percentage area of CSZs affected by these confirmed and potential impacts are minute, (Soprano Pipistrelle = 0.58%; Leisler's Bat = 0.23%; 0.58% and 1.02%; and Brown Long-eared Bat = 0.09% and 0.46%), only negligible adverse impacts are predicted in respect to bats occupying these six bat roosts.

Lighting Disturbance of Foraging and Commuting Activities

Direct and indirect impacts are likely to occur on foraging and commuting identified bat species frequenting the habitats within and adjacent to the Scheme's boundary, as a result of the introduction of additional artificial lighting during the Construction Phase. Direct lighting impacts refers to compound or works areas lighting spilling into adjacent habitats that support the foraging and movements of nocturnal animals, such as the local bat species. This light spillage will cause local bats to avoid these excessively lit habitats, which effectively reduces the total habitat available to them for both foraging and commuting within and adjacent to the boundaries of the proposed Scheme. In some potential cases, such light spillage may cut-off commuting routes along linear habitat features, e.g. lighting spillage south from the proposed compound area immediately north of the Royal Canal may deter bats from commuting and east-west / west-east along this section of the canal.

The indirect lighting impacts have the potential to arise through influencing the distribution and frequency of the local bats prey items within habitats adjacent to areas within additional construction- / compound-based lighting, resulting in a negative impact on foraging activity, especially for bats which are extra sensitive to lighting, i.e. Daubenton's Bat. As these additional lights will attract nocturnal winged-invertebrates towards them out of the usual host habitat (van Langevelde et al., 2018), the local bat species will be left with the option to commute to new foraging grounds or pursue their prey and in turn enter the light impacted area.

For some bat species who have adapted relatively well to urban landscapes, namely Common Pipistrelle, Soprano Pipistrelle, Nathusius' Pipistrelle and Leisler's Bat, the pursuit of prey items into light impacted areas is less impactful (Russ and Montgomery, 2002; Russ et al., 2003). Moreover, studies have shown that pipistrelle species and Leisler's Bat can congregate around urban street lighting feeding on the nocturnal winged-insects attracted to the lower impact lighting (Rydell et al., 1993, Blake et al., 1994; Stone et al., 2015; Spoelstra et al., 2015; 2017). The remaining bat species, i.e. Daubenton's Bat, Brown Long-eared Bat and Whiskered / Brandt's Bat, will be less likely to forage within these light impacted areas, which will result in affected individuals commuting further to new foraging grounds and expending additional energy reserves as result, a significant physiological impact for any small mammal species with limited fat reserves.

Habitat Loss and Fragmentation

Temporary habitat fragmentation / loss impact will occur as result of the construction works that will take place within the River Tolka's riparian zone; and while the river itself will still be open for foraging and commuting, the banks will undergo a degree of vegetation removal, which will in turn remove a section of the local bats' known commuting corridor along the river banks. Additionally, the removal of semi-mature and mature trees from treelines will likely impact the commuting corridors of the local bat species, particularly those based in the more urbanised areas outside of the larger parks / green areas, i.e. Wellmount Road, Patrickswell Place, Mellowes Road, Finglas Bypass and St Margaret's Road.

Physiological and Habitat Degradation via Pollutants

Of the bat species identified utilising the habitats within and adjacent to the proposed Scheme's work area, the local Daubenton's Bat population will be particularly vulnerable to direct adverse surface water-based impacts during the Construction Phase, given that its unique hunting technique of catching invertebrates floating on top of waterbodies results in an increased frequency of surface water contact, in comparison to other bat species which only drink from the water's surface. Were hydrocarbon pollutants accidentally introduced into the local surface water and groundwater (surface water recharge) networks, local Daubenton's Bat may come in contact with the substance whilst hunting along the surface of a waterbody, with potential additional contact when considering the small splash created when catching prey.

A series of direct and knock-on impacts will occur as a result of this direct contact. The affected individual's feet / claws will be covered in the slick hydrocarbon substance reducing its ability to catch and hold prey items reducing foraging success; and in the event that the individual manages to catch and consume a prey item, which is now partial coated with the hydrocarbon, the bat will physiologically suffer from the ingestion of the contaminated prey item. Furthermore, the act of bringing the prey item to its mouth may also result in the spread of the hydrocarbon to the bat's face, potentially affecting its breathing airways and eyes. Following the direct contact with the hydrocarbon, the affected bat may return to its roost where it will hang from its claws, and orientation which will allow for the hydrocarbon to flow downwards, towards the bat's torso, where it will seep into its fur. Also, these hydrocarbons can potentially be ingested by bats as they groom their affected fur, leading to further physiological stress.

The affected Daubenton's Bat, with its fur now contaminated and its insulative qualities degraded as result of the disruption of its furs' ability to trap air (heat) close to the body, will likely seek out other bats within the roost, if not already in a group, so that it may better achieve suitable thermoregulation whilst resting. This act has the potential to spread the hydrocarbon on to the furs of the other bats within the roost. While the volume of the hydrocarbon spread to the other bats at this point is likely be negligible, were several bats from the same roost to encounter a hydrocarbon slick within the local surface waterbody over a short period of time the cumulative exposure to the hydrocarbon may prove detrimental to roost's overall health / fecundity status. While the likelihood of the above scenario is relatively low, worst-case scenarios must be considered under the precautionary principle.

All identified bat species (Common Pipistrelle; Soprano Pipistrelle; Nathusius' Pipistrelle; Leisler's Bat; Brown Long-eared Bat; Daubenton's Bat; and Whiskered/ Brandt's Bat) are at risk of potentially being adversely impacted through the direct ingestion of contaminated water during the Construction Phase. In the event a bat was to drink from a waterbody, which had been accidentally contaminated with polluting substance, (in particular a pollutant which floats on top of the water's surface e.g. hydrocarbons), the bat has the potential to fly over a slick of contaminated water with its mouth open, consuming water from the

top of the waterbody's surface. The consumption of such water can potentially result in damaged lungs and/or carcinogenic effects for affected individual.

Additionally, surface water, groundwater and air (dust)-based construction emissions have the potential to lead to pollution impacts that will indirectly impact all local bat species via degradation of local habitats resulting in the deterioration of quality and decreased frequency of their terrestrial- and/or aquatic-based prey items in the food chain. This impact also has a knock-on effect as the consumption of prey items containing polluting elements may lead to bioaccumulation of toxic substances within the local bat populations, resulting in physiological stress and potential reduced fecundity.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of moderate significance for the local bat species, as a result of potential noise, vibration and artificial light as well as disturbance to habitats in which bats may forage and commute.

Other Terrestrial Mammals [Higher Local]

The local Irish Hare, Badger, Pine Marten, Stoat, Hedgehog and Pygmy Shrew populations will potentially be exposed to a range of construction emissions (surface water, groundwater and air-based pollutants) which will be generated within the proposed Scheme's work area (see Chapter 6 (Construction Activities)).

Physiological and Habitat Degradation via Pollutants

In the event that hydrocarbon pollutants are accidentally introduced into the local surface water and groundwater (surface water recharge) networks, Irish Hare, Badger, Pine Marten, Stoat, Hedgehog and Pygmy Shrew individuals may come in contact with the substance whilst navigating a waterway or wetland, resulting in degraded furs, which will notably impact their furs' insulative qualities, resulting in physiological stress for any affected individuals. Additionally, these hydrocarbons can potentially be ingested by these protected mammal species as they groom their affected furs, leading to further physiological stress.

All local mammal species are at risk of potentially being adversely impacted through the direct ingestion of contaminated water during the Construction Phase. In the event that a mammal were to drink from a waterbody, which had been accidentally contaminated with polluting substance, (in particular a pollutant which floats on top of the water's surface e.g. hydrocarbons), this can potentially result in damaged lungs and/or carcinogenic effects for affected individual.

Moreover, surface water, groundwater and air (dust)-based pollution impacts have the potential to indirectly impact these mammal species via the deterioration in quality and population decline (availability) of prey items in their respective food webs. This impact also has a knock-on effect as the consumption of contaminated prey items may lead to bioaccumulation of toxic substances within the local populations of these protected mammal species.

Habitat Loss and Fragmentation

There will be a temporary fragmentation / loss of habitats, most notably within the Tolka Valley Park and Mellowes Park, as result of the construction works that will take place. Within the Tolka Valley Park, the river will remain open for commuting purposes but the dry meadows and river banks will undergo vegetation removal. This removal of vegetation will in turn remove a notable section of the east-west commuting corridor within the Tolka Valley Park for these protected mammal species. In Mellowes Park, construction works will lead to a longitudinal divide between the parkland and the mixed broadleaved and conifer woodland which runs along the eastern boundary of the park.

Disturbance

Adverse impacts to terrestrial mammals may also arise in the form of visual and audible disturbance to foraging and commuting activities, as well as potential loss of life in the case of accidents within the construction site (e.g. accidental trappings), after failure to exclude entry.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of slight significance for these mammal species, as a result of potential impacts.

Marine Mammals [County]

The downstream marine mammal populations will potentially be exposed to a series of construction-based emissions (surface water, groundwater and air-based pollutants), which will be generated / occur within the proposed Scheme's work area (see Chapter 6 (Construction Activities)).

Physiological and Habitat Degradation via Pollutants

During the construction works, adverse impacts may arise in the form of accidental introduction of pollutants, such as hydrocarbons, into the local surface water and groundwater (surface water recharge) networks, which can have the ability to degrade the insulative qualities of marine mammal furs, such as Harbour Seal and Grey Seal, which inhabit the River Tolka Estuary. Furthermore, surface water and groundwater-to-surface water-based pollution impacts have the potential to indirectly impact marine mammals species via the deterioration of prey items in the food chain. This adverse impact also leads to a knock-on effect as the consumption of prey items containing polluting elements may lead to bioaccumulation of toxic substances within the marine mammal populations that frequent Dublin Bay.

All marine mammal species are at risk of potentially being adversely impacted through the exposure of contaminated water during the Construction Phase. In the event that a marine mammal were to drink from a waterbody, which had been accidentally contaminated with polluting substance, (in particular a pollutant which floats on top of the water's surface e.g. hydrocarbons), the marine mammal has the potential to swim through a slick of contaminated water with its mouth open, consuming water from the top of the waterbody's surface. Exposure to hydrocarbons can result in range of damaging effects, including direct consumption which leads to adrenal dysfunction, reduced reproductive success, impacted immune systems, haematological injury and organ alteration; dermal exposure resulting in eye irritation and lacrimation; lung diseases and/or lesions from direct (physical contact) airway exposure; and inhalation of volatiles leading to neurotoxicity and abnormal behaviour, all of which can lead to mortality and population decline (Ruberg et al. 2021).

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of moderate significance for these marine mammal species, as a result of above potential impacts.

Breeding Birds [Higher Local, County, Regional]

The local breeding bird populations will potentially be exposed to a series of construction-based emissions (surface water, groundwater and air-based pollutants) and land-take (habitat loss), which will be generated / occur within the proposed Scheme's work area (see Chapter 6 (Construction Activities)).

Reduction of Nesting Sites

Local breeding bird species will experience a reduction in current and potential nesting sites as result of the general vegetation clearance and tree felling required to allow for the installation of pedestrian, road and light rail infrastructure. The required tree felling will result in the loss of four of the five active nests noted during the 2024 breeding bird surveys, three of which are occupied by protected Wood Pigeon (Annex II & III) and the fourth by Magpie (Green-listed). A total of 11 bird species (i.e. Greenfinch; Grey Wagtail; Goldcrest; House Sparrow; Spotted Flycatcher; Starling; Wood Pigeon; Meadow Pipit; Linnet; Willow Warbler; and Skylark) which are protected and/or of conservation concern (Amber / Red-listed), will have their preferred nesting habitats negatively impacted (reduced) as result of the temporary and/or permanent loss of grassland; hedgerow; treeline; scrub; woodland / parkland; riverbank; and artificial (structure) habitats. Moreover, 18 Green-listed species recorded within or adjacent to the boundaries of the proposed Scheme will also be impacted from the habitat loss outlined above. Ultimately, 29 local breeding bird populations will experience a short-term to medium-term loss of potential nesting sites as a result of the construction works.

Habitat Loss, Fragmentation and Degradation

Additionally, habitat loss and the general deterioration of retained habitats through surface water, groundwater or air-based pollutants have the potential to reduce and/or degrade the foraging grounds of local breeding bird species. The degradation of floral species in these habitats has the potential to negatively impact insectivorous bird species of conservation concern (i.e. Goldcrest; Grey Wagtail; Black-headed Gull; Herring Gull; House Martin; Lesser Black-backed Gull; Kingfisher; Spotted Flycatcher; Tufted Duck; and Meadow Pipit), who are reliant on healthy host flora supporting a range of invertebrate species, which feed on or frequent these flora for foraging purposes. Similarly, seed- and frugivorous or fruit/berry-eating bird species of conservation concern (i.e. Greenfinch and Wood Pigeon) will be adversely impacted if pollutant-affected flora were unable to produce these reproductive products, or only produce low-quality and/or below average quantities of these food sources. A number of omnivorous bird species of conservation concern will be negatively impact by both of the above scenarios, namely Mallard; Mute Swan; House Sparrow; Starling; Meadow Pipit; and Linnet. Mallard and Mute Swan will also be negatively impacted by the reduction in quantity and quality of their preferred grazing flora species. The polluting of the local waterbodies also has the potential to negatively affect the local fish populations, which will in turn adversely impact piscivorous species of conservation concern, such as Cormorant and Kingfisher. Such impacts on foraging grounds and diet will range from temporary to short-term in regard to impact length.

The temporary and permanent habitat loss, as well as potential habitat degradation, have the potential to result in habitat fragmentation within the boundaries of the proposed Scheme. The temporary fragmentation of habitats will take place within the Tolka Valley Park and Mellowes Park, as a result of the construction works that will take place. Within the Tolka Valley Park, the river will remain open for commuting purposes but the dry meadows and river banks will undergo vegetation removal, leading to gap within the riparian commuting corridor. In Mellowes Park, construction works will lead to a longitudinal divide between the parkland and the mixed broadleaved and conifer woodland which runs along the eastern boundary of the park. Potential degradation of habitats to be retained, through direct physical or pollutant-based impacts, also has the potential to increase the width of these habitat divisions in these parklands as well as other green spaces within the boundaries of the Scheme. While the level of fragmentation in regard to movement / distance travelled is within acceptable range for standard commuting purposes for the local breeding bird species, the lack of cover / refuge is problematic for any bird species which can be hunted by local predators, such as Buzzard and Sparrowhawk *Accipiter nisus* (both Green-listed species), thus increasingly the likelihood of being predated and reducing the local populations of breeding bird species of conservation concern. The potential loss of juvenile and/or adult birds of conservation concern will result in short-term impact for local breeding bird species.

Physiological Degradation

In a scenario where hydrocarbon pollutants are accidentally introduced into the local surface water and groundwater (surface water recharge) networks, breeding birds may come in contact with the substance whilst navigating, drinking from, foraging in or washing within a waterbody or wetland, resulting in degraded feathers, which will notably impact their feathers' insulative qualities, resulting in physiological stress for any affected individuals. Also, these hydrocarbons can potentially be ingested by bird species as they preen their affected feathers, leading to further physiological stress.

All local breeding bird species are at risk of potentially being adversely impacted through the direct ingestion of contaminated water during the Construction Phase. In the event that a bird were to enter a waterbody, which had been accidentally contaminated with a polluting substance, (in particular a pollutant which floats on top of the water's surface e.g. hydrocarbons), the bird could consume water from the upper (polluted) layers of the water column. This also applies to bird species which drink from waterbodies while in flight (e.g. House Martin). The consumption of such water can potentially result in reduced egg production and hatching; increased clutch or brood abandonment; reduced growth and increased organ weights (Albers, 2006).

Moreover, surface water, groundwater, and air (dust) -based pollution impacts have the potential to indirectly impact breeding bird species via the deterioration of food / prey items in the food chain for the local bird species. This impact also has a knock-on effect as the consumption of prey items containing polluting

elements may lead to bioaccumulation of toxic substances within the local breeding bird populations (Costa et al., 2013; Idan and Jazza, 2022; and Ding et al., 2023).

Disturbance

Additionally, breeding bird species that utilise the site for commuting or foraging purposes may also be visually and/or audibly disturbed by the construction works and workers entering /exiting the works area, causing these breeding bird species to vacate the site during active work periods. Additionally, the clearance of vegetation within and adjacent to the works area will increase local breeding bird species alert distances as there will be less vegetation available for refuge (Fernández-Juricic et al., 2001).

Noise generated by the construction works has the potential to effect egg production, incubation, brooding, predators, brood parasites, and abandonment, as well as the ability to find or attract a mate and the ability of parents to hear and respond to begging calls of their offspring. Any bird species that regularly experience fright–flight responses or failure to attract mates and defend territories (Slabbekoorn and Ripmeester, 2008) as a result of the excessive noise, will likely suffer from decreased fecundity of their local respective populations (Ortega, 2012). Given the projected length of the Construction Phase, a temporary to short-term disturbance impact is predicted for local breeding bird populations.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a range of temporary to medium-term adverse impacts of slight significance for these breeding bird species of conservation concern, as a result of the above impacts.

Wintering Birds [Higher Local, County, International]

Environmental pollutants accidentally introduced via the surface water, groundwater and/or air impact pathways into the habitats within and adjacent to proposed Scheme's boundaries during the Construction Phase (see Chapter 6 (Construction Activities)) have the capacity to negative impact wintering bird species which utilise these habitats.

Habitat Loss, Fragmentation and Degradation

The temporary and permanent habitat loss associated within the Construction Phase, as well as the potential deterioration of retained habitats through surface water, groundwater or air-based pollutants have the potential to reduce and/or degrade the foraging grounds of wintering bird species. The degradation of floral species in these habitats has the potential to negatively impact insectivorous bird species of conservation concern (i.e. Black-headed Gull; Common Gull; Curlew; Herring Gull; Lapwing; Lesser Black-backed Gull; Redwing and Tufted Duck), which are reliant on healthy host flora supporting a range of invertebrate species, which feed on or frequent these flora for foraging purposes. Similarly, berry-eating bird species of conservation concern (i.e. Redwing) will be adversely impacted if pollutant-affected flora were unable to produce these reproductive products, or only produce low-quality and/or below average quantities of these food sources. A number of omnivorous bird species of conservation concern will be negatively impact by both of the above scenarios, namely Mallard and Mute Swan. Additionally, Barnacle Goose; Light-bellied Brent Goose; Mallard and Mute Swan will also be negatively impacted by the reduction in quantity and quality of their preferred grazing flora species. Also, the polluting of the local waterbodies also has the potential to negatively affect the local fish populations, which will in turn adversely impact piscivorous species of conservation concern, such as Cormorant. Such impacts on foraging grounds and diet will range from temporary to short-term in regard to impact longevity.

The temporary and permanent habitat loss, as well as potential habitat degradation, have the potential to result in habitat fragmentation within the boundaries of the proposed Scheme. The temporary fragmentation of habitats will mainly take place mainly within the Tolka Valley Park and Mellowes Park, as result of the construction works. Within the Tolka Valley Park, the River Tolka will remain open for commuting purposes for waterfowl and wading species, but the dry meadows and river banks will undergo vegetation removal, leading to gap within the riparian commuting corridor. In Mellowes Park, construction works will lead to a longitudinal divide between the parkland and the mixed broadleaved and conifer woodland which runs along the eastern boundary of the park. Potential degradation of habitats to be retained, through direct physical or pollutant-based impacts, also has the potential to increase the width of these commuting corridor fragmentation within these parklands, as well as other green spaces within the boundaries of the Scheme.

While the level of fragmentation in regard to movement / distance travelled is within an acceptable range for standard commuting purposes for bird species, the lack of cover / refuge is problematic for smaller bird species (i.e. Redwing), which can be hunted by local predators, such as Buzzard and Sparrowhawk, thus increasingly the likelihood of being predated and reducing the Redwing wintering population (short-term impact).

Physiological Degradation

In the event that hydrocarbon pollutants are accidentally introduced into the local surface water and groundwater (surface water recharge) networks, wintering bird species may come in contact with the substance whilst navigating, drinking from, foraging in or washing within a waterbody or wetland, resulting in degraded feathers, which will notably impact their feathers' insulative qualities, resulting in physiological stress for any affected individuals. Furthermore, these hydrocarbons can potentially be ingested by bird species as they preen their affected feathers, leading to further physiological stress.

Wintering bird species are at risk of potentially being adversely impacted through the direct ingestion of contaminated water during the Construction Phase of the proposed Scheme. If a wintering bird were to drink from a waterbody which had been accidentally contaminated with polluting substance, (in particular a pollutant which floats on top of the water's surface e.g. hydrocarbons), the bird would consume water from the upper (polluted) layers of the water column. The consumption of such water can potentially result in reduced egg production and hatching; increased clutch or brood abandonment; reduced growth and increased organ weights (Albers 2006).

Moreover, surface water, groundwater, and air (dust)-based pollution impacts have the potential to indirectly impact wintering bird species via the deterioration of food / prey items. This impact also has a knock-on effect as the consumption of prey items containing polluting elements may lead to bioaccumulation of toxic substances within the insectivorous and omnivorous wintering bird populations, such as Black-headed Gull; Common Gull; Curlew; Herring Gull; Lapwing; Lesser Black-backed Gull; Mallard; Mute Swan; Redwing and Tufted Duck (Costa et al. 2013; Idan and Jazza 2022; and Ding et al. 2023).

Disturbance

Additionally, wintering bird species that utilise the site for commuting or foraging purposes may also be visually and/or audibly disturbed by the construction works and workers entering /exiting the works area, causing these breeding bird species to vacate the site during active work periods. Furthermore, the clearance of vegetation within and adjacent to the works area will increase wintering bird species alert distances, for species such as Redwing, as there will be less vegetation available for refuge (Fernández-Juricic et al. 2001).

Additionally, wintering bird species that utilise the amenity grasslands within and adjacent to the site (i.e. Tolka Valley Park, Farnham, Mellowes Park and Erin's Isle playing pitches) for foraging purposes may also be visually and/or audibly disturbed by the construction works, causing wintering bird species such as Black-headed Gull; Barnacle Goose; Common Gull; Curlew; Herring Gull; Lapwing; Lesser Black-backed Gull; Light-bellied Brent Goose, to vacate these foraging / grazing habitats during active work periods. This impact is particularly problematic for long-distance migrant species, which are heavily reliant on inland foraging (i.e. the Dublin Bay wintering population of Light-bellied Brent Goose), as regular disturbance whilst foraging may adversely affect energy reserves of these wintering species, which will in turn, negatively impact nesting success, fecundity, and survival of individuals (Ankney and MacInnes, 1978; Krapu, 1981; Havera et al., 1992; and Pease et al., 2005). Visual and noise disturbance-based impacts are predicted to range from temporary to short-term in regard to longevity.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of slight significance for Red, Amber and Green-listed wintering bird species, barring Black-headed Gull and Light-bellied Brent Goose which may experience temporary to short-term adverse impacts of moderate significance, as a result of impacts listed above.

Reptiles [Higher Local]

Physiological and Habitat Degradation via Pollutants

Deleterious pollutants accidentally introduced via surface water pathways into the habitats located on-site and adjacent, during the Construction Phase (see Chapter 6 (Construction Activities)), will reduce the capacity of these habitats to support the foraging activities of local Common Lizard population. Furthermore, surface water- and groundwater- and air (dust)-based pollution impacts have the potential to indirectly impact Common Lizard via the deterioration of food / prey items in the food chain for the local Common Lizard population. This impact also has a knock-on effect as the consumption of prey items containing polluting elements may lead to bioaccumulation of toxic substances within the local Common Lizard population.

Disturbance

Common Lizard may also be subjected to disturbance-based impacts in habitats adjacent to the site boundary at Broombridge, which have the potential to negatively impact their foraging and commuting activities, as well as potential loss of life in the unlikely event that individuals enter the construction site (e.g. accidental trappings), after failure to exclude entry.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of slight significance for Common Lizard, as a result of potential surface water, groundwater, air (dust) pollution; toxin bioaccumulation / disruption of food-chain, as well as general disturbance and potential fatalities within the site (accidental entrapment).

Amphibians [Higher Local]

Physiological and Habitat Degradation via Pollutants

Deleterious pollutants accidentally introduced via surface water, groundwater and air(dust) pathways into the habitats located on-site and adjacent, during the Construction Phase (see Chapter 6 (Construction Activities)), will reduce the capacity of these habitats to support the foraging, spawning and hibernation activities of both Common Frog and Smooth Newt.

This of particular concern within wetland and aquatic habitats given the osmotic physiological nature of amphibians' dermal layers, leaving them especially vulnerable to water-based pollutants. Moreover, if a polluting event were to occur whilst spawn was present within these aquatic environments, it has the potential to lead to deformities in the Common Frog and Smooth Newt tadpoles, therefore, impacting the next generation of the local amphibian populations, leading to the minimum of a short-term adverse impact for these species.

Moreover, surface water- and groundwater- and air (dust)-based pollution impacts have the potential to indirectly impact these two amphibian species via the deterioration of food / prey items in the food chain for the local amphibian species. This impact also has a knock-on effect as the consumption of prey items containing polluting elements may lead to bioaccumulation of toxic substances within the local Common Frog and Smooth Newt population.

Disturbance

Additionally, these two amphibian species may also be subjected to disturbance-based impacts, which have the potential to negatively impact their foraging, spawning, commuting and hibernation activities, as well as potential loss of life for individuals within the construction site (e.g. accidental trappings), after failure to exclude entry.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of slight significance for these amphibian species.

Fish [Higher Local, National, International]

Physiological and Habitat Degradation via Pollutants

For local fish populations, adverse impacts may arise during the construction (see Chapter 6 (Construction Activities)) in the form of accidental introduction of pollutants, such as hydrocarbons, or excessive sediment

into the local surface water network (i.e. River Tolka, Royal Canal and Tolka Valley Park pond). Such uncontrolled discharges into River Tolka have the potential to directly impact fish species through substance toxicity or in the case of sediment input, the degradation of spawning habitat downstream. These polluting events also have the potential to indirectly impact local fish species through the depletion and/or degradation of the invertebrate trophic level (food supply).

In a scenario where hydrocarbons, solvents or lubricants have been accidentally introduced into a waterbody, the heavy metals within these substances have the potential to pass through the gills of local fish species. These metals may also enter fish through their digestive tract via ingestion of metal accumulated prey items. Metals such as cadmium, chromium, nickel, arsenic, copper, mercury, lead and zinc are the most notable metals that cause severe toxicity in fish species. The exposure to these metals results in the development of oxidative stress by affected fish, which weakens the immune system, causing tissue and organ degradation, as well as growth defects and a reduced fecundity (Garai et al., 2021). The longevity of type of impact will vary depending on the quantity of the pollutant entering the waterbody and whether the waterbody is a lotic (River Tolka) or lentic (Royal Canal and Tolka Valley Park pond) in nature. Therefore, in the absence of mitigation measures, it is predicted that metal toxicity impacts have the potential to result in temporary to medium-term adverse impacts for local fish species.

Increased vehicular presence adjacent to the local waterbodies will lead to local increases in nitrogen oxides (NOx) potential resulting in the minor acidification / change of pH of the surface water network. Research has detailed how freshwater fish species have shown diminished abilities to respond to damage-released chemical alarm cues from other fish of the same species under weakly acidic conditions. This group of fish species includes Three-spined Stickleback (Peterson et al., 1989) and Atlantic Salmon (Leduc et al., 2010), which will likely suffer an increased mortality predation rate within the River Tolka in the event that river and/or the Tolka Valley Park pond becomes slightly acidic (pH~ 6.0) during the Construction Phase of the proposed Scheme. A short-term negative impact is predicted from potential impact of acidification of local surface water network. Additionally, acidification / low pH levels in combination high metal concentrations, which can be introduced to the surface waterbody via a hydrocarbon or solvent spill, have the potential to increase the mortality of River Lamprey *Lampetra fluviatilis* eggs and newly emerged larvae (Myllynen et al., 1997; and Lucas et al., 2021).

Disturbance

A number of fish species are sensitive to both noise and associated vibrations so there is the potential for high decibel / vibration activities located adjacent to the River Tolka and Royal Canal to cause adverse behaviour of local fish species, as well as potentially acting as a barrier to fish migration in the case of salmonids, European Eel and Lamprey spp. within the River Tolka. However, both Atlantic Salmon and European Eel have been deemed to be less sensitive to noise when compared to other fish species. This is due to their specific hearing mechanisms and it has been observed that these two species do not display avoidance behaviour in response to noise production (e.g. construction piling activities) (Hawkins and Johnstone, 1978). Additionally, it has also been documented that River Lamprey are also not notably sensitive to noise compared to other fish species (Maes et al., 2004). Therefore, noise and vibration impacts are not predicted for these fish species of conservation concern during the Construction Phase.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be temporary to short-term adverse impacts ranging from slight (Brown Trout, Three-spined Stickleback, Minnow and Stone Loach) to moderate (Atlantic Salmon, Lamprey spp. and European Eel) significance for these fish species.

Terrestrial Invertebrates [Higher Local]

Physiological and Habitat Degradation via Pollutants

In the event that construction-based environmental pollutants (see Chapter 6 (Construction Activities)) were accidentally introduced, via surface water, groundwater and air (dust) pathways, into the terrestrial and semi-aquatic / wetland habitats present within and adjacent to the proposed Scheme, local terrestrial invertebrates', including red-listed Large Red-tailed Bumblebee and Moss Carder-bee, foraging resources may be notably degraded, potentially reducing their quality and frequency of occurrence within the affected habitat(s). Furthermore, a number of invertebrate groups (e.g. Lumbricina - earthworms) are known to

bioaccumulate pollutants within the soils of these polluted habitats, damaging their physiological health, as well as introducing the toxin into the lowest trophic level of the local food web.

Disturbance
Additionally, negative impacts may arise for local terrestrial invertebrates in the form of disturbance to foraging and commuting activities via temporary habitat loss and fragmentation during the Construction Phase. This will occur most notably at the Royal Canal, Tolka Valley Park, St Helena's green space and Mellowes Park, as result of the construction works required for the installation of the pedestrian, cycling and light rail infrastructure.

Habitat Loss and Fragmentation
The northern bank of the Royal Canal will experience small-scale habitat loss, which will ultimately result in the division of the terrestrial (dry) linear habitats running along this bank, fragmenting the northern half of this important commuter corridor for terrestrial invertebrates. Within the Tolka Valley Park, the river will remain open for commuting purposes but the dry meadows and river banks will undergo vegetation removal. This removal of vegetation will in turn remove a notable section foraging grounds and create an east-west divide in the commuting corridor within the Tolka Valley Park for these terrestrial invertebrates. A notable proportion of the St Helena's green area will be lost permanently to artificial hard surfaces due to the construction works of the proposed Scheme, thus reducing the total available area to support terrestrial invertebrates in this area. And while the eastern section of the St Helena's dry grassland will be retained, this commuting corridor will now be a bottleneck corridor between the Tolka Valley Park and Farnham green areas. In Mellowes Park, the construction works will lead to a longitudinal temporary divide between the amenity parkland and the mixed broadleaved and conifer woodland, which runs along the eastern boundary of the park.

Moreover, grassland habitats to undergoing temporary and permanent area reductions will limit the availability of hive sites for dense-grass tussock hives and subterranean hives. This will adversely impact the local populations of White-tailed Bumblebee; Large Red-tailed Bumblebee; Common Carder-bee; and Moss Carder-bee. Additionally, the loss of these grassland habitats will reduce the total available host plants for butterfly species laying their eggs, with species such as Meadow Brown; Peacock; Small Tortoiseshell; Small White; Large White; and Speckled Wood having their reproductive cycle negatively impacted.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of slight significance for these terrestrial invertebrate species.

Protected Freshwater Invertebrates: Glutinous Snail [National]

The Royal Canal Glutinous Snail population will potentially be exposed to a range of construction-based emissions (see Chapter 6 (Construction Activities)) including surface water and air (dust) -based pollutants.

Physiological and Habitat Degradation via Pollutants
Research has suggested that Glutinous Snail has very low tolerance to various environmental factors, particularly eutrophication (Donohue et al., 2009; and Carlsson, 2000). Additionally, research has suggested that this red-listed snail species is susceptible to biodegradable pollution, (Mouthon and Charvet, 1999), high degree of water's hardness (Beriozkina et al., 1980), and low values of ambient pH (Vinarski et al., 2013). It is believed that this species' glutinous mantle allows for greater absorption, making it more susceptible to pollution and changes in water quality. As such, studies have concluded that increases in freshwater pollution and eutrophic conditions in freshwater bodies have driven this species' decline. Therefore, in a scenario where a pollutant such as hydrocarbon, solvents or cement leachate were to enter the Royal Canal, this has the potential to result in the physiological harm and potential mortality of Glutinous Snails located downstream between the 7th and 6th canal locks. Additionally, the introduction of sediment into the canal during the works has the potential to lead to increased eutrophication within the canal, given that the addition of sediment will increase the levels of the soil-bound nitrogen and phosphorus within the canal. This increase in eutrophication has the potential to negatively impact the downstream Glutinous Snail population as documented by the above research.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of moderate significance for the local Glutinous Snail population within the Royal Canal.

Other Freshwater Invertebrates [Higher Local]

Physiological and Habitat Degradation via Pollutants

Aquatic invertebrates may also be subject to degraded foraging habitats as result of pollutants and excess sediments; toxicity issues due to bioaccumulation in the freshwater environment; and disturbance to foraging and commuting activities during construction (see Chapter 6 (Construction Activities)). Further to this, a number of invertebrate groups are known to bioaccumulate pollutants within the waterbodies of these polluted habitats (Spehar et al., 1978), damaging their physiological health, as well as introducing the toxin into the lowest trophic level of the local food web.

Therefore, in the absence of mitigation during the Construction Phase, it is predicted that there will be a temporary to short-term adverse impact of slight significance for these aquatic invertebrate species, as a result of the above adverse impacts.

See Table 9-34 for a summary of KERs and their respective Construction Phase impacts.

9.4.4 Operational Phase Impacts

9.4.4.1 Designated Sites

Surface water, groundwater and air (dust and emissions)-based operational impacts are not predicted for KER habitats of South Dublin Bay SAC; North Dublin Bay SAC; Rockabill to Dalkey Island SAC, North Dublin Bay pNHA; Dolphins, Dublin Docks pNHA; South Dublin Bay; Booterstown Marsh pNHA; Ramsar sites – Sandymount Strand / Tolka Estuary and North Bull Island; SAAO North Bull Island; and UNSECO Dublin Bay Biosphere, given the operational nature and emissions of the proposed Scheme.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to downstream designated sites (Natura 2000; pNHA; Ramsar; SAAO; and UNSECO sites), a series of SuDS are proposed throughout the Scheme's drainage / landscape operational designs, see Urban Integration Report (Volume 5 - Appendix A21.2), including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing road junctions / infrastructure, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the surface waterbodies, which hydrologically connect the proposed Scheme with the designated sites, will not experience any operational contamination from surface water run-off of hardstanding surfaces within the boundaries of the proposed Scheme.

Therefore, in absence of specific designated site mitigation, it is predicted that there will be a long-term neutral operational impact that is not significant for the designated sites and their respective KERs (barring ex-situ faunal species frequenting site of the proposed Scheme), located downstream of the proposed Scheme, given the proposed drainage design and associated SuDS.

For KER species (listed below) associated with the above designated sites, that frequent the habitats within the boundaries of the proposed Scheme, the respective operational impact sub-section is in 9.4.4.4:

- Black-headed Gull (Breeding Birds and Wintering Birds);
- Light-bellied Brent Goose (Wintering Birds);
- Curlew (Breeding Birds and Wintering Birds);
- Cormorant (Breeding Birds and Wintering Birds);
- Common Gull (Breeding Birds and Wintering Birds);
- Lesser Black-backed Gull (Breeding Bird and Wintering Birds);
- Herring Gull (Breeding Bird and Wintering Birds);

- Irish Hare (Other Terrestrial Mammals);
- Meadow Pipit (Breeding Birds);
- Skylark (Breeding Birds);
- Mallard (Breeding Birds and Wintering Birds); and
- Kingfisher (Breeding Birds).

In regard to the Royal Canal pNHA, which is located within the proposed Scheme, the operational impact sub-sections for the following habitats, flora and fauna are 9.4.4.2, 9.4.4.3 and 9.4.4.4:

- Canal (Habitats);
- Tall-herb swamp (Habitats);
- Amenity grassland (improved) (Habitats);
- Hedgerows (Habitats);
- Scrub (Habitats);
- Tassel Stonewort (Protected Flora);
- Opposite-leaved Pondweed (Protected Flora);
- Pointed Stonewort (Protected Flora);
- Clustered Stonewort (Protected Flora);
- Otter (Protected Fauna);
- Common Pipistrelle (Bats);
- Soprano Pipistrelle (Bats);
- Leisler's Bat (Bats);
- Nathusius Pipistrelle (Bats);
- Grey Wagtail (Breeding Birds);
- Mallard (Breeding Birds and Wintering Birds);
- Mute Swan (Breeding Birds and Wintering Birds);
- Black-headed Gull (Breeding Birds and Wintering Birds);
- Tufted Duck (Breeding Birds and Wintering Birds);
- European Eel (Fish);
- Atlantic Salmon (Fish);
- Grey Seal (Marine Mammals);
- Harbour Seal (Marine Mammals); and
- Common Dolphin (Marine Mammals).

9.4.4.2 Habitats

Stone walls and other stonework [Lower Local]

As the stone walls and other stonework habitat, located along the existing bridge within the Tolka Valley Park, are to be fully retained as part of the proposed Scheme's operations (see Chapter 21 (Landscape and Visual Amenity)).

Therefore, in absence of specific stone walls and other stonework habitat mitigation, adverse operational impacts are not predicted, resulting in long-term neutral operational impact for this linear artificial habitat.

Other artificial lakes and ponds [County]

As the Tolka Valley Park pond exists outside the works area of the proposed Scheme it will not be subject to any operational impacts, except that of potential surface water run-off containing pollutants. However, as surface water run-off from hardstanding areas will be collected by a series of proposed SuDS features throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the Tolka Valley Park

pond will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific other artificial lakes and ponds habitat mitigation, it is predicted that there will be an initial long-term neutral operational impact that is not significant for the artificial pond habitat, given the SuDS features within the Scheme's proposed drainage / landscape designs (see Urban Integration Report (Volume 5 - Appendix A21.2).

Reed and large sedge swamps [Higher Local]

Both the reed and large sedge swamp habitats lining the pond habitat and within the integrated constructed wetlands (ICW) are to be retained as part of the Scheme's Urban Integration Report (refer to Volume 5 - Appendix A21.2) and as such will not experience any habitat loss during the Operational Phase. However, the new Tolka Valley Park light-rail bridge will overshadow a section (approx. <5%) of reed and large sedge swamp reducing its seasonal growth potential, resulting in slight reduction in the habitats condition within this section.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the Scheme's drainage / landscape operational designs (see Urban Integration Report (Volume 5 - Appendix A21.2), including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the reed and large sedge swamps lining the Tolka Valley Park pond will not experience any operational contamination from surface water run-off of hardstanding surfaces; while the reed and large sedge swamps forming the majority of the ICWs will continue to operate under its original SUDs function.

Therefore, in absence of specific reed and large sedge swamps habitat mitigation, it is predicted that there will be an initial short-term term negative impact that is not significant for the reed and large swamp habitats, given that they will not undergo any increase or decrease in size or ecological quality.

Tall-herb swamps (Potential Annex I habitat: 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430)) [National]

The tall-herb swamp habitat is to be retained along the banks of the Royal Canal and will undergo some minor enhancement as result of the proposed Urban Integration Report (refer to Volume 5 - Appendix A21.2).

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the tall herb swamp habitats will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific tall-herb swamps habitat mitigation, it is predicted that there will be an initial short-term neutral impact that is not significant for the tall-herb swamps habitats, given that they will not undergo any increase or decrease in size or ecological quality.

Depositing / lowland rivers (River Tolka) [County]

The depositing / lowland river habitat will not experience any habitat loss as a result of proposed Scheme's operations. The only environmental change this waterbody will experience will be increased shading as a result of the physical structure of the new light rail and pedestrian / cycle bridge within the Tolka Valley Park. Given the lack of floating and emergent aquatic flora within this section of the river, the increased shading will not result in any decreased floral growth within the lowland river habitat during the Operational Phase. The increased shading of the River Tolka will help stabilise local water temperatures within this section of the Tolka Valley Park, which will be beneficial for the aquatic fauna it supports, assisting in the mitigation of increased temperatures as a result of climate change.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs (see Urban Integration Report (Volume 5 - Appendix A21.2), including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the River Tolka will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific depositing / lowland river mitigation, it is predicted that there will be an initial long-term neutral operational impact that is not significant for the River Tolka (depositing / lowland river habitat) present within and downstream of the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Canals (Royal Canal) [National]

The canal (aquatic) habitat will not experience any habitat loss as a result of proposed Scheme's operations. Similarly to the River Tolka, the only environmental change this waterbody will experience will be increased shading as a result of the physical structure of the new light rail bridge. Given the lack floating and emergent aquatic flora in the affected section, the increased shading will not result in any decrease in floral growth within the canal.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs (see Urban Integration Report (Volume 5 - Appendix A21.2), including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, surface waterbodies, such as Royal Canal, will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific canal mitigation, it is predicted that there will be an initial long-term neutral operational impact that is not significant for the canal habitat present within and downstream of the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Amenity grassland (improved) [County]

As a result of the proposed Scheme's pedestrian and light rail infrastructure, the amenity grassland habitat will permanently lose notable sections of habitat within the parks and small green areas within the boundaries of the proposed Scheme (see Chapter 21 (Landscape and Visual Amenity)). There will also be creation of small sections of amenity grassland throughout the Scheme as well, though not enough to

remedy the loss of the existing amenity grasslands. It is important to note that amenity grasslands (playing pitches) within the Farnham green area will be retained, though at slightly different orientation, ensuring their continued capacity to support wintering bird species such as Barnacle Goose, Black-headed Gull, Common Gull, Herring Gull and Light-bellied Brent Goose.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs (see Urban Integration Report (Volume 5 - Appendix A21.2), including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Farnham Drive, Wellmount Road, Patrickswell Place, Cappagh Road, Cardiff Castle Road, Mellowes Road, Finglas Bypass, St Margaret's Road and Melville Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the amenity grassland habitat will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific amenity grassland mitigation, it is predicted that there will be an initial short-term negative operational impact that is not significant for the amenity grassland habitats given the reduction in the habitat's total area as a result of habitat loss and conversion to higher quality ecological habitats, as well as the proposed drainage / landscape designs and associated SuDS.

Marsh [Higher Local]

The marsh habitat is to be retained within the proposed Urban Integration Report (refer to Volume 5 - Appendix A21.2). However, the new Tolka Valley Park light-rail bridge will overshadow approx. 90% of the marsh affecting its seasonal growth potential, resulting in slight reduction in the habitats condition within this section.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Additionally, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, marsh forming part of the ICWs will continue to operate under its original SUDs function.

Therefore, in absence of specific marsh mitigation, it is predicted that there will be an initial short-term negative operational impact that is not significant for the marsh habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Dry calcareous and neutral grassland [County]

As a result of the proposed Scheme's pedestrian and light rail infrastructure, the dry calcareous and neutral grassland habitat will lose a notable extent of habitat within the western section St Helena's green area (see Urban Integration Report (Volume 5 - Appendix A21.2). Therefore, there will be a short-term habitat loss of this dry grassland habitat.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and

hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Tolka Valley Road and St Helena's Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the dry calcareous and neutral grassland habitat will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific dry calcareous and neutral grassland mitigation, it is predicted that there will be an initial short-term negative operational impact of moderate significance for the dry calcareous and neutral grassland habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Dry meadow and grassy verges [Higher Local]

As a result of the proposed Scheme's pedestrian, road and light rail infrastructure, the dry meadow and grassy verges habitat will lose linear sections of habitat along the Broombridge Road, Tolka Valley Park, Finglas Bypass (R135), and St Margaret's Road (see Urban Integration Report (Volume 5 - Appendix A21.2).

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Moreover, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Finglas Bypass and St Margaret's Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the dry meadow and grassy verges habitat will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific dry meadow grassland mitigation, it is predicted that there will be an initial short-term negative operational impact of moderate significance for the dry meadow grassland habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

(Mixed) broadleaved woodland [Higher Local]

All mixed broadleaved woodland habitat is set to be retained within the proposed Urban Integration Report (refer to Volume 5 - Appendix A21.2).

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Ballyboggan Road and Finglas Bypass, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the mixed woodland habitat will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific mixed broadleaved woodland mitigation, it is predicted that there will be an initial medium-term neutral operational impact that is not significant for the mixed broadleaved woodland habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Scattered trees and parkland [Higher Local]

Multiple groupings of scattered trees, and the immediate understorey vegetation, will be lost as result of the footprint of the pedestrian, road and light rail infrastructure, with 170 trees to be removed within parkland habitats present within / along Broombridge Luas Stop, Tolka Valley Park, St Helena's green area, Farnham green area, Casement Road, Wellmount Road, Patrickswell Place, Cardiff Castle Road, Mellowes Park, Finglas Bypass and St Margaret's Road (see Urban Integration Report (Volume 5 - Appendix A21.2).

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Farnham Drive, Casement Road, Wellmount Road, Patrickswell Place, Cardiff Castle Road, Mellowes Road, Finglas Bypass and St Margaret's Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the scattered trees and parkland habitats will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific scattered trees and parkland mitigation, it is predicted that there will be an initial medium-term negative operational impact of slight significance for the scattered trees and parkland habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Hedgerows [Higher Local]

A short section (approx. 10m) of hedgerow habitat will be lost as result of the footprint of the Royal Canal rail bridge, which is a loss of 5% of the total hedgerow habitat present within the Scheme's boundaries ((see Urban Integration Report (Volume 5 - Appendix A21.2) for further detail).

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Moreover, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the hedgerow habitat will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific hedgerow mitigation, it is predicted that there will be an initial medium-term negative operational impact of slight significance for the hedgerow habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Treelines [Higher Local]

Several short sections of treeline habitat will be lost as result of the footprint of the pedestrian, road and light rail infrastructure. In total, 29 trees of varied maturity (see Urban Integration Report (Volume 5 - Appendix A21.2), will be removed from the treeline habitats present along Wellmount Road, Patrickswell Place, Mellowes Road, Mellowes Park, Finglas Bypass and St Margaret's Road.

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside

beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Wellmount Road, Patrickswell Place, Mellowes Road, Finglas Bypass and St Margaret's Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the treeline habitats will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific treeline mitigation, it is predicted that there will be an initial medium-term negative operational impact of slight significance for the treeline habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Wet willow-alder-ash woodland [Higher Local]

A total of three semi-mature trees will be lost from the wet willow-alder-ash woodland habitat, as result of the footprint of the pedestrian and light rail infrastructure, i.e. the proposed Tolka Valley light rail, pedestrian, and cycle bridge (see Urban Integration Report (Volume 5 - Appendix A21.2).

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Ballyboggan Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the wet willow-alder-ash woodland habitats will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific wet willow-alder-ash woodland mitigation, it is predicted that there will be an initial medium-term negative operational impact of slight significance for the wet willow-alder-ash woodland habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Scrub [Higher Local]

The main impact for scrub habitat from the Construction Phase is the direct habitat loss (approx. 82%) as result of the physical footprint of the Scheme (see Urban Integration Report (Volume 5 - Appendix A21.2).

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Moreover, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road and St Margaret's Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase. Therefore, the scrub habitats will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific scrub habitat mitigation, it is predicted that there will be an initial short-term negative operational impact of slight significance for the scrub habitat present within the proposed Scheme, given the proposed drainage / landscape designs and associated SuDS.

Ornamental / non-native shrub [Lower Local]

While the two existing small linear stretches of ornamental / non-native shrub habitat along the St Margaret's Road will be removed in their entirety, the proposed Urban Integration Report (refer to Volume 5 - Appendix A21.2).

Therefore, in the absence of specific ornamental / non-native shrub habitat targeted mitigation, it is predicted that there will be an initial long-term negative operational impact of profound significance for the ornamental / non-native shrub habitat present within the site, given that it will see a minor increase in its area and ecological value (biodiversity and ecological beneficial species).

9.4.4.3 Rare and Protected Flora

Opposite-leaved Pondweed [National]

The main operational emission of concern for the Opposite-leaved Pondweed population, located downstream of the proposed Scheme, between the 1st and 3rd locks of the Royal Canal, will be the surface water run-off from hardstanding areas within the locality of the Royal Canal. However, a range of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the Opposite-leaved Pondweed population. Therefore, the downstream Opposite-leaved Pondweed population will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific Opposite-leaved Pondweed targeted mitigation, it is predicted that there will be an initial long-term neutral impact that is not significant for the Opposite-leaved Pondweed population, given the SuDS features within the proposed Scheme's drainage / landscape designs (see Urban Integration Report (Volume 5 - Appendix A21.2).

Tassel Stonewort [National]

The Scheme's main operational emission of concern for Tassel Stonewort within the Royal Canal will be the surface water run-off from hardstanding areas within the locality of the Royal Canal. However, a range of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the Tassel Stonewort population. Therefore, the upstream Tassel Stonewort population will not experience any operational contamination from surface water run-off of hardstanding surfaces.

Therefore, in absence of specific Tassel Stonewort targeted mitigation, it is predicted that there will be an initial long-term neutral impact that is not significant for the Tassel Stonewort population, given the SuDS features within the proposed Scheme's drainage / landscape designs (see Urban Integration Report (Volume 5 - Appendix A21.2).

Pointed Stonewort [County]

The Scheme's main operational emission of concern for the Pointed Stonewort population, located downstream of the proposed Scheme, between the 2nd and 3rd locks of the Royal Canal, will be the surface water run-off from hardstanding areas within the locality of the Royal Canal. However, a range of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals,

and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the Pointed Stonewort population. Therefore, the downstream Pointed Stonewort population will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific Pointed Stonewort targeted mitigation, it is predicted that there will be an initial long-term neutral impact that is not significant for the downstream Pointed Stonewort population, given the SuDS features within the proposed Scheme's drainage / landscape designs (see Urban Integration Report (Volume 5 - Appendix A21.2).

Rare / Uncommon Freshwater Macrophytes: Clustered Stonewort [Higher Local]

The proposed Scheme's main operational emission of concern for the Clustered Stonewort population, located downstream of Broombridge, within the 1st and 2nd, and the 6th and 7th canal locks, will be the surface water run-off from hardstanding areas within the locality of the Royal Canal. However, a series of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Moreover, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the Clustered Stonewort population. Therefore, the Clustered Stonewort population will not experience any operational contamination from the surface water run-off of hardstanding surfaces within the proposed Scheme.

Therefore, in absence of specific Clustered Stonewort targeted mitigation, it is predicted that there will be an initial long-term neutral impact that is not significant for the downstream Clustered Stonewort population, given the SuDS features within the proposed Scheme's drainage / landscape designs (see Urban Integration Report (Volume 5 - Appendix A21.2).

Uncommon / Rare Terrestrial Flora: Pyramidal Orchid and Bee Orchid [Higher Local]

Both orchid species are present outside of the physical footprint of the proposed light rail, road and pedestrian infrastructure, safeguarded from direct physical impacts within their respective retained habitats during the Operational Phase of the proposed Scheme. These two orchid species will still be vulnerable to polluted surface water run-off from hardstanding surfaces during the Scheme's operations. However, a series of SuDS are proposed throughout the Scheme's drainage / landscape operational designs, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively engage in surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Tolka Valley Road and Finglas Bypass roundabout, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the Pyramidal Orchid and Bee Orchid populations. Therefore, the local Pyramidal Orchid and Bee Orchid populations will not experience any operational contamination from surface water run-off.

Therefore, in absence of specific Pyramidal Orchid and Bee Orchid targeted mitigation, it is predicted that there will be an initial long-term neutral impact that is not significant for the Pyramidal Orchid and Bee Orchid populations, given the proposed SuDS features within the proposed Scheme's drainage / landscape designs (see Urban Integration Report (Volume 5 - Appendix A21.2).

9.4.4.4 Rare and Protected Fauna

Otter [International]

Disturbance

As the proposed Scheme's active light railway line is located within or immediately adjacent to existing roadways (Broombridge Road and Ballyboggan Road); an active standard railway line (along the Royal Canal); and vehicular access routes (Tolka Valley Park), the cumulative noise levels of the existing baseline and the operational noise from the light rail activity will be negligible (not significant), given that local Otters frequently utilise these areas (including Otters associated with the Royal Canal holt), and are therefore already habituated to existing baseline noise levels of 58dB (AT-11: Bridge over Tiver Tolka in Tolka Valley Park) and 65dB (AT12: Bridge on Broombridge Road) [see Chapter 15: Noise and Vibration: Table 15-20 and Table 15-22]. Additionally, Otters will be more nocturnally active than diurnally; therefore, the length of time they will spend in proximity to these mainly day-time active LRVs will be notably reduced, with a degree of seasonal variance.

Habitat Loss and Fragmentation

As the light rail bridges and associated structural foundations / supports will be located outside of the core riparian zones of the Royal Canal and River Tolka, this retains access to the existing bankside commuting routes utilised by the local Otter population. Additionally, the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will ensure the re- establishment of these riparian corridors through remedial planting, following the partial vegetation clearance carried out to accommodate the construction of the new bridges. This remedial planting will ensure refuge for Otters as they commute along the banks of these waterways. Therefore, the Operational Phase of the proposed Scheme will not result in any long-term habitat fragmentation for the local Otter population.

Physiological and Habitat Degradation

The proposed Scheme's main operational emission of concern for the habitats (and prey items contained within) utilised by the local Otter population will be the surface water run-off from hardstanding areas within the locality of the Royal Canal, River Tolka and Tolka Valley Park pond. However, a series of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Moreover, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the Otter population from surface run-off generated in these areas. Therefore, the prey items and habitats associated with the local Otter population will not experience any operational contamination from the surface water run-off of hardstanding surfaces within the proposed Scheme.

Collision Mortality

Given that Otters typically commute within or along the banks of waterbodies (i.e. setback from the operational light rail route), a long-term significant increase to Otter collision mortality risk is not predicted during the Operational Phase of the proposed Scheme.

Therefore, in absence of specific Otter targeted mitigation measures during the Operational Phase, it is predicted that there will be an initial long-term neutral impact that is not significant for the local Otter population.

Bats [County]

Habitat Loss and Fragmentation

As the light rail bridges and associated structural foundations / supports will be located outside of the core riparian zones of the Royal Canal and River Tolka, this retains access to the existing bankside vegetation for commuting and foraging by the local bats species. Additionally, the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will ensure the re-establishment of these riparian corridors through remedial planting, following the partial vegetation clearance carried out to accommodate the

construction of the new bridges. Furthermore, the landscaping will also ensure that existing bat species commuting corridors are retained and enhanced throughout the proposed Scheme; as well as the improving corridor structures (complexity of the commuting habitat) through the planting shrubs, hedging, treelines and woodland copses (i.e. increased prey diversity and frequency, as well as future roosting features).

Lighting Disturbance

The proposed Scheme's route and its associated lighting design (with minimum lux levels for health and safety requirements) passes through a number of dark corridors, namely Tolka Valley Park, St Helena's green area; and Farnham green area (central), which will result in a moderate bottle-neck effect in these areas that local bat species utilise for commuting and foraging purposes. Although, it is important to note that these will still be able to function as dark corridors, and following medium-term ecological lag, increased tree-planting across these areas will provide additional shaded areas for bats to commute between, such as the woodland copses proposed in the eastern section of the St Helena's green section. It is also important to note that the main bat species (Common Pipistrelle, Soprano Pipistrelle and Leisler's Bat) that frequent the Scheme areas north of Tolka Valley Park are the species most adapted to utilising urban spaces with lighting impacts. Therefore, the Operational Phase of the proposed Scheme will not result in any long-term vegetation- or light-based habitat fragmentation for the local bat populations.

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the habitats (and prey items contained within) utilised by the local bat populations will be the surface water run-off from hardstanding areas. However, a range of SuDS features are to be located throughout the proposed Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through the existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Farnham Drive, Wellmount Road, Patrickswell Place, Cappagh Road, Cardiff Castle Road, Mellowes Road, Finglas Bypass, St Margaret's Road and Melville Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the local bat species populations from surface run-off generated in these areas. Therefore, the prey items and habitats associated with the local bat populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces within the proposed Scheme.

Collision Mortality

Given that bat species typically commute within / along dark areas / corridors (i.e. away from illuminated light rail route / LRT traffic), bat species collision mortality risk is predicted to be negligible (not significant) during the Operational Phase of the proposed Scheme.

Therefore, in the absence of targeted bat mitigation during the Operational Phase, it is predicted that there will be an initial long-term adverse impact of moderate significance for bat species, as a result of additional lighting and the bottle-necking of dark corridors and partial loss of other dark zones negatively impacting foraging and commuting habitats.

Other Terrestrial Mammals [Higher Local]

Disturbance

As the proposed Scheme's active light railway line is located within or immediately adjacent to existing roadways (throughout the Scheme); an active standard railway line (along the Royal Canal); and vehicular access routes (Tolka Valley Park and Mellowes Park), the cumulative noise levels of the existing baseline and the operational noise from the light rail activity will be negligible (not significant) for local Badger, Pine Marten, Irish Hare, Irish Stoat, Hedgehog, and Pygmy Shrew populations.

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the habitats (and foraging resources contained within) utilised by the local Badger, Pine Marten, Irish Hare, Irish Stoat, Hedgehog, and Pygmy

Shrew populations, will be that of polluted surface water run-off from hardstanding areas. However, a series of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds, that will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Moreover, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Farnham Drive, Wellmount Road, Patrickswell Place, Cappagh Road, Cardiff Castle Road, Mellowes Road, Finglas Bypass, St Margaret's Road and Melville Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the local terrestrial mammal populations from surface run-off generated in these areas. Therefore, the foraging resources and habitats associated with these protected mammal populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Habitat Loss and Fragmentation

As the light rail bridges and associated structural foundations / supports will be located outside of the core riparian zones of the Royal Canal and River Tolka, this retains access to the existing bankside commuting routes utilised by the local protected mammal populations. Additionally, the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will ensure the re-establishment of these riparian corridors through remedial planting, following the partial vegetation clearance carried out to accommodate the construction of the new bridges. Furthermore, the landscaping will also ensure that existing mammal commuting corridors are retained and enhanced throughout the proposed Scheme; as well as the improving corridor structures (complexity of the commuting habitat) through the planting shrubs, hedging, treelines and woodland copses. Therefore, the Operational Phase of the proposed Scheme will not result in any long-term habitat fragmentation for the local Badger, Pine Marten, Irish Hare, Irish Stoat, Hedgehog, and Pygmy Shrew populations.

Collision Mortality

In regard to operational impacts from light rail collision mortality, while light rail traffic has the potential to cause mammal mortality, studies on LRVs and local wildlife have shown that they are not a significant source of mortalities in an urban environment when compared to other transportation methods (i.e. road-based vehicles). This is due to their slower operating speeds and lower volume of traffic volumes (Moroń et al., 2024). Given that the operation of the proposed Scheme will reduce the higher collision risk from road traffic volumes within the locality, the introduction of the new lower collision risk light rail route will not result in a significant ('Not significant') increase in the overall collision mortality risk in the locality for these local mammal populations.

Therefore, in the absence of targeted terrestrial mammal mitigation during the Operational Phase, it is predicted that there will be an initial short-term negative operational impact of slight significance for Badger, Pine Marten, Irish Hare, Irish Stoat, Hedgehog, and Pygmy Shrew populations.

Marine Mammals [County]

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the aquatic habitats (and foraging resources contained within) utilised by the marine mammal populations in the Tolka Estuary and Dublin Bay will be the surface water run-off from hardstanding areas within the locality of the Royal Canal, River Tolka and Tolka Valley Park pond. However, a series of SuDS features are proposed within the locality of these waterbodies, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the downstream marine mammal populations from surface run-off generated in these areas. Therefore, the foraging resources and aquatic

habitats associated with the downstream marine mammal populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Therefore, in the absence of targeted marine mammal mitigation during the Operational Phase, it is predicted that there will be an initial long-term neutral impact that is not significant for the marine mammal populations of the Tolka Estuary and Dublin Bay, given the proposed SuDS features, which safeguard the aquatic habitats that hydrologically connect the proposed Scheme area to the above estuarine and coastal waterbodies.

Breeding Birds [Higher Local; County; Regional]

Disturbance

As the proposed Scheme's active light railway line is located within or immediately adjacent to existing roadways (throughout the Scheme); an active standard railway line (along the Royal Canal); and vehicular access routes (Tolka Valley Park and Mellowes Park), the cumulative noise levels of the existing baseline and the operational noise from the light rail activity will be negligible (not significant) for resident breeding bird populations.

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the habitats (and foraging resources contained within) utilised by the local breeding bird populations, will be that of polluted surface water run-off from hardstanding areas. However, a range of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds, that will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Farnham Drive, Wellmount Road, Patrickswell Place, Cappagh Road, Cardiff Castle Road, Mellowes Road, Finglas Bypass, St Margaret's Road and Melville Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the local breeding bird populations from surface run-off generated in these areas. Therefore, the foraging resources and habitats associated with these breeding bird populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Habitat Loss and Fragmentation

As the light rail bridges and associated structural foundations / supports will be located outside of the core riparian zones of the Royal Canal and River Tolka, this retains access to the existing bankside commuting routes utilised by the local breeding bird populations. Additionally, the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will ensure the re-establishment of these riparian corridors through remedial planting, following the partial vegetation clearance carried out to accommodate the construction of the new bridges. Moreover, the landscaping will also ensure that existing breeding bird commuting corridors are retained and enhanced throughout the proposed Scheme; as well as improving corridor structures (complexity of the commuting habitat) through the planting of shrubs, hedging, treelines and woodland copses (i.e. increased nesting site availability). Therefore, the Operational Phase of the proposed Scheme will not result in any long-term habitat fragmentation for the local breeding bird populations.

Collision Mortality

Regarding operational impacts from LRT collision mortality, while light rail traffic has the potential to result in bird mortalities, studies on LRT and local wildlife have shown that they are not a significant source of mortalities in an urban environment when compared to other transportation methods (i.e. road-based vehicles). This is due to their slower operating speeds and lower volume of traffic volumes (Moroń et al., 2024). Given that the operation of the proposed Scheme will reduce the higher collision risk road traffic volumes within the locality, the introduction of the new lower collision risk light rail route will not result in a significant increase to the overall collision mortality risk in the locality for these local breeding bird populations.

A number of larger breeding bird waterfowl species, such as Mute Swan, have poor front-facing vision when in flight; and as a result, are vulnerable to collisions with overhead cables. Therefore, the introduction of the overhead cables along the route of the proposed Scheme has the potential to result in injuries to local breeding birds, and potential mortalities in more severe cases.

Therefore, in the absence of targeted breeding bird mitigation during the Operational Phase, it is predicted that there will be an initial medium-term negative operational impact of slight significance for local breeding bird populations.

Wintering Birds [Higher Local; County; International]

Disturbance

As the proposed Scheme's active light railway line is located within or immediately adjacent to existing roadways (East and West Farnham areas) and vehicular access routes (Tolka Valley Park), increases to operational disturbance from the light rail activity will be negligible, given that the KER bird species, which periodically utilise these areas are already habituated to a regularised baseline noise levels of 54dB at distances as close as 50m, which is supported by the observations made throughout the wintering bird surveys (96 hours total) [Daytime LAeq,16hr value of 54dB - Noise Chapter Section 15.3.1: Baseline Noise Survey, Table 15-21: Unattended Location UT3 at St Helena's Childcare Centre].

As operational noise in this area will peak at 55dB noise level during the Operational Phase [Daytime LAeq,16hr value of 54dB - Noise Chapter Section 15.6.3.1: Rail Noise, Table 15-39: U Calculated Mitigated Rail Noise Levels for Each NSL], this noise level will be unlikely to elicit any form vigilance behaviour from the foraging wintering bird species (Cutts et al, 2013) recorded within this area, namely Light-bellied Brent Goose, Black-headed Gull, Herring Gull, Lesser Black-backed Gull and Curlew. The Barnacle Goose and Curlew were observed only utilising green areas over 100m away from the St Helena's Childcare Centre; and while Light-bellied Brent Goose, Black-headed Gull and Herring Gull were also most commonly recorded beyond this 100m range, occasional flocks of these three species have been present within 50m of the St Helena's Childcare Centre. However, given the small size of these flocks and the ample foraging opportunities in areas immediately adjacent, the potential disturbance impact on overall foraging activities for these three species within 100m of St Helena's Childcare Centre is deemed to be negligible. Given the rise of 1dB in operational noise there is the potential for a low-level behavioural response (occasional vigilance behaviour), which will lessen as the KER bird species become habituated to this new low-level disturbance element, as birds often habituate to regular noise levels between 55-72dB in urban environments (Cutts et al, 2013). Visual disturbance from increased pedestrian traffic, with associated activities such as dog-walking, will prove to be more disruptive than the operation of LRT, as species such as Light-bellied Brent Goose will begin to engage in vigilance behaviour within 105m of the disturbance source, or Curlew at 120m (Cutts et al, 2013). It also important to note that both these species are sheltered from visual disturbance when foraging within Erin's Isle GAA. Other KER wintering bird species, which frequent this area such as Black-headed Gull, Herring Gull, Lesser Black-backed Gull and Lapwing are less sensitive to such visual disturbances.

Physiological and Habitat Degradation via Pollutants

As surface water run-off from hardstanding areas will be the main operational emission from the proposed Scheme, in relation to habitats, a series of SuDS are proposed throughout the proposed Scheme's drainage / landscape operational designs (see Urban Integration Report (Volume 5 - Appendix A21.2), including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Farnham Drive, Wellmount Road, Patrickswell Place, Cappagh Road, Cardiff Castle Road, Mellowes Road, Finglas Bypass, St Margaret's Road and Melville Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the migrant wintering bird populations from surface run-off generated in these areas. Therefore, the wintering birds will not experience any operational contamination from surface water run-off of hardstanding surfaces within the proposed Scheme.

Collision Mortality

A number of larger wintering bird waterfowl species, such as Mute Swan, have poor front-facing vision when in flight; and as a result, are vulnerable to collisions with overhead cables. Given that proposed Scheme will have these installed along the route, this will potentially raise the rate of waterfowl collision injuries and mortalities within the locality.

Therefore, in the absence of targeted wintering bird mitigation during the Operational Phase, it is predicted that there will be an initial long-term negative operational impact that is not significant for herbivorous, insectivorous, piscivorous and omnivorous wintering bird populations.

In addition, in the absence of targeted wintering bird mitigation during the Operational Phase, it is predicted that there will be an initial long-term neutral operational impact that is not significant for frugivorous wintering bird populations (i.e. Redwing).

Reptiles [Higher Local]

Physiological and Habitat Degradation via Pollutants

Contaminated surface water run-off will be the main operational emission of concern for the habitats (and foraging resources contained within) utilised by the local Common Lizard populations, which may expand their range west along the Royal Canal / railway and further along the Scheme's route. However, a series of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds, that will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the Common Lizard from surface run-off, in the event that Common Lizard expand their range into this area. Therefore, the foraging resources and habitats, associated with the local Common Lizard population, will not experience any operational impacts from contamination surface water run-off of hardstanding surfaces.

Habitat Loss and Fragmentation

As the light rail bridges and associated structural foundations / supports will be located outside of the core riparian zones of the Royal Canal and River Tolka, this retains access to the existing bankside commuting routes that have the potential to be used by the local Common Lizard population in the event that it expands its range towards the boundaries of the proposed Scheme. Additionally, the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will ensure the re-establishment of these riparian corridors through remedial planting, following the partial vegetation clearance carried out to accommodate the construction of the new bridges. Furthermore, the landscaping plan will also ensure that potential future Common Lizard commuting corridors are retained and enhanced throughout the proposed Scheme; as well as the improving / creating new corridor structures (complexity of the commuting habitat) through the creation of basking areas (e.g. grasscrete paving) planting shrubs, hedging, treelines and woodland copses. Therefore, the Operational Phase of the proposed Scheme will not result in any long-term habitat fragmentation for the potential expansion of the Common Lizard population; and will instead provide new foraging grounds and commuting corridors.

Collision Mortality

Operational collision mortality risk for Common Lizard is predicted to be not significant, given the small-scale of the species and the LRT ground clearance, the collision impact zone is limited to the wheels of the LRVs. Furthermore, relatively slow operating speeds and traffic volumes of the LRTs further limits the overall collision risk (Moroń et al., 2024).

Therefore, in the absence of targeted Common Lizard mitigation during the Operational Phase, it is predicted that there will be an initial long-term neutral operational impact that is not significant for local Common Lizard population.

Amphibians [Higher Local]

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the aquatic and adjacent terrestrial habitats (and foraging resources contained within) utilised by the local amphibian populations in the Royal Canal, River Tolka and Tolka Valley Park pond will be the surface water run-off from hardstanding areas within the locality of theses waterbodies. However, the proposed drainage / landscaping include a series of SuDS features within the locality of these waterbodies, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds (see Urban Integration Report (Volume 5 - Appendix A21.2). These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the local Common Frog and Smooth Newt populations from surface run-off generated in these areas. Therefore, the foraging resources and aquatic and terrestrial habitats associated with the local Common Frog and Smooth Newt populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Habitat Loss and Fragmentation

As the light rail bridges and associated structural foundations / supports will be located outside of the core riparian zones of the Royal Canal and River Tolka, this retains access to the existing bankside commuting routes utilised by the local Common Frog and Smooth Newt populations. Additionally, the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will ensure the re-establishment of these riparian corridors through remedial planting, following the partial vegetation clearance carried out to accommodate the construction of the new bridges. Furthermore, the landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will also ensure that existing amphibian commuting corridors are retained and enhanced throughout the proposed Scheme; as well as the improving corridor structures (complexity of the commuting habitat) through the planting shrubs, hedging, treelines and woodland copses (i.e. increased hibernation areas). Therefore, the Operational Phase of the proposed Scheme will not result in any long-term habitat fragmentation for the local Common Frog and Smooth Newt populations.

Collision Mortality

Operational collision mortality risk for Common Frog and Smooth Newt are predicted to be not significant, given the small-scale of these two species and the LRT ground clearance, the collision impact zone is limited to the wheels of the LRVs. Furthermore, relatively slow operating speeds and traffic volumes of the LRT further limits the overall collision risk (Moroń et al., 2024).

Therefore, in the absence of targeted amphibian mitigation during the Operational Phase, it is predicted that there will be an initial long-term negative operational impact that is not significant for local Common Frog and Smooth Newt populations.

Fish [Higher Local, National, International]

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the aquatic habitats (and foraging resources contained within) utilised by the local fish populations in the Royal Canal, River Tolka and Tolka Valley Park pond will be the surface water run-off from hardstanding areas within the locality of theses waterbodies. However, the proposed drainage / landscaping include a series of SuDS features within the locality of these waterbodies, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds (see Urban Integration Report (Volume 5 - Appendix A21.2). These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the local fish populations from surface run-off

generated in these areas. Therefore, the foraging resources and aquatic habitats associated with the local and downstream fish populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Alteration of Habitat Characteristics (Shading)
The increased shading of the River Tolka as result of the light rail and pedestrian bridge will help stabilise local water temperatures within this section of the Tolka Valley Park, which will be create a slight positive impact for the local fish populations, in particular those sensitive to higher water temperatures, as climate change will result in unshaded waterbodies experiencing more extreme temperature fluctuations. The Royal Canal will also experience more shading as a result of the light rail bridge; however, this waterbody is notably deeper and a more stable environment in respect to water temperature so the increased shading will have an imperceptible positive/neutral impact on fish population within the canal.

Therefore, in the absence of targeted fish mitigation during the Operational Phase, it is predicted that there will be an initial long-term neutral impact that is not significant for the local and downstream fish populations of the Royal Canal and Tolka Valley Park pond, given the proposed SuDS features, which safeguard the aquatic habitats within and adjacent to the proposed Scheme. Whereas it is predicted that there will be an initial long-term positive impact of slight significance for the fish population within the River Tolka, as a result of the proposed SuDS features and increased shading.

Terrestrial Invertebrates [Higer Local]

Physiological and Habitat Degradation via Pollutants
The proposed Scheme's main operational emission of concern for the habitats (and foraging resources contained within) utilised by the local terrestrial invertebrate populations, will be that of contaminated surface water run-off from hardstanding areas. However, a range of SuDS features are proposed throughout the Scheme, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds, that will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road, Tolka Valley Road, St Helena's Road, Farnham Drive, Wellmount Road, Patrickswell Place, Cappagh Road, Cardiff Castle Road, Mellowes Road, Finglas Bypass, St Margaret's Road and Melville Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the local terrestrial invertebrate populations from surface run-off generated in these areas. Therefore, the foraging resources and habitats associated with the local terrestrial invertebrate populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Habitat Loss and Fragmentation
As the light rail bridges and associated structural foundations / supports will be located outside of the core riparian zones of the Royal Canal and River Tolka, this retains access to the existing bankside commuting routes utilised by the local terrestrial invertebrate populations. Additionally, the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will ensure the re-establishment of these riparian corridors through remedial planting, following the partial vegetation clearance carried out to accommodate the construction of the new bridges. Furthermore, the landscaping will also ensure that existing terrestrial invertebrate commuting corridors are retained and enhanced throughout the proposed Scheme; as well as the improving / creating new corridor structures (complexity of the commuting habitat) through the planting of shrubs, hedging, treelines and woodland copses. Therefore, the Operational Phase of the proposed Scheme will not result in any long-term habitat fragmentation for the local terrestrial invertebrate populations; and will instead provide new rich foraging grounds and commuting corridors through pollinator-friendly planting.

Therefore, in the absence of targeted terrestrial invertebrate mitigation during the Operational Phase, it is predicted that there will be an initial long-term negative operational impact of slight significance for local terrestrial invertebrate populations.

Protected Freshwater Invertebrates: Glutinous Snail [National]

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the Royal Canal sections (and foraging resources contained within), utilised by the downstream Glutinous Snail population, will be the surface water run-off from hardstanding areas within the locality. However, the proposed drainage / landscaping include a series of SuDS features within the locality of Royal Canal, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds (see Urban Integration Report (Volume 5 - Appendix A21.2). These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent to road junctions / infrastructure, i.e. Broombridge Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the downstream Glutinous Snail population from surface run-off generated in this area. Therefore, the foraging resources and aquatic habitats associated with the downstream Glutinous Snail population will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Therefore, in the absence of targeted Glutinous Snail mitigation during the Operational Phase, it is predicted that there will be an initial long-term neutral impact that is not significant for the Royal Canal's downstream Glutinous Snail population, given the proposed SuDS features, which safeguard the canal habitat.

Other Freshwater Invertebrates [Higher Local]

Physiological and Habitat Degradation via Pollutants

The proposed Scheme's main operational emission of concern for the aquatic habitats (and foraging resources contained within) utilised by the freshwater invertebrate populations in the Royal Canal, River Tolka and Tolka Valley Park pond will be the surface water run-off from hardstanding areas within the locality of theses waterbodies. However, the proposed drainage / landscaping include a series of SuDS features within the locality of these waterbodies, including grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds (see Urban Integration Report (Volume 5 - Appendix A21.2). These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). Furthermore, in areas of the proposed Scheme where the LRT navigates through existing habitat adjacent road junctions / infrastructure, i.e. Broombridge Road, Ballyboggan Road and Tolka Valley Road, the existing surface water drainage infrastructure in these areas will provide additional surface water run-off collection during the Operational Phase, safeguarding the local freshwater invertebrate populations from surface run-off generated in these areas. Therefore, the foraging resources and aquatic habitats associated with the local freshwater invertebrate populations will not experience any operational contamination from the surface water run-off of hardstanding surfaces.

Therefore, in the absence of targeted freshwater invertebrate mitigation during the Operational Phase, it is predicted that there will be an initial long-term neutral impact that is not significant for the local aquatic invertebrate populations of the Royal Canal, River Tolka and Tolka Valley Park pond, given the proposed SuDS features, which safeguard the aquatic habitats within and adjacent to the proposed Scheme.

See Table 9-34 for a summary of KERs and their respective operational impacts.

9.5 Mitigation and Monitoring Measures

9.5.1 Introduction

This section describes the avoidance and mitigation measures required to prevent or reduce impacts generated during the construction and operation of the proposed Scheme on the following designated sites, and their respective protected habitats, protected flora and fauna; as well as local habitats, flora and fauna of ecological value.

All prescribed mitigation measures will be strictly adhered to throughout the length of the Construction and Operational Phases.

A site-specific Construction and Environment Management Plan (CEMP) has been prepared and submitted as an appendix of this EIAR (refer to Volume 5 - Appendix A6.1). The CEMP incorporates the mitigation measures listed here, as well as those listed within the Arboricultural Method Statement (see Volume 5 - Appendix A21.1 for further detail). The proposed Scheme's principal contractor, as well as all other construction contractors, will be required to comply with all the mitigation details outlined within the CEMP. It is important to note that the CEMP, and management plans (Surface Water Management Plan, Pollution Control Plan, Dust Management Plan and Invasive Species Management Plan), may require a number of limited refinements in the event that the baseline environment changes during the pre-construction monitoring stage (e.g. the further spread of invasive non-native species prior to their respective treatments); and/or in the case that additional conditions are to be included within the CEMP, as set out by the competent authority. For further details see Volume 5 - Appendix A6.1 of this EIAR.

9.5.2 Construction Phase Mitigations

The Construction Phase mitigation sections below will be divided into:

- Standard environmental best practice;
- Compound environmental management;
- Mitigation management plans ensuring the protection of surface water, groundwater and air quality and prevention of invasive species spread throughout the proposed Scheme's site;
- Specific Flora and Fauna mitigation measures; and
- Specific area-based mitigations measures which address localised sensitive ecological elements.

9.5.2.1 Standard Environmental Best Practice

The activities required for the proposed Scheme's Construction Phase shall remain within the boundary of the proposed site, excluding select compound areas, which will be located in adjacent lands for mitigation control reasons. The prepared CEMP strictly adheres to best practice environmental guidance including but not limited to the following:

- BS (2012) – Trees in Relation to Design, Demolition and Construction. British Standard 5837;
- NRA (2006e): Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes. Dublin: National Roads Authority;
- CIRIA Guidance C532: Control of water pollution from construction sites. Guidance for consultants and contractors. (CIRIA 2019a);
- CIRIA Guidance C741: Environmental good practice on site guide (Charles & Edwards, 2015; CIRIA, 2023);
- CIRIA Guidance C750D: Groundwater control: design and practice (Preene et al., 2016; CIRIA, 2019b);
- CIRIA (C512): Environmental Handbook for Building and Civil Engineering Projects (CIRIA, 2000);
- CIRIA (C697): The SuDS Manual (CIRIA, 2015);
- CIRIA (C649) Control of water pollution from linear construction projects: Site guide (CIRIA, 2006a);
- CIRIA (C848): Control of water pollution from linear construction projects: Technical guidance (CIRIA, 2006b);
- Inland Fisheries Ireland: Guidance on Protection of Fisheries During Construction Works In and Adjacent to Waters (IF,I 2016); and
- Inland Fisheries Ireland: A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning (IFI, 2020).

9.5.2.2 Environmental Management of Site Compounds

The principal contractor will be required to ensure good environmental management within the site compounds set up along the length of the proposed Scheme. A suitably qualified Ecological Clerk of Works (ECoW) will be required to regularly conduct site compound checks to ensure they are adhering to ecological

safeguarding protocols The below list of measures will be incorporated into site compound environmental management:

- Site compounds will not be set up within Flood Zone A or B lands in accordance with the Office of Public Works (OPW) 'Planning System and Flood Risk Management Guidelines' (2009);
- Site compounds will not be located within core foraging areas utilised by protected wintering bird species;
- Only plant and materials necessary for the construction of the works will be permitted to be stored at the compound locations;
- Site establishment by the Contractor will include the following;
  - Site offices;
  - Site facilities (canteen, toilets, drying rooms, etc.);
  - Office for construction management team;
  - Secure compounds for the storage of all on-site machinery and materials;
  - Temporary car parking facilities; and
  - Temporary fencing
- Site Security to restrict unauthorized entry;
- All Subcontractors will be given induction toolbox talk so that they are aware of material storage arrangements;
- Construction materials within the compounds will be stored in a designated area in an organised manner so as to protect them from accidental damage and deterioration as a result of exposure;
- Bunded storage of fuels and refuelling area. Bunds shall be 110% capacity of the largest vessel contained within the bunded area;
- A separate container will be located in the Contractors compounds to store contaminated absorbents used to contain spillages of hazardous materials. The container will be clearly labelled, and the contents of the container will be disposed of by an appropriately licenced waste contractor at an appropriately licenced site. Waste disposal documentation of hazardous waste material taken off site for disposal will be retained by the Contractor;
- A maintenance programme for the bunded areas will be managed by the site environmental manager. The removal of rainwater from the bunded areas will be their responsibility. Records will be maintained of materials taken off site for disposal;
- The site environmental manger will be responsible for maintaining all training records and weekly environmental inspections;
- Drainage collection system for washing area to prevent run-off into surface water system;
- Stockpiling of spoil and spoil-like materials will be appropriately located within the compounds to minimise exposure to prevailing winds; and
- All refuelling of vehicles will be carried out at the fuel stores within the main site compounds and only ADR trained personnel will be permitted to operate fuel bowsers.

9.5.2.3 Protection of Surface Water, Groundwater and Air Quality

In order to protect surface water, groundwater and air quality throughout the proposed Scheme site, the Contractor will be required to implement the prepared Surface Water Management Plan (SWMP), Environmental Incident Response document, and Dust Management Plan (DMP). The minimally required list of mitigations measures outlined below will be incorporated into these plans. For further details of these plans see Volume 5 - Appendix A6.1; Volume 5 - Appendix A6.4; and Volume 5 - Appendix A6.6.

Surface Water Management Plan

The SWMP and the control and management measures relating to surface water management have been prepared (Refer to Volume 5 - Appendix A6.4 of this EIAR) with regard to the following guidance documents, where relevant:

- Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) (Construction Industry Research and Information Association) (CIRIA, 2001);

- Best Practice Guide BPGCS005 – Oil Storage Guidelines (Enterprise Ireland, 2003);
- PUB C811 Environmental Good Practice on Site, 5th Edition (CIRIA, 2023);
- Control of Water Pollution from Linear Construction Projects. Technical Guide (C648) (CIRIA, 2006a);
- Control of Water Pollution from Linear Construction Projects. Site Guide (C649) (CIRIA, 2006b);
- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (NRA, 2006d);
- Safety, Health and Welfare at Work (Construction) Regulations 2013 – S.I. No. 291 of 2013;
- Design Manual for Roads and Bridges Part 3 DN-DNG-03022 (NRA HD 33/15) (Including Amendment No. 1) (TII, 2015a);
- Road Drainage and the Water Environment DN-DNG-03065 (TII, 2015b);
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Board (IFI, 2016); and
- Planning for Watercourses in the Urban Environment, A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning (IFI, 2020).

In order to safeguard the local surface water network, and in turn the local groundwater network, from surface water-based pollution events, the following must be strictly adhered to:

- The Contractor will ensure compliance with environmental quality standards specified in the relevant legislation, namely European Communities (Environmental Objectives (Surface Waters)) Regulations, 2009 (S.I. No. 272 of 2009 and amendments), and the European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988);
- Management of silt-laden water on-site, including procedures for accidental leaks / spills to ground, as well as water quality monitoring to ensure compliance with environmental quality standards specified above;
- At no point during the Construction Phase will treated- or untreated-water be discharged to local surface water network without the water quality meeting the statutory limits as set under the environmental quality standards specified above, or limits imposed by a relevant authority such as An Bord Pleanála:
- Fail-safe site drainage and bunding, e.g. drip trays on plant and machinery will be provided to prevent discharge of chemical spillage from the sites to surface water;
- To prevent the spread of any accidental discharge into the surface water network, oil retention booms will be on hand when construction activities are located beside aquatic habitats in order to control and minimise the spread of the spill;
- Washout of concrete plant will occur at a designated impermeable area with waste control facilities (C649 – CIRIA, 2006b);
- Wherever reasonably possible, pre-cast concrete bridge features will be utilised to minimise the risk of a concrete-based pollution event;
- Concrete delivery, concrete pours and related construction methodologies will be part of the procedure agreed with the Contractor to mitigate any possibility of spillage or contamination of the local environment. Particular attention will be paid during the pouring process in order to avoid leakages or spills of concrete;
- Temporary stockpiles will be monitored for leachate generation. These stockpiles will be placed within designated areas (C649 – CIRIA, 2006b) and not located within 20m of any watercourses and wetlands or within 10m artificial surface water drainage features;
- Excavated contaminated soils (most likely present in Tolka Valley Park) will be segregated and securely stored in a designated area where the possibility of runoff generation or infiltration to ground or surface water drainage has been eliminated through bunding and imperviable geotextile linings. The contaminated soils will then be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC. Furthermore, the Contractor will ensure that no cross-contamination with clean soils happens elsewhere throughout the proposed Scheme site;
- Silt fencing will be installed prior to the commencement of any construction works in order to enhance the protection of identified water features (River Tolka, Tolka Valley Park wetlands and Royal Canal). Shallow interceptor trenches will be installed in front of these silt fences where possible, as there are space and depth constraints within certain areas of Tolka Valley Park. An Ecological Clerks of Works (ECoW) will be present during the installation of these protective measures to ensure that they are

installed to best practice standard and correctly located in their assigned areas. The following sections will provide greater detail on specific locations of these silt fence / trench sections (see sub-section 9.5.2.8 and Volume 4 - Map Figure 9-21 and Map Figure 9-22);
- Silt fences will be repaired and/or replaced as necessary by the Contractor as part of the on-going environmental monitoring programme.

Construction Compound
There will be a number of construction compounds and working areas of various scales along the whole proposed Scheme. These will include areas along track areas, construction areas at bridge locations and for other surface features. The construction compound will include installation of the necessary facilities including the site office, welfare facilities, etc.

Further details on the construction compound, including the construction compound layout, are provided in section 6.8 of Chapter 6 (Construction Activities) of this EIAR.

Site Establishment
As some of the construction compounds are located on a greenfield site, the appointed contractor will be required to provide a temporary geogrid mattress overlain in stone for trafficking within the construction compound. All surface water runoff will be intercepted and directed to appropriate treatment systems (settlement facilities and oil trap) for the removal of pollutants prior to discharge.

Security
Controlled access to the construction compound will be implemented, fencing will be erected, and lighting will be installed. The construction compound will be monitored by Closed-Circuit Television (CCTV) with security contractors on standby, to ensure safe storage of all material, plant and equipment.

Welfare and Sanitary Facilities
The construction compound will be engineered with appropriate services as discussed in section 6.8 of Chapter 6 (Construction Activities) of this EIAR. Water and wastewater disposal etc. will be organized by the appointed contractor. In work areas of the proposed Scheme, where permanent provisions (for the duration of the construction programme) are not practicable, appropriate temporary provisions will be made. Temporary welfare facilities will need to be used: for example, portable toilets in the vicinity of works. Welfare facilities will discharge wastewater either to an existing sewer, with the permission of the water utility, or wastewater will be collected and disposed of in an appropriate manner to a suitably-licensed facility offsite to prevent water pollution and in accordance with the relevant statutory requirements.

Fuel Storage
- All hydrocarbons used during the Construction Phase will be appropriately handled, stored, and disposed of in accordance with recognised standards as laid out by the EPA within the Guidance Note on Storage and Transfer of Materials for Scheduled Activities (EPA, 2004);
- All chemical and fuel filling locations will be contained within signposted, designated bunded areas, a minimum of 10m from any surface water drain;
- At the construction compound, where the site is pervious, an area of hard standing will be installed in a demarcated area for refuelling, and vehicle / plant cleaning and service areas. This area will be drained via a hydrocarbon interceptor trap to a soakaway if possible, or to local surface water drains, with the permission of the asset owner, under a permit or licence authorised by the relevant authority;
- The retained contents of the separators will be collected for disposal by a licensed operator to a licensed waste disposal / recovery facility;
- Suitable precautions will be taken to prevent spillages from equipment containing small quantities of hazardous substances (for example, chainsaws and jerry cans) including:

  – Each container or piece of equipment will be stored in its own drip tray made of a material suitable for the substance being handled;
  – Spill kits and drip trays will be provided for all equipment and at locations where any liquids are stored and dispensed, and staff will be trained on the procedures to be followed; and
  – Containers and equipment will be stored on a firm, level surface.

- Procedures and contingency plans will be in place at each work area to address cleaning up small spillages as well as dealing with an emergency incident. A stock of absorbent materials such as sand, spill granules, absorbent pads and booms will be kept at each work site, on plant working near water and particularly at refuelling areas and where fuel or oil is stored;
- The storage of fuels, other hydrocarbons and other chemicals within the construction compound shall be in accordance with relevant legislation and with best practice. In particular:

  – Fuel tanks, drums, and mobile bowsers (and any other equipment that contains oil and other fuels) will be housed within a bund of at least 110% capacity of the fuel tank itself or at least 25% of the total volume of the containers, whichever is greatest. The fuel tank will be double skinned. There will be no passive drainage from the bund; any water collected within it will be pumped out and removed off site for disposal; and
  – Any designated area or areas for oils, fuel, chemicals, hydraulic fluids, etc. storage and refuelling will be set up at least 10m from any surface water drains (C649 – CIRIA, 2006b) and the storage location within the construction compound shall be organised so as to be as far away from surface water drains as is practicable to minimise risks from leaks and spills.

- Storage areas will be covered, wherever possible, to prevent rainwater filling the bunded areas;
- Fuel fill pipes will not extend beyond the bund wall and will have a lockable cap secured with a chain;
- Where fuel is delivered through a pipe permanently attached to a tank or bowser:

  – The pipe will be fitted with a manually operated pump or a valve at the delivery end which closes automatically when not in use;
  – The pump or valve will be fitted with a lock;
  – The pipe will be fitted with a lockable valve at the end where it leaves the tank or bowser;
  – The pipework will pass over and not through bund walls;
  – –Tanks and bunds will be protected from vehicle impact damage;
  – Tanks will be labelled with contents; capacity information and hazard warnings; and
  – All valves, pumps and trigger guns will be turned off and locked when not in use. All caps on fill pipes will be locked when not in use.

Construction Phase Haul Road Mitigations

Through grassed areas, shallow land drains will be provided adjacent to haulage roads. The land drains will be provided with check dams which will allow infiltration of the collected surface water to ground. These will not be provided in the vicinity of the historical landfill in Tolka Valley Park, where runoff from haulage roads, will be allowed to runoff onto adjacent lands.

Silt screens will be provided running alongside the haulage roads through grassed areas to prevent silt and fines from impacting on the adjacent habitats and drainage features.

Procedures and contingency plans will be in place at each haul road to address cleaning up small spillages, as well as dealing with an emergency incident.

Control of Sediment

There are a number of sources of sedimentary or silt-laden water on a construction site, including silty ‘runoff’ from stripped soils; and the stockpiling of soils. Control measures for each of these are to be provided. Area specific measures are identified below in section 9.5.2.7 Area Specific Mitigation Measures.

Fuel and Chemical Spillages

For pollution prevention measures, including area specific measures, refer to the SWMP in Volume 5 - Appendix A6.4 of the EIAR. Emergency procedures will be further developed by the Contractor with either scheme-specific works, area-specific or activity-specific measures, and all personnel will be required to know these procedures.

An effective pollution SWMP relies on the following elements, with regards to fuel, and chemical spillages:

- Identification of receptors / pathways (e.g. water body/surface water paths);
- Identification and clear marking of surface water drain locations within the construction compound and other work areas;
- Having designated re-fuelling areas;
- All hydrocarbons used during the Construction Phase will be appropriately handled, stored, and disposed of in accordance with recognised standards as laid out by the EPA;
- Identification of all possible emergency scenarios;
- Effective planning, e.g. oil booms and oil soakage pads will be maintained at appropriate locations on site to enable a rapid and effective response to any accidental spillage or discharge. These shall be disposed of correctly and records will be maintained by the environmental manager of the used booms and pads taken off site for disposal;
- Identification and dissemination of contact numbers;
- Definition of personnel responsibilities;
- Assurance that all appropriate personnel are aware of the emergency procedure(s) (e.g. spillage, leakage, fire, explosion, and flooding), that drain covers and spill kits are available, and personnel know how to use them;
- Knowledge of incident scenarios, such as spill drills; and
- Implementation of lessons learnt from previous incidents.

In terms of pollution spill response procedures, these will vary depending on the sensitive receptor and nature of construction activities. However, the following information will be included as a minimum and displayed at appropriate locations along the proposed Scheme, at river crossings, near outfalls, re-fuelling locations, fuel storage areas etc.:

- Instructions on how to stop work and switch off sources of ignition;
- Instructions on how to contain the spill;
- Location of spill clean-up material;
- Name and contact details of responsible personnel (these personnel will assess the scale of the incident to determine whether the environmental regulator needs to be called); and
- Measures particular to that location or activity (for example, close to a settlement pond).

More detailed plans may be location-specific, or specific to a particular activity depending on the nature of the work. They will identify the potential sources of pollution and pathways to receptors so that containment measures can be put in place at these locations. Suitable equipment, such as spill kits, oil booms and absorbent material, will be held at appropriate locations along the proposed Scheme and personnel will be trained in the use of the equipment.

Emergency equipment will be obtained from a reputable supplier, and personnel will be trained in its correct use. Material Safety Data Sheets (MSDS) and best practice assessments will be used for advice on appropriate spill measures. The type of equipment required will depend on the activity taking place. The Construction Industry Research and Information Association, '*Control of Water Pollution from Linear Construction Projects'* (C648), Technical Guidance document (CIRIA, 2006a), hereafter referred to as the CIRIA Technical Guidance Document, provides details on the types and applications of emergency equipment. Refer to Table 15.2 of the CIRIA Technical Guidance Document for further information.

Every effort will be made to prevent an environmental incident during the Construction Phase of the proposed Scheme. The objective of the measures in the SWMP is to prevent an incident arising in the first place. Oil / fuel spillages are one of the main environmental risks that will exist during the Construction Phase of the proposed Scheme which will require an emergency response procedure. An example of the steps that will be followed in the event of a spillage to ensure that the environmental risk is reduced to as low as reasonably practical is provided in this section. This procedure can be tailored to be location / activity specific as required:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers;

- Notify the Environmental Manager immediately giving information on the location, type, and extent of the spill so that they can take appropriate action;
- If necessary, the Environmental Manager will inform the appropriate regulatory authority, including the Fire Services, depending on the size and nature of the spill - the appropriate regulatory authority will vary depending on the nature of the incident;
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the spill using the spill control materials, track mats or other material as required. Do not use detergent or hoses to disperse spilled fuel;

If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats;

- Clean up as much as possible using the spill control materials;
- Contain any used spill control material and dispose of used materials appropriately using a fully-licensed waste contractor with the appropriate permits so that further contamination is limited;
- The details of the incident will be recorded on an Environmental Incident Form (identified by the appointed Contractor), which will provide information such as the cause, extent, actions, and remedial measures used following the incident. The form will also include any recommendations made to avoid the reoccurrence of the incident;
- A record of all environmental incidents will be kept on file by the Environmental Manager and the appointed Contractor;
- These records will be made available to the relevant authorities if required; and
- The Environmental Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the appointed contractor as appropriate.

By carrying out the above steps, a proper system will be in place to investigate, record and report any potential fuel or chemical spillages.

Surface Water Monitoring

The appointed Contractor shall carry out visual inspection of surface water control measures (settlement tanks, silt fences, fuel storage areas etc.) on a daily basis for any damage and correct functioning. In addition, daily visual inspections of the Royal Canal and the River Tolka will be carried out.

Furthermore, surface water quality sampling will be undertaken at four locations: at stream outlets of the Finglaswood Stream, Bachelors Stream, and at the River Tolka (upstream and downstream), and Royal Canal (upstream and downstream).

Surface water sampling will be undertaken throughout the length of the Construction Phase, with the first round to align with the commencement of the Geotechnical Ground Investigation works, and at intervals of 2 / 3 months thereafter. Indicators that water pollution may have occurred include the following:

- Change in water colour;
- Change in water transparency;
- Increases in the level of silt in the water;
- Oily sheen to water surface; and
- Floating detritus, or scums and foams.

If hydrocarbons are observed or other water quality parameters are suspected to have been exceeded, relevant regulatory authorities will be informed immediately so that they can contribute to any investigations conducted to determine whether any element of the construction of the proposed Scheme may be causing the contamination. If any potential sources of contamination are observed, appropriate actions will be taken (depending on the source and nature) to prevent further contamination and the incident shall be recorded and investigated in more detail to prevent a recurrence. If required, the relevant regulatory authorities will be informed.

Environmental Incidence Response

A pollution control plan has been prepared as a part of the Environmental Incidence Response document (see Volume 5 - Appendix A6.6). Environmental incidents are not limited to just fuel spillages. For example, other environmental incidents may include:

- Accidental stripping of a protected habitat;
- Accidental excavation of protected archaeological structure (without archaeologist present);
- Accidental release from settlement pond / tank etc.; and
- Unplanned utility strikes, resulting in foul water releases, temporary loss of services etc.

Therefore, any environmental incident will be investigated in accordance with the following steps.

- Immediately notify the Environmental Manager, giving information on the location, type, and extent of the incident so that they can take appropriate action;
- In the very unlikely event of an incident occurring which may impact on a sensitive receptor, the Environmental Manager will inform the appropriate persons / regulatory authority. The appropriate persons / regulatory authority will vary depending on the nature of the incident;
- The details of the incident will be recorded on an Environmental Incident Form (identified by the appointed contractor) which will provide information such as the cause, extent, actions, and remedial measures used following the incident. The form will also include any recommendations made to avoid the reoccurrence of the incident;
- A record of all environmental incidents will be kept on file by the Environmental Manager and the appointed contractor. These records will be made available to the relevant authorities if required; and
- The Environmental Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the appointed contractor as appropriate.

By carrying out the above steps, a proper system will be in place to investigate, record and report any potential accidents or incidents.

Dust Management Plan

A Dust Management Plan has been prepared as part of the EIAR which provides the strategy to be adopted in order to manage dust during construction. This will be incorporated by each contractor into their Plans and implemented as part of their works. This plan and mitigation measures are in accordance with the IAQM Guidance, with the mitigation measures proposed in accordance with the determination that the highest risk category will be applied to the Construction Phase of the proposed Scheme. Please see Air Quality Chapter 15.5.1.1 for details.

9.5.2.4 Invasive Species Management Plan (ISMP)

The prepared ISMP (Volume 5 - Appendix A6.3) includes mitigation measures that utilises the below best practice management guidance documents, where relevant:

- The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (TII, 2020a);
- The Management of Invasive Alien Plant Species on National Roads – Standard (TII, 2020b);
- Inland Fisheries Ireland - Biosecurity Protocol for Field Survey Work (IFI, 2010);
- Managing Invasive Non-Native Plants in or near Freshwater (EA, 2010);
- Invasive Species Ireland (ISI) Best Practice Management Guidelines for Japanese Knotweed (ISI, 2008a);
- Best Practice Management Guidelines for Himalayan Balsam (ISI, 2008b);
- Best Practice Management Guidelines for Giant Hogweed (ISI, 2008c); and
- *The Environment Agency (EA) Managing Japanese Knotweed on development sites - the Knotweed Code of Practice* (Version 3, amended in 2013, withdrawn from online publication in 2016) (EA, 2013). (This document, although no longer supported by the EA, is nonetheless a practical document in determining the approach and control mechanisms for Japanese Knotweed).

General Measures to Control and Prevent the Spread of Non-native Invasive Species

Pre-construction Survey

- An updated invasive species baseline survey as outlined in the Biodiversity Chapter of the accompanying EIAR, shall be conducted prior to the commencement of the proposed Scheme's enabling works. This updated baseline is required as invasive species may have continued to spread within and adjacent to the proposed Scheme since the last invasive species or habitat survey was conducted on-site;
- As per TII guidance (TII, 2020a), this additional invasive species survey will include detailed maps of the precise location of each individual invasive species plant, as well as photos of these specific locations; and
- During the interim between the original non-native invasive species surveys and the commencement of construction following grant of planning permission, it is possible that the existing stands of Third Schedule non-native invasive species may have expanded (if unmanaged) or decreased (if there is an active management regime in place), or that newly established Third Schedule non-native invasive species may have become established within the footprint of the proposed Scheme. A confirmatory pre-construction invasive species survey will be undertaken by a suitably qualified specialist, arranged by the contractor(s), to confirm the absence, presence and / or extent of all Third Schedule non-native invasive species within the footprint of the proposed Scheme. Where an infestation is confirmed / identified within the footprint of the proposed Scheme, this will require the implementation of the final ISMP.

Final Invasive Species Management Plan (ISMP)

- Following appointment, the contractor(s) will be required to develop more specific Method Statements and submit an updated ISMP that is cognisant of the proposed construction activities, equipment and plant usage and environmental monitoring plan for the proposed Scheme. The updated ISMP is referred to as the 'final ISMP' in this document. The Contractor(s) may only propose modifications to the ISMP which will not give rise to any impacts which are more significant than those already identified and assessed in the EIAR or NIS;
- All of the measures set out in this ISMP will be implemented in full by the appointed contractor(s) and its finalisation will not affect the robustness and adequacy of the information presented and relied upon in the EIAR and NIS;
- The ISMP will be updated following the pre-construction invasive species survey to detail the exact measures for any non-native invasive species population present within the footprint of the proposed Scheme. Depending on the extent and nature of the works, a number of approaches / treatments may be approved, all following the measures in the ISMP; and
- All control measures specified in the final ISMP shall be implemented by a suitably qualified and licenced specialist prior to the Construction Phase of the proposed Scheme to control the spread of any newly established INNS within the footprint of the proposed Scheme. Furthermore, the Contractor will adhere to control measures specified within the final ISMP throughout the Construction Phase of the proposed Scheme. The site will be monitored by the appointed contractor after control measures have been implemented. Any re-growth will be subsequently treated by the Contractor. All measures that are prescribed in the final ISMP shall be equally applicable to advance works as to construction works. The Contractor will be required to update the Final Invasive Species Management Plan (ISMP) with a detailed Monitoring Plan and Programme which will require approval by NPWS.

General Measures to Avoid the Spread of INNS

The unintentional spread of INNS during construction works (within the proposed Scheme, originating from outside the proposed Scheme, such as through the importation of materials, poor biosecurity practices regarding plant and machinery or natural processes) can be a significant issue, and if not managed properly, can result in the spread of non-native invasive species to non-infested areas (within or adjacent to works areas). This will potentially increase the future cost and effort required to control the species and has the potential to pose further public health and safety risks (Japanese Knotweed can cause damage to weaknesses in built environment, whilst Giant Hogweed is an environmental public health hazard).

Listed below is a brief detailing of necessary measures to be undertaken to ensure biosecurity within this section of the proposed Scheme, all of which will need to be included within the proposed Scheme ISMP:

- The adherence to a set of biosecurity measures, including:

  - the fencing off / demarcating of the individual invasive species;
  - communicating the location, risk and hazards associated with invasive species to construction personnel (e.g. Giant Hogweed);
  - identifying dedicated access points into and out of fenced-off areas;
  - the installation of designated decontamination facilities (where appropriate);
  - protocols around the removal of contaminated soils; and
  - seed and fragment checks on boot, tyres and tracks entering and leaving the work site.

- Best practice measures for the treatment of soils contaminated with invasive species (including potential seeds and fragments of mature plants) to prevent the accidental spread of INNS;
- As required by law, licences for the disposal of contaminated materials will be obtained, as well as the utilisation of licensed facilities;
- In regard to the importation of soil and other materials, the principal contractor will only utilise traceable topsoil for landscaping that has been cleared of any invasive species material;
- Measures to be implemented during the application of herbicides – Commitment to the appointment of a suitably qualified/registered/licensed pesticides advisor for any works requiring the use of pesticides, and safety precautions for consideration in the use of pesticides near watercourses; and
- Areas which contained invasives species, where invasives were treated on-site or removed, prior to the enabling and construction works will require an on-going post-construction monitoring programme to ensure that there is no reestablishment of any invasive species within these areas. The appointed INNS contractor will provide this detailed Monitoring Plan and Programme within the final Invasive Species Management Plan.

Biosecurity Mitigations

Prior to commencement of the enabling works in the Tolka Valley Park area, a series of biosecurity measures will have to be undertaken to prevent spread of invasive species, namely Japanese Knotweed, Himalayan Balsam and potentially undiscovered Giant hogweed. Japanese Knotweed is present along the southern bank of the River Tolka, within the immediate vicinity of the proposed bridge's southern abutment. Himalayan balsam is present on both banks but closer to the water's edge and not in the immediate vicinity of the works. There is the potential for Giant Hogweed seeds to be present in both banks. While not listed on Third Schedule list of the European Communities (Birds and Natural Habitats) Regulations 2011 [S.I.477/2011], the invasive Butterfly-bush present in this area will also be removed in the interest of the site's native floral composition.

Unwashed construction equipment, plant and vehicles, and footwear can provide a vector for the spread of non-native invasive species within the proposed Scheme and from areas outside the scheme where INNS are present or where vector material potentially containing seed / root material is attached to plant or personnel. The following hygiene measures shall be undertaken for the proposed Scheme:

- Known or potentially infested areas within the working area of the proposed Scheme shall be clearly demarcated and fenced off in advance of works and access restricted until such time that treatment has commenced and / or construction works are monitored in accordance with the ISMP in the area. In relation to Japanese Knotweed, the guidance recommends an exclusion buffer of 7m (metres) in all directions (within the works area and 3m vertically underground);
- The implementation of clear signage in accordance with TII IAPS standards will be erected at compounds, and at the boundary of the exclusion fencing. These signs will be briefed out at toolbox talks specific to each INNS to personnel on site and particular attention will be given to INNS that have the potential to cause injuries such as Giant Hogweed;
- Identify and create access points into exclusion areas for INNS. These are only to be used by specialist personnel for the removal of INNS and are not to be used by general site workers until such a time as all contaminated material has been removed from site and it is safe to enter;
- Where it is practicable, a wheel wash and footwear washing facilities will be provided to ensure biosecurity measure are preventing the further potential spread of INNS. These locations are to be provided by the contractor. Where a dedicated / bespoke wheel wash cannot be installed owing to space

limitations, the appointed contractor will ensure that no excavated loose material is allowed off site from within an exclusion zone;
- Where plant that is used to excavate soils, it shall be visually checked for loose soil before movement to another part of site (where possible, the movements of tracked machinery will be restricted within the non-native invasive species exclusion zone). Loose soil shall be scraped off and disposed of, and a solution of Virkon© (or similar approved disinfectant) applied to machinery to ensure that no obscured seed / root material remains viable. Vehicular movements within the exclusion area shall be minimised as far as is practical;
- Unless in the exceptional circumstance that direction is given from a suitably qualified ecologist, no storage of contaminated soil on site. Instead, being disposed of in a licenced soil waste facility; and
- Where there are small volumes (e.g. volumes capable of being double bagged in quarantine bags such as cut plants, bulbs or loose soil occur), it may be practical to bag the material and bring it to a clearly demarcated and dedicated quarantine area within the Construction Compounds until such time that the material is disposed of to an authorised facility, similar to the process of disposing of bulk excavated contaminated soil.

Soil Excavation
- No excavation or removal of soil within areas demarcated as having INNS present is to be permitted unless under strict supervision by a suitably qualified ecologist or INNS specialist. Buffer zones to be installed by the contractor(s) will be advised by a suitably qualified ecologist or INNS specialist and strictly adhered to. Guidance regarding Japanese Knotweed recommends a buffer of 7m from the plant due to its expansive rhizomes;
- Where mechanical means of removal are required to dispose of INNS (treated or un-treated by chemicals) a suitably qualified ecologist or INNS specialist will be present to supervise and provide support to the contractor(s) for the duration of the operation;
- There will be no temporary storage on-site of bulk excavated contaminated material. Where the final ISMP calls for shallow / deep burial, this material shall be removed from the excavated area and transported immediately to approved receptor area on-site. Furthermore, the temporary storage of non-contaminated material will not occur within a European or National designated site nor within 20m of any watercourse / wetland and any land within an identified flood zone;
- Plant and machinery used in the control, excavation and transport of contaminated material shall also be subject to the recommendations described in the above Biosecurity Mitigations sub-section;
- The installation of industry-rated non-native invasive species-proof membrane before infilling construction of road / paths surface may be required. All waste arising out of this process which has been in contact with the excavated ground shall be treated as contaminated waste and disposed of at a facility that is authorised to accept such waste; and
- Where the movement of any Third Schedule non-native invasive species is required off site, a licence will be required from NPWS in advance of any movement to a site / facility licensed to accept such waste, as per the Birds and Natural Habitats Regulation. This licence is separate to and does not negate the need for licences / permits / authorisations required under waste legislation.

Disposal of Material
- Where any INNS related material is collected and is required to be disposed of, it is essential to dispose of said material in a manner that does not afford it the potential to spread further either within the proposed Scheme or in the nearby vicinity of Site;
- The movement of invasive plant material, off site, requires a licence from the NPWS, as per the Birds and Natural Habitats Regulations. Invasive species (particularly roots, flower heads or seeds) must be disposed of at licensed waste facilities or composting sites, appropriately buried, or incinerated having regard to relevant legislation (e.g. Waste Management Act, as amended, Section 4 of Number 6 of 1987 - Air Pollution Act, 1987, relevant local authority bylaws and any other relevant legislation). All disposals must be carried out in accordance with the relevant waste management legislation, as per guidance Guidelines for the Management of Waste from National Road Construction Projects (TII, 2017); and
- It is important to note that some invasive species plant material or soil (vector material) containing residual herbicides may be classified as either ‘hazardous waste’ or ‘non-hazardous waste’ under the terms of the Waste Management Act, as amended, and both categories may require special disposal

procedures or permissions. Advice will be sought from a suitably qualified waste expert regarding the classification of waste and the suitability of different disposal measures.

Measures to be Implemented During the Application of Herbicides

- If the application of herbicides is the expert advice given and then implemented during the lifespan of the proposed Scheme then a suitably qualified pesticides advisor, registered with the Department of Agriculture, Food and the Marine must be employed;
- The appointed contractor is required to refer to the appropriate guidance documents, including but not limited to those listed at the beginning of sub-section 9.5.2.4, which provide detailed recommendations for the control of invasive species and noxious weeds. The appointed contractor (or specialist license holder) will update the final ISMP in accordance with current and relevant guidelines before commencing works; and
- It is important to note that where a chemical treatment is to be used, there is a risk of contaminating a watercourse. The choice of herbicide is typically limited to formulations of Glyphosate or 2,4-D amine that are approved for use near water. Full details of any chemical used, where required and as advised by a registered pesticides advisor, will be included in the final ISMP prepared in advance of construction of the proposed Scheme.

Post-construction Monitoring

- Following the construction of the proposed Scheme, there may be ongoing treatment programmes which extend for a number of years (length of programme is dependent on the effectiveness of treatment) into the Operational Phase. In the Operational Phase, the management of the infrastructure will be the responsibility of the local authority and the control of invasive species will be as per their plans and procedures, and responsibilities under The Birds and Natural Habitats Regulations;
- The above measures are important for all Third Schedule non-native invasive species, and in particular Japanese Knotweed, where it occurs, as maintenance works associated with landscaping, such as mowing and hedge cutting have the potential to spread this plant via the dispersal of very small amounts of shredded plant material;
- If invasive plants are found, then they shall be treated as per the measures outlined in the ISMP and any species-specific guidelines; and
- The appointed INNS contractor will provide a detailed post-construction section within the Monitoring Plan and Programme within the final Invasive Species Management Plan.

Assessment of Management Options for Third Schedule Non-native Invasive Species

- The general measures included in the sections above are required to ensure good on-site practices in respect of known or potential Third Schedule non-native invasive species as per Regulations 2011 [S.I.477/2011];
- The following sections further identify practical management controls. It is acknowledged that more than one potential control measure exists and that a single or combination of measures may be required;
- The recommendations presented in this ISMP provide the minimum requirements for the likely control measures and the measures outlined in this ISMP shall be developed (with further detail on methodology used at each location, timing, practical management etc.) by the appointed contractor(s) (or the specialist as appropriate) by way of producing and implementing the final ISMP; and
- The use of chemical treatments is recognised as a potential treatment option. However, the services of a registered herbicide advisor must be employed in the specifying of named chemicals including those rated for use adjacent to aquatic environments where required, treatment type, dosage, and timing etc., and / or use of pesticides in the management of potential Third Schedule non-native invasive species within the proposed Scheme.

Selected management controls

The selected management control to be defined for each non-native invasive species stand within the proposed Scheme will depend on:

- Results of the pre-construction survey;
- Construction requirements – timing of works at specific locations, level of infestation and practical considerations such as reducing disturbance to road users / homeowners; and

- Feasibility of control measure, where possible the most practicable method (with regards to the environmental impact and human health) will be used e.g.; if mechanical methods of removal are not feasible due to access. Then a step back and assess approach will be employed to remove INNS.

The ISMP, which will be updated (in the form of the final ISMP) following on from the pre-construction surveys, may require the utilisation of a number of controls that are described below.

Japanese Knotweed

Japanese Knotweed is a high impact non-native invasive species that is particularly effective at colonising disturbed ground (e.g. construction sites) and can spread by the re-growth of cut fragments or root material, Therefore, if it is broken up during site clearance or other earthworks, it can readily re-grow in new areas to which contaminated soil is moved. Japanese Knotweed reproduces asexually (in Ireland insofar as only Female plants have been recorded) and regrowth can occur from plant material weighing as little as 0.7g (grams) of viable material. It is acknowledged to be very difficult to effectively control and even more difficult to fully eradicate.

Given the nature of Japanese Knotweed, chemical treatments are often preferred over physical methods as they can, if implemented properly, reduce the disturbance of the plant / population, thus reducing the chances of its spread. If herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective or monitored for a minimum of two years during which no regrowth is recorded. However, physical removal may be necessitated when timely interventions are required.

Table 9-31 assessed the potential management methods for Japanese Knotweed with colour coding of the potential to implement on the proposed Scheme. The methods to be used will be fully detailed in the Contractors ISMP after the recommended pre-construction survey of the proposed Scheme has been undertaken.

Table 9-31: Assessment of Management Methods for Japanese Knotweed

Approach	Treatment Options	Comment	Potential for Implementation on the proposed Scheme
Physical	Dig and dispose offsite, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. In addition to waste permits / authorizations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite. Depending on the nature of the excavation the proximity of services etc, the use of root barrier membrane may be required.	Likely – given the nature of the scheme, there may be a need to excavate soil and plant material to enable construction works to go ahead in timely manner.
	Dig and dispose onsite. - Shallow burial - Deep burial	Wildlife licence from NPWS is not ordinarily required if the burial of collected material is proposed for within the consented proposed Scheme. Shallow burial in a constructed pit such as a dedicated sealed cell within a constructed berm will allow for periodic monitoring and of easy chemical treatment of any regrowth. Deep burial entails a dedicated sealed cell within a constructed excavation, that is at least 2m below the surface of the ground. The landscaping regime will not specify trees or scrub to be planted above. Either shallow or deep options may require the use of root barrier membrane. The use of chemical pretreatment of deep / shallow cells may also be required	Unlikely – given the lack of suitable lands within the largely developed metropolitan area.

Approach	Treatment Options	Comment	Potential for Implementation on the proposed Scheme
	Screen on site – remove fragments offsite and reuse soil.	A control option that can be used to reduce the volume of soil / sediment to be moved elsewhere for burial, this option requires suitable plant, adequate space and volumes of soil to make the operation at a location cost effective. This option often requires the use of root barrier membrane owing to reuse of screened soil. The use of chemical pre-treatment of deep / shallow cells may also be required.	Possible but unlikely given the space requirements for a screener (unless a bespoke small-scale screener is available).
	Cutting and / or strimming	Not recommended and does not apparently diminish vigour of plants over time. Largely cosmetic and can result in considerable spread of viable vegetative material that can readily regenerate on suitable conditions.	Not Recommended
Chemical	Spot	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water will be rated for use near aquatic locations.	Chemical treatments are often a preferred option for treating Japanese knotweed, but the process can take between 3 to 5 years before eradication can be guaranteed and requires at least 2-year post implementation monitoring. However, given the nature of the proposed Scheme, the use of chemical treatment alone is unlikely to be adequate unless treatment regime begins a number of years before construction commencement.
	Spray / Stem injections	Used for isolated plants or large populations using knapsack or weep sprayers. In accessible areas including along riverbanks, lance sprayers can be used. Chemical treatments for infestations near water will be rated for use at or near aquatic locations. Can result in chemical drift. Stem Injection is considered very effective, if the injection is timed appropriately for growth phase. However, it is labour-intensive (sometimes) requiring some cutting and is usually only carried out on small / isolated populations. Chemical treatments for infestations near water will be rated for use at or near aquatic locations.	

Root Barrier Membrane

- Following the excavation of Japanese knotweed, there may be a need to install a root barrier membrane. These are specialised products that can provide protection to structures / services etc. from regrowth from within or outside a site, if suitably rated and properly installed. Thereafter, any small adjacent infestation can be more readily treated with chemical treatment for example. This durable material can be used to line spoil pits and prevent rhizome lateral root spread or effective growth in the plant and can keep it contained to an area where suitable chemical treatment can be undertaken.

Reseeding Following Eradication

- This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post-control management of affected sites. A grass sward established in autumn will compete with germinating Japanese knotweed seedlings in the following spring.

Giant Hogweed

- This is a high-risk invasive species, that is also a biohazard in that it can pose a threat to humans. The chemistry of its sap is such that exposure to it on skin can result in prolonged photosensitizing reactions with blistering;
- Thus, a clearly demarcated exclusion buffer, in excess of 4m, is recommend for any individual / populations of this species before commencing works;

- It spreads via heavy seeds which can easily be transported by water. Hence, it is often found along river corridors. While the plant favours riverbanks, it is known to be found on waste / derelict ground as well as railway lines for instance. Its presence can impact local biodiversity and undermine bankside integrity. The seedling stage is the most vulnerable. Mortality of seedlings is comparable to many other plants and its seed bank is considered to be persistent for a short number of years only. Since Giant hogweed can only reproduce via seed, control measures applied before flowering and fruit set will limit subsequent generations (and even then, only with favourable conditions). The ideal time to control Giant hogweed via chemical treatment is April, with follow on monthly applications targeting regrowth, although for this treatment options, it can require up to five years before successful eradication;
- Table 9-32 assessed the potential management methods for Giant Hogweed with colour coding of the potential to implement on the proposed Scheme. The potential treatment option is to be fully detailed in the contractor's ISMP for the treatment of Giant hogweed.

Table 9-32: Assessment of Management Methods for Giant Hogweed

Approach	Treatment Options	Comment	Potential for Implementation on the proposed Scheme
Physical	Dig and dispose offsite, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. Given the phytotoxic nature of the plant, it will not be buried onsite nor disposed of with general Construction and Demolition waste. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Possible and may be required.
	Above ground cutting	Not recommended. Largely cosmetic and prolongs flowering until such time that control halted. However, if digging is used, it is recommended that the removal be attempted in April / early May when the plant is usually less than 30cm tall. However, the root must be captured also.	Unlikely - requires specialist equipment to enable working alongside the biohazardous plant
	Root cutting	Individual plants may be killed by cutting at a 45-degree angle 15cm below ground level with a spade in April or May. Can be laborious unless small/isolated stands. Can be effective if combined with chemical treatment over 4-5 years repeat treatment.	Given the nature of the proposed Scheme, root cutting may be used to remove biohazard plant and thereafter allow for chemical control against any regrowth. Requires specialist equipment to enable working alongside the biohazardous plant.
	Pulling	Hand pulling is only suitable for small / immature plants (and with suitable PPE to protect exposure of bare skin). Potential remains for tap root to remain underground and regenerate. Recommended in April - May	Unlikely for mature plants. Requires specialist equipment to enable working alongside the biohazardous small / immature plants.
	Strimming / Grazing	Not recommended owing to spread of sap.	Not recommended or practical given the nature of the river and metropolitan landscape and nature of the proposed Scheme.

Approach	Treatment Options	Comment	Potential for Implementation on the proposed Scheme
Chemical	Spot	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water will be rated for use near aquatic locations.	Most widely used method, but to be wholly effective, requires total control over ~5 years of treatments within a river catchment or the isolated location. Is weather dependent and can result in chemical drift to adjacent vegetation or watercourses.
	Spray / Stem injections	More suitable for large stands, where machine-mounted blanket sprays are used. Chemical treatments for infestations near water will be rated for use near aquatic locations. Stem Injection can only be carried out on young stems. Due to difficulties with the timing of application and the potential safety risk of contact with the large leaves this method requires specialist safety equipment.	Possible but unlikely owing to nature and size of population recorded on proposed Scheme.

Temporary Storage of Collected Material

Given the phytotoxic nature of Giant Hogweed, cut material will not be discarded. It will be disposed of immediately with similar non-native invasive species waste to a facility authorised to accept such waste. However, given the nature and relative sizes of Giant Hogweed infestations, it may be suitable to collect cut biomass (where not disposed of immediately to a facility authorised to accept such waste), and to double bag it for transport to a dedicated quarantine area (location to be approved as part of the ISMP) to decompose before disposal with similar non-native invasive species waste in a facility authorised to accept such waste. The locations of areas for which Giant Hogweed has been eradicated will be notified to the local authority, so that any future public health issue involving similar symptoms can be tracked.

Reseeding Following Eradication

This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post-control management of affected sites. A grass sward established in autumn will compete with germinating Giant hogweed seedlings in the following spring and retard its establishment.

Himalayan Balsam

This high-risk invasive species is easily disturbed, particularly if in flower and readily becomes re-established along riparian corridors, which are annually subject to alluvial flooding. Unlike Japanese Knotweed though, it does not reproduce asexually. Plants can produce in excess of 6,000 seeds, and it aggressively colonises bare ground along riverbanks, including wet woodlands, as well as waste ground where suitable conditions exist. Due to its rapid growth, it can outcompete most native species. While its seedbanks are viable for up to 18 months, the resupply of seed is often achieved through annual river flooding and riparian inundation with freshly deposited soil-laden alluvium.

Table 9-33 assessed the potential management methods for Himalayan Balsam with colour coding of the potential to implement on the proposed Scheme. The potential treatment options available for the treatment of Himalayan Balsam will aim to prevent flowering and shall be undertaken before June. However, eradication may take up to five years. It is important to note that successful localised management of Himalayan Balsam is difficult along watercourses, as the spread of this non-native invasive species from upstream areas (e.g. outside of the proposed Scheme) onto bare ground often occurs after winter flooding.

Table 9-33: Assessment of Management Methods for Himalayan Balsam

Approach	Treatment Options	Comment	Potential for Implementation on the proposed Scheme
Physical	Dig and dispose offsite, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Possible given the nature of the proposed Scheme, this may be an optimal control measure.
	Hand Pulling	Not recommended. Largely cosmetic and prolongs flowering until such time that control halted. However, if digging is used, it is recommended that the removal be attempted in April / early May when the plant is usually less than 30cm tall. However, the root must be captured also.	Possible, ideal for smaller areas adjacent to the proposed Scheme boundary.
	Mechanical	Repeated cutting or mowing is effective for larger stands, but plants can regrow if the lower parts (above lowest node) are left intact. Regeneration can be further halted by ensuring full ground vegetative layer through reseeding.	Possible but unlikely main option given the nature of works along existing river.
	Grazing	Regular grazing is said to suppress the plant over time.	Not practical given the nature of the river and metropolitan landscape and nature of the proposed Scheme.
Chemical	Spot / weed wiper	Can be used for smaller infestations in spring before flowering occurs, but as late as to allow germinating seedlings to have become established and thus be able to uptake the chemical treatment. Adjacent to the works boundary, chemical treatments for infestations near water will be rated for use near aquatic locations.	Possible, within the proposed Scheme boundary, where ground is to be excavated, may require physical control also.
	Foilar spray	Can be applied to larger infestations via knapsack spray / lance spray etc. in spring before flowering occurs, but as late as to allow germinating seedlings to have become established and thus be able to uptake the chemical treatment. Chemical treatments for infestations near water will be rated for use near aquatic locations.	

Temporary Storage of Collected Material

Given the nature and relative extent of Himalayan Balsam infestations in some urban situations, collected biomass (pulled stems / roots and bagged flower heads), where not disposed of immediately to a facility authorised to accept such waste, will be double bagged and put in dedicated quarantine areas (locations to be approved as part of the final ISMP). Here, the material will be left to decompose before disposal with similar Non-native Invasive Species waste at an authorised facility.

Reseeding Following Eradication

Areas devoid of or cleared of vegetative cover near watercourses will be reseeded with appropriate riparian ground cover species in summer months to ensure that bare banks do not provide favourable conditions for Himalayan Balsam to become re-established and to protect banks from accelerated erosion.

For any area of ground that is cleared of this non-native invasive species, and which is not subsequently constructed upon, follow-on mechanical cutting regimes and / or chemical treatments may be required to ensure the seed bank is fully exhausted.

9.5.2.5 Tree Protection Measures (Arboricultural Method Statement)

This Arboricultural Method Statement and the details on tree protection measures within outline how sensitive operations are to be achieved in proximity to trees to be retained. It also details measures for the general management of site activities to ensure that retained trees are not accidentally damaged. A list of tree-based habitat mitigation measures (Order of operations) are outlined within the document; these are listed below:

- Pre commencement Site meeting;
- Preliminary tree works;
- Site Briefing for Site personnel;
- Installation of protective fencing and ground protection as required;
- Demolition and enabling works including utility diversions;
- Re-adjustment of protective fencing and ground protection as required;
- Construction operations;
- Re-adjustment of protective fencing and ground protection as required;
- Installation of new hard surfaces and hard landscaping;
- Site signed off on agreed completion of significant works;
- Dismantling of tree protection measures; and
- Soft landscaping works within the Root Protection Area of retained trees.

For greater detail on the above measures see Volume 5 - Appendix A21.1 of this EIAR.

9.5.2.6 Rare and Protected Flora Mitigations

All Protected and Rare Macrophytes [Higher Local; County; National]

Pre-construction surveys will be conducted for Opposite-leaved Pondweed; Tassel Stonewort; Pointed Stonewort; and Clustered Stonewort between the 7th and 8th locks of the Royal Canal, to observe the continued presence of Tassel Stonewort, as well as identify the potential new colonisation of the other three species within this canal section. All data from the pre-construction surveys will be provided to the appointed ECoW, who will continue to monitor the existing Tassel Stonewort population and for potential new Opposite-leaved Pondweed; Pointed Stonewort; and Clustered Stonewort colonisation, with aid from an aquatic flora specialist.

Uncommon / Rare Terrestrial Flora: Pyramidal Orchid and Bee Orchid [Higher Local]

Pre-construction surveys will be conducted for Orchid species to the potential expansion of the existing populations into areas of the proposed Scheme that will undergo vegetation clearance. All data from the pre-construction surveys will be provided to the appointed ECoW, who will continue to monitor the potential spread of Orchid species during the Construction Phase.

Additionally, the ECoW will relocate any newly sprouted Orchid species from work areas to be cleared of vegetation into suitable areas, that will not undergo any future vegetation clearance, e.g. the eastern section of the St Helana's green area. In this new location, the Orchid(s) will be sectioned (rope / tape fence) off with a 1m buffer to prevent stray machinery or site personnel entering their immediate vicinity, ensuring no physical impacts. The sectioning off will be carried out under the supervision of the ECoW.

9.5.2.7 Rare and Protected Fauna Mitigations

Otter

Regular (seasonal) pre-construction surveys will be required for monitoring of the currently inactive Otter holt located along the south bank of the Royal Canal at Broombridge, as detailed in the accompanying Otter Derogation Licence. These surveys will determine frequency of use across a multi-year study period. All data from the pre-construction surveys will be provided to the appointed ECoW, who will briefed in detail by

the pre-construction study team. The ECoW will then continue to monitor the Otter holt during the Construction Phase.

The works have the potential to impact local Otters via the following pathways: surface water, groundwater-to-surface water and air (dust)-to-surface water pollution impacts. Additionally, the consumption of food items containing polluting elements have the potential to impact the health of the local Otter population. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality.

Standard mammal mitigation measures will be adhered to including the covering of all excavations to prevent accidental trapping or the use of mammal ramps in larger excavations to allow for escape as well as the use of exclusionary fencing where appropriate to prevent mammals from entering any potentially dangerous areas.

Given that bankside vegetation clearance that will take place along the Royal Canal (south bank) and River Tolka during the Construction Phase, the provision of replacement commuting shelter will be required. In order to achieve this trees due to be felled in the immediate locality will be cut to into segments and bundled, forming multiple floating log rafts, which will mirror the occurrence of deadwood building up behind a collapsed riparian tree. These will be secured to the southern banks of both the Royal Canal and River Tolka whilst works are on-going in these areas. The securing element will need to be able to adjust to rising and falling water levels, e.g. chain or heavy-duty rope with surplus length. These log rafts will cover a minimum length of 15m along the southern bank of the Royal Canal, immediate east of the existing bridge, which provides cover up to the beginning of the scrub hedging along the southern bank. Along the River Tolka, a minimum length of 20m along the southern bank will be required to cover the length of open area between the existing bridge and the wet woodland strip. These log rafts will mainly provide cover for the Otters whilst in the water, allowing them to emerge from the water in gaps between bundled logs and between the rafts and the bank.

There will also be a toolbox talk given to the site personnel by the appointed ECoW about the local Otters and where they are likely to potentially encounter them within works area (i.e. Royal Canal, River Tolka and Tolka Valley Park pond and their respective banks).

The ECoW will monitor site lighting along Ballyboggan Road and within the Tolka Valley Park during the Construction Phase, in order to ensure that there is no light spillage into the River Tolka, which may disturb the commuting and foraging activities of Otter along the River Tolka. In the case of Otter, the level of existing light pollution at Broombridge Station renders this mitigation measure moot at the works area along the Royal Canal.

All of the above mitigation details pertaining to otter in the Royal Canal can also be found in the accompanying Otter Derogation Application Licence (Volume 5 - Appendix A9.6).

Bats

The proposed Scheme's construction works have the potential to impact local bat populations via the following pathways: surface water, groundwater-to-surface water and air (dust)-to-surface water pollution impacts. Additionally, the consumption of food items containing polluting elements have the potential to impact the health of the local bat species. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality, in order to safeguard the local bat populations and their prey base.

Additionally, regular (seasonal) pre-construction surveys will be required for monitoring of newly formed potential bat roost features within structures and trees present within the works area of the proposed Scheme. If the event that suitable potential bat roost features are formed, subsequent endoscopic examinations will need to be performed, with further follow-up through emergence activity surveys. At the time of writing of this chapter, no bat roosts have been recorded within or the lands immediately adjacent to the proposed Scheme's work area, therefore no derogation licence will be accompanying the submission of this EIAR.

Site lighting required during Construction Phase will be installed in a manner that it is positioned, directed and cowled away from any dark corridors (e.g. River Tolka riparian zone) or high-quality foraging areas (e.g. Tolka Valley Park pond) located beyond the construction compound / immediate works area, therefore avoiding any unnecessary light spill and disturbance to bat activities. The site lux levels at suitable foraging and commuting habitats for local bat species will not be increased above 1lux in important dark corridors or baseline levels in secondary habitats (amenity grasslands) as a result construction activities within the proposed Scheme's work area. Furthermore, wherever reasonably possible, works will be carried out in daylight hours in order to reduce the need for lighting on site (outside of compound areas). The appointed ECoW will be present when site lighting is initially set up in a works area and will regularly monitor the lux levels to ensure that they are not impacting dark corridors or secondary foraging locations. The ECoW will also familiarise themselves with the following best practice documentation in order to ensure that they are correctly fulfilling their role in respect to lighting mitigation:

- Bats and Lighting in the UK – Bats and the Built Environment Series (BCT, 2008);
- Bats & Lighting - Guidance Notes for Planners, Engineers, Architects and Developers (BCI, 2010); and
- Guidance Notes for the Reduction of Obtrusive Light GN01 (ILP, 2011).

There will also be a toolbox talk given to the site personnel by the appointed ECoW about the bat species known to frequent the works area, in the event the personnel encounter a downed / or stunned bat during the works period.

Other Terrestrial Mammals

Pre-construction surveys will be conducted for terrestrial mammals, such as Badger, Pine Marten, Irish Hare, Stoat, Hedgehog and Pygmy Shrew, to check if these species have expanded their respective ranges into the proposed Scheme's works area, including the formation of new setts, dens, forms and hibernacula within the disturbance buffer of the proposed Scheme. All data from the pre-construction surveys will be provided to the appointed ECoW, who will continue to monitor the potential expansion of these mammal species into the works area during the Construction Phase.

The works have the potential to impact terrestrial mammals via the following pathways: surface water, groundwater-to-surface water and air (dust)-to-surface water pollution impacts. Additionally, the consumption of food items containing polluting elements have the potential to impact the health of mammal species. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality.

Standard mammal mitigation measures will be adhered to including the covering of all excavations to prevent accidental trapping or the use of mammal ramps in larger excavations to allow for escape as well as the use of exclusionary fencing where appropriate to prevent mammals from entering any potentially dangerous areas.

There will also be a toolbox talk given to the site personnel by the appointed ECoW about the terrestrial mammals known to frequent the works area, as well as those that may expand their range into the works area (e.g. Badger).

Additionally, in the event one of the above mammals establishes a resting place e.g. sett etc., within the proposed works area, the ECoW will be required to adjust the mitigation measures within the area of the new resting place in order to safeguard the mammal species in question. Furthermore, the ECoW will be responsible for performing checks within areas to immediately undergo vegetation clearance, in order to safely disturb / relocate mammal species, such as Irish Hare, so that they may vacant the area before machinery enters the area. Moreover, the ECoW will also have to check the vegetation and relocated any Hedgehog hibernacula present (hibernation nests formed under hedges, tree roots, and piles of deadwood / leaves / grass).

Marine Mammals

Adverse impacts may arise in the form of accidental introduction of pollutants, such as hydrocarbons, into the local surface water network, including the transitional waters of the Tolka Estuary / North Dublin Bay. A number of marine mammal species are known to bioaccumulate pollutants within the estuarine and marine environment, damaging their physiological health, as well as introducing the toxin into the lowest trophic level of the local food web. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality, in order to safeguard the downstream marine mammal populations.

Breeding Birds

Pre-construction surveys will be conducted for breeding birds to check if the local species have built new nests within trees due to be felled as a result of the works. All data from the pre-construction surveys will be provided to the appointed ECoW, who will continue to monitor the presence of previously recorded and new breeding bird nests during the Construction Phase.

The works have the potential to impact wintering birds via the following pathways: surface water, groundwater-to-surface water and air (dust)-to-surface water pollution impacts. Additionally, the consumption of food items containing polluting elements have the potential to impact the health of wintering birds. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality.

The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes. If a scenario presents itself where vegetation must be cleared within the breeding bird season, the appointed ECoW will be required to undertake a breeding bird nest-check survey in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with the nests' hedge / tree left untouched by trimming or removal works, until the chicks have successfully fledged.

There will also be a toolbox talk given to the site personnel by the appointed ECoW about the breeding bird species known to frequent the works area, with a focus on nests, fallen nests and hatchlings / fledglings.

Wintering Birds

Migrant wintering bird populations have the potential to establish new foraging areas within the ZoI of the proposed Scheme after the time of writing of this EIAR. In order to address this data limitation, pre-construction wintering bird surveys will be continued during the winter periods up until the commencement of the enabling works / Construction Phase of the proposed Scheme, ensuring that mitigation measures can be adjusted accordingly in the event that wintering bird species establish new foraging areas within the ZoI of the Scheme. All data from the pre-construction surveys will be provided to the appointed ECoW (and extended survey team in this instance), who will continue to monitor these wintering bird populations during the Construction Phase.

The works have the potential to impact breeding birds via the following pathways: surface water, groundwater-to-surface water and air (dust)-to-surface water pollution impacts. Additionally, the consumption of food items containing polluting elements have the potential to impact the health of breeding birds. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality.

Seasonal construction constraints are required in order to mitigate for the risk of disturbance to disturbance-sensitive wintering bird species during the winter period within the amenity grasslands (West Farnham area - Western playing pitches and East Farnham area - Erin's Isle GAA pitches), located within and adjacent to the proposed Scheme. Up to 64.59% of North Bull Island SPA's Light-bellied Brent Goose population, as well as smaller flocks of other wintering species (Black-headed Gull, Herring Gull and Curlew), can be present within the Farnham area during the high frequency utilisation months (November to March inclusive) a minimum disturbance buffer of 400m from the identified core foraging areas will be in place throughout these months (see Volume 4 – Map Figure 9-23). This will mean that no enabling or construction works will be conducted within this 400m buffer for these months.

There will also be a toolbox talk given to the site personnel by the appointed ECoW about the wintering bird species known to frequent the works area; with a particular focus on their sensitivity to audible and visual disturbance.

Reptiles

Pre-construction surveys will be conducted for Common Lizard to check if the species has expanded its range to include sections of the proposed Scheme's work area. All data from the pre-construction surveys will be provided to the appointed ECoW, who will continue to monitor the potential presence of Common Lizard during the Construction Phase.

Common Lizard have the potential to be impacted by the following pathways: surface water polluting events, disturbance, and through deterioration of their food chain. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality.

Under the precautionary principle, the ECoW must consider the potential expansion of Common Lizard into the proposed Scheme's works area, and as such will also perform checks of potential basking locations prior to vegetation clearance, in order to ensure that any basking Common Lizard individuals within the area are relocated safely to another suitable location to continue their basking activity. There will also be a toolbox talk given to the site personnel by the appointed ECoW about Common Lizard potential appearing within works area.

Amphibians

Pre-construction surveys will be conducted for both Common Frog and Smooth Newt to check if their respective local populations have expanded the range of habitats they utilise within the proposed Scheme's work area; as well as their continued presence within habitats they have previously been recorded in. All data from the pre-construction surveys will be provided to the appointed ECoW, who will continue to monitor these amphibian populations during the Construction Phase.

Deleterious pollutants accidentally introduced via surface water pathways into the habitats located on-site and adjacent, during the Construction Phase, will reduce the capacity of these habitats to support the foraging activities of amphibians. Common Frog and Smooth Newt may also be subjected to disturbance-based impacts, which have the potential to negatively impact their foraging and commuting activities, as well as potential loss of life for individuals within the construction site (e.g. accidental trappings), after failure

to exclude entry. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality, in order to safeguard local Common Frog and Smooth Newt populations.

There will also be a toolbox talk given to the site personnel by the appointed ECoW about the Common Frog and Smooth Newt and where they are likely to encounter them within the works area. The ECoW will also perform checks prior to vegetation clearance within meadow, scrub and woodland areas, in order to ensure that any hibernating Common Frog and Smooth Newt individuals within the area are relocated safely to another suitable location to continue their hibernation period.

Fish

Adverse impacts may arise in the form of accidental introduction of pollutants, such as hydrocarbons, into the local surface water network. A number of fish species are known to bioaccumulate pollutants within the marine and freshwater environment, damaging their physiological health, as well as introducing the toxin into the lowest trophic level of the local food web. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality, in order to prevent any deleterious effects on the local fish species, in particular the more sensitive species such as Atlantic Salmon and Lamprey, as well as species of high conservation concern, i.e. European Eel.

Seasonal restrictions will be in place for works along the River Tolka and its riparian zone (10m from the top of the bank), as per IFI best practice. These seasonal works restrictions will be in place from July to September for all construction-based works; other small-scale work types, i.e. invasive species management, may be conducted during this seasonal time period given the seasonal treatment restrictions for specific invasive non-native species, such as Japanese Knotweed.

Terrestrial Invertebrates

The works have the potential to impact upon terrestrial invertebrates via the following pathways: surface water, ground water, air (dust) and disturbance. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality, in order to protect local terrestrial invertebrate species.

There will also be a toolbox talk given to the site personnel by the appointed ECoW about the terrestrial invertebrates, in particular the identification of tree, shrub, grass-tussock or subterranean based bee and wasp hives. While the ECoW will conduct pre-clearance checks of vegetated areas to be cleared, it is still possible for hives to be established in the works area following clearance. Where reasonably practicable, prior to clearance, hives will be relocated by the qualified apiarist under supervision of the ECoW to nearby suitable habitat, safe from any future clearance, thus safeguarding the local hive-based bee and wasp species.

Additionally, prior to vegetation clearance the ECoW will check for any larval stage pollinators located in large groupings upon host-flora (food plants), e.g. Peacock Butterfly caterpillars on Nettle or Cinnabar Moth caterpillars on Ragwort. The ECoW will then relocate these larval groups to another area containing the larvae's respective host-flora, that will not be subject to any future clearance within that summer (flight period).

Glutinous Snail

Negative impacts may arise in the form of accidental introduction of pollutants, such as hydrocarbons, into the local surface water network. A number of gastropod species are known to bioaccumulate pollutants within the freshwater environment, damaging their physiological health, as well as introducing the toxin into the lowest trophic level of the local food web. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality, in order to safeguard the downstream Glutinous Snail population within the Royal Canal.

Other Freshwater Invertebrates

Adverse impacts may arise in the form of accidental introduction of pollutants, such as hydrocarbons, into the local surface water network. A large range of freshwater invertebrate species are known to bioaccumulate pollutants within the freshwater environment, damaging their physiological health, as well as introducing the toxin into the lowest trophic level of the local food web. Therefore, there will be strict adherence to the mitigation measures outlined in the CEMP (Volume 5 - Appendix A6.1), including Standard Environmental Best Practice (sub-section 9.5.2.1); Environmental Management of Site Compounds (sub-section 9.5.2.2); Surface Water Management Plan, Pollution Control Plan and Dust Management Plan (sub-section 9.5.2.3; and Air Quality Chapter 15.5.1.1), which pertain to best practice guidance and the protection of surface water, groundwater and air quality, in order to safeguard the local freshwater invertebrate species within the Royal Canal, River Tolka and Tolka Valley Park pond.

9.5.2.8 Area Specific Mitigation Measures

For the purposes of providing clearly defined mitigations measures, the more precise mitigations to take place within the specific areas and sections of the proposed Scheme have been outlined in individual mitigation sections below. The approximate areas and sections of the proposed sections are displayed in Volume 4 – Map Figure 9-19.

Area 30 – S30.1: Broombridge Stabling Site

- Detailed (mapped) area specific mitigation measures are not required for Area 30 - S30.1: Broombridge Stabling Site during the Construction Phase. The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), which area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the potential construction-based impacts for local KERs within this area of the proposed Scheme, given that this area only supports artificial and scrub habitats;
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes. If a scenario presents itself where vegetation must be cleared within the breeding bird season, the appointed ECoW will be required to undertake a breeding bird nest-check survey in advance of the works to ensure that there will be no impacts on nesting birds. If nests are found, they will be safeguarded, with the nests' hedge / tree left untouched by trimming or removal works, until the chicks have successfully fledged; and
- Hold regular liaison meetings with other active and future construction sites within 500m of the proposed Scheme if applicable (where there is the potential for cumulative and in-combination impacts), to ensure plans are co-ordinated so that disturbance, dust and particulate matter emissions are minimised.

Area 31 - S31.1: Broombridge to Tolka Valley Park (including Rail Overbridge)

- In addition to the mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), the Broombridge to Tolka Valley Park, (including Rail Overbridge), this

Section requires specific surface water run-off control measures to ensure that construction-based pollutants do not enter the Royal Canal pNHA, which is also a surface water pathway connecting the proposed Scheme to the downstream designated sites;

- This Section will require the installation of geotextile sandbag barriers to protect the Royal Canal and its bankside vegetation. See Volume 4 – Map Figure 9-20 for the indicative locations of these proposed geotextiles sandbag barriers, the locations of which may be relocated provide there is acceptable rationale backing the relocation, as well as assurance that the functional integrity of the mitigation measures is not compromised. Volume 4 – Map Figure 9-20 also highlights the indicative location of this Section's site compound away from the canal. The local topography will help ensure no surface water from the compound reaches the canal;
- An ECoW will be present throughout the enabling and construction works in this section given the sensitivity of the habitats within Royal Canal pNHA;
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes;
- Lower screening barriers. In addition to standard barriers (e.g. Hamas fencing), lower full screening barriers will be installed in order to exclude small mammals and amphibians from entry into active work areas; which will notably reduce the risk of accidental fatalities; and
- Hold regular liaison meetings with other active and future construction sites within 500m of the proposed Scheme if applicable (where there is the potential for cumulative and in-combination impacts), to ensure plans are co-ordinated so that disturbance, dust and particulate matter emissions are minimised.

Area 31 - S31.2: Tolka Valley Park Bridge

Biosecurity Mitigations

- Prior to commencement of the enabling works in this area, a series of biosecurity measures will have to be undertaken to prevent spread of invasive species as outlined within the ISMP (Volume 5 - Appendix A6.3 of this EIAR).

Surface Water Mitigations

- In addition to the mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 – Appendix A6.3), which area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, the Tolka Valley Bridge section requires specific surface water run-off control measures to ensure that pollutants do not enter the surface water pathway connecting the site to the designated sites within Dublin Bay;
- Following the treatment and removal of the invasive species from this section of the works, this section will require the installation of silt fences and geotextile sandbag barriers to protect the Tolka Valley Park ICWs and Pond, and the River Tolka. See Volume 4 - Map Figure 9-21 for the indicative locations of these proposed silt fences and geotextiles sandbag barriers, the locations of which may be relocated provide there is acceptable rationale backing the relocation as well as assurance that the functional integrity of the mitigation measures is not compromised;
- An ECoW will be present throughout the enabling and construction works in this section given the sensitivity of the habitats and species in this location, and the River Tolka's status as a surface water pathway to the Dublin Bay-based designated sites. The ECoW will be key overseer for when the surface water barriers (silt fences and geotextile sandbag barriers) are adjusted for the works on the creation of the bridge abutments; and the construction of the bridge's temporary falseworks. The temporary falseworks will also include above ground level platforms to ensure that there is no unnecessary footfall or small-scale material storage on the habitats located beneath;
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes.
- Seasonal restrictions will be in place for works along the River Tolka and its riparian zone (10m from the top of the bank), as per IFI best practice. These seasonal works restrictions will be in place from July to September for all construction-based works; other small-scale work types, i.e. invasive species management, may be conducted during this seasonal time period;

- Lower screening barriers. In addition to standard barriers (e.g. Hamas fencing), lower full screening barriers will be installed in order to exclude small mammals and amphibians from entry into active work areas; which will notably reduce the risk of accidental fatalities; and
- Hold regular liaison meetings with other active and future construction sites within 500m of the proposed Scheme if applicable (where there is the potential for cumulative and in-combination impacts), to ensure plans are co-ordinated so that disturbance, dust and particulate matter emissions are minimised.

Area 31 – S31.3: Tolka Valley Park to Tolka Valley Road

- The remainder of the Tolka Valley Park area / section will require the installation of silt fences and geotextile sandbag barriers to safeguard the Tolka Valley Park ICWs and Pond, and the River Tolka. See Volume 4 – Map Figure 9-22 for the indicative locations of these proposed silt fences and geotextiles sandbag barriers, the locations of which may be relocated provide there is acceptable rationale backing the relocation as well as assurance that the functional integrity of the mitigation measures is not compromised. Volume 4 – Map Figure 9-22 also displays the location of this section's site compound;
- The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the remainder of the potential construction-based impacts for local KERs within this area of the proposed Scheme;
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes.
- An ECoW will be regularly present on-site during the works to ensure that all the prescribed mitigation measures are being strictly adhered to; and
- Hold regular liaison meetings with other active and future construction sites within 500m of the proposed Scheme if applicable (where there is the potential for cumulative and in-combination impacts), to ensure plans are co-ordinated so that disturbance, dust and particulate matter emissions are minimised.

Area 32 – S32.1: Tolka Valley Road to St Helena's Road

- Seasonal construction constraints are required in order to mitigate for the risk of disturbance to KER bird species during the winter period within the amenity grasslands (West Farnham area - Western playing pitches and East Farnham area - Erin's Isle GAA pitches), located within and adjacent to the proposed Scheme. Given that up to 64.59% of North Bull Island SPA's Light-bellied Brent Goose population, as well as smaller flocks of other KER species (Black-headed Gull, Herring and Curlew), can be present within the Farnham area during the high frequency utilisation months (November to March inclusive) a minimum disturbance buffer of 200m from the identified core foraging areas will be in place throughout these months (see Volume 4 – Map Figure 9-23). This will mean that no enabling or construction works will be conducted within this 400m buffer for these months;
- The recorded Pyramidal Orchid, or any other orchids which establish within the eastern section of the St Helena's green area, will be sectioned (rope / tape fence) off with a 1m buffer to prevent stray machinery entering their immediate vicinity, ensuring no physical impacts. This will be carried out under the supervision of the ECoW;
- The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the remainder of the potential construction-based impacts for local KERs within this area of the proposed Scheme;
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes; and
- Lower screening barriers In addition to standard barriers (e.g. Hamas fencing), lower full screening barriers will be installed in order to exclude small mammals and amphibians from entry into active work areas; which will notably reduce the risk of accidental fatalities.

Area 32 - S32.2: St Helena's Road to Cardiff Castle Road

- The Tolka Valley Road to St Helena's Road section, Area 32 - S32.2 will also be required to follow the seasonal restrictions on enabling and construction works within the Farnham area (See Volume 4 – Map Figure 9-23). This will mean that no enabling or construction works will be conducted within this 400m buffer between the months of November to March inclusive;
- The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the remainder of the potential construction-based impacts for local KERs within this area of the proposed Scheme; and
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes.

Area 32 - S32.3: Finglas Village and Finglas Village Stop

- Detailed (mapped) area specific mitigation measures are not required for Area 32 - S32.3: Finglas Village and Finglas Village Stop during the Construction Phase. The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the potential construction-based impacts for local KERs within this area of the proposed Scheme; and
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes.

Area 33 - S33.1: Mellowes Park

- Detailed (mapped) area specific mitigation measures are not required for Area 33 - S33.1: Mellowes Park during the Construction Phase. The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the potential construction-based impacts for local KERs within this area of the proposed Scheme;
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes;
- The recorded Bee Orchids, or any other orchids which establish within Mellowes Park will be sectioned (rope / tape fence) off with a 1m buffer to prevent stray machinery entering their immediate vicinity, ensuring no physical impacts. This will be carried out under the supervision of the ECoW; and
- Lower screening barriers. In addition to standard barriers (e.g. Hamas fencing), lower full screening barriers will be installed in order to exclude small mammals and amphibians from entry into active work areas; which will notably reduce the risk of accidental fatalities.

Area 33 - S33.2: R135/R104 Junction

- Detailed (mapped) area specific mitigation measures are not required for Area 33 - S33.2: R135/R104 junction during the Construction Phase. The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the potential construction-based impacts for local KERs within this area of the proposed Scheme;

- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes; and
- The recorded Bee Orchids, or any other orchids which establish within Mellowes Park will be sectioned (rope / tape fence) off with a 1m buffer to prevent stray machinery entering their immediate vicinity, ensuring no physical impacts. This will be carried out under the supervision of the ECoW.

Area 33 - S33.3: St Margaret's Stop

- Detailed (mapped) area specific mitigation measures are not required for Area 33 - S33.3: St Margaret's Stop during the Construction Phase. The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the potential construction-based impacts for local KERs within this area of the proposed Scheme; and
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes.

Area 33 - S33.4: St Margaret's Road and Charlestown Terminus

- Detailed (mapped) area specific mitigation measures are not required for Area 33 - S33.4: St Margaret's Road and Charlestown Terminus during the Construction Phase. The mitigation measures that have been incorporated in this EIAR's CEMP and Surface Water Management Plan (Volume 5 - Appendix A6.4), Pollution Control Plan (Volume 5 - Appendix A6.6), Dust Management Plan (Air Quality Chapter 15.5.1.1) and Invasive Species Management Plan (Volume 5 - Appendix A6.3), in which this area is discussed in detail in sub-sections 9.5.2.1, 9.5.2.2 and 9.5.2.3, along with seasonal restrictions on vegetation removal, will adequately mitigate the potential construction-based impacts for local KERs within this area of the proposed Scheme; and
- The seasonal restriction on the removal of vegetation is in place from March till August (inclusive), in order to safeguard breeding bird species utilising scrub and wooded vegetation for nesting purposes.

See Table 9-34 for a summary of KERs and their respective Construction Phase mitigations.

9.5.3 Operational Phase

The Operational Phase mitigation sections below will address bird collision mitigation measures, remedial and enhancement planting, operational surface water run-off management and woodland enhancement for amphibians and terrestrial invertebrates. Much of operational mitigations were pre-emptively accounted for and planned into the bridge (and overhead cables), drainage, landscape and lighting designs (Design Incorporated Mitigation). This help ensure neutral and positive residual impacts wherever possible.

9.5.3.1 Bird Collison Mitigation (Design Incorporated Mitigation)

The new bridges over the railway line / Royal Canal and River Tolka have been designed without cables in order to reduce the risk of bird collision. Furthermore, to mitigate for the risk of collision with overhead lines, deflectors will be installed on wires parallel to the overhead lines at a number of strategic locations, including the Broombridge rail over the Royal Canal; and Tolka Valley Park bridge; and along the tracks within the Tolka Valley Park and Farnham areas.

9.5.3.2 Remedial and Enhancement Planting (Design Incorporated Mitigation)

Listed below are remedial and enhancement mitigation actions to be carried out for selected habitats, as part of the proposed Scheme's landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2).

Tall-herb swamps (Potential Annex I habitat: 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430))

The tall-herb swamp habitat is to be retained along the banks of the Royal Canal, with the southern bank tall-herb swamp habitat undergoing minor biodiversity enhancement, through the sowing of locally-sourced, i.e. seed harvesting from the more diverse northern bank (preserving genetic integrity) native tall-herb swamp flora, which will in turn enhance its capacity to fulfil ecosystem services for local fauna.

Amenity grassland (improved)

The amenity grassland habitats that have been disturbed during the construction works will be reinstated to their former condition, in the case of playing pitches; while general amenity green space will be enhanced through more ecologically beneficial mowing regimes.

Marsh

The marsh habitat in Tolka Valley Park will undergo enhancement as part of the planting plan, which will increase its overall diversity with the introduction of locally-sourced (preserving genetic integrity) native marsh flora, which will in turn enhance its capacity to fulfil ecosystem services for local fauna.

Dry calcareous and neutral grassland

The soil removed from the dry calcareous and neutral grassland will be relocated, as a number of areas proposed for dry meadow creation do not currently have an existing grassland (and associated seed bank) to enhance, meaning they will need local soil with an existing seed bank to ensure genetic integrity of the local floral species. Additionally, given the dominance of low sward height floral species within the dry calcareous and neutral grassland, this habitat's seedbank will be relocated into the proposed green track and planted track sections of the light rail route. The loss of this valuable dry calcareous and neutral grassland will be prevented through this relocation / reinstatement strategy.

Dry meadow and grassy verges

The dry meadow and grassy verge habitats that have been disturbed during the construction works will be reinstated to their former condition where they are to be retained. Additionally, as the proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2)) outlines large section of amenity grassland and parkland to be converted into dry meadows, this grassland habitat will be enhanced through increased frequency throughout much of the proposed Scheme's area. Furthermore, these dry meadows and grass verges will also be enhanced through more ecologically beneficial mowing regimes, which will allow increased floral diversity. A good example of mowing regime benefits have already occurred within the site over the baseline study period, with Bee Orchids and other positive-indicator grassland species in north-west corner of Mellowes Park emerging after a change in the mowing regime within that area.

(Mixed) broadleaved woodland

The proposed Scheme's tree planting plan includes the creation of ten small, mixed broadleaved woodland copses within the eastern St Helena's dry grassland section, and as a result the site will experience a slight biodiversity enhancement through this increase in the total mixed broadleaved woodland habitat and woodland flora diversity. It is important to note that while other small woodland copses will be planted elsewhere within the boundaries of the Scheme, the St Helena's woodland copses will be the only new woodlands to be allowed to develop a typical woodland understorey, while the other copses will be maintained, aligning them with the scattered tree and parkland habitat.

Scattered trees and parkland [Higher Local]

The proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will include the planting of 70 trees, which will help remedy the loss of those felled during the Construction Phase. It is important to note that a notable proportion of scattered trees and parkland habitat will be converted into meadow grasslands with numerous short treelines; and were these grassland to be retained as amenity grassland / parkland, the number of trees being planted for the Operational Phase of the Scheme will be notably higher than the number felled during the Construction Phase.

Hedgerows

The proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) for the Scheme's operation will include the planting of new linear (screening) native hedging at the Royal Canal, St Helena's and Farnham green areas, Mellowes Park and St Margaret's Road, thus remedying the loss experience by the hedgerow habitat during the Construction Phase. When these new hedges have matured, they will mirror the ecological diversity and ecosystem services (e.g. refuge; nesting opportunities for birds; and wildlife commuting corridors) of the existing hedgerow section to be removed. This new planting with lead to an increased frequency and more florally diverse hedgerow habitats present within the proposed Scheme's boundaries.

Treelines

The proposed Scheme's landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will include the planting of 658 trees in mixed native and non-native treeline sections (including street trees) throughout the length of the Scheme, thus remedying the loss experience by the treeline habitats during the Construction Phase. When these newly planted trees have matured, they will mirror the ecological diversity and ecosystem services (e.g. refuge; nesting opportunities for birds; and wildlife commuting corridors) of the existing treeline sections to be removed. This wide-scale tree planting with lead to an increased frequency and more florally diverse treeline habitats present within the proposed Scheme's boundaries.

Wet willow-alder-ash woodland

The proposed landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) for the Scheme's operation will include the remedial planting of native understorey flora associated with wet willow-alder-ash woodland, and also four new trees to replace the three to be felled to accommodate the construction of the bridge. Additionally, as a result of the invasive species management plan, this wet woodland will have its understorey floral condition improved by the removal of Butterfly-bush and Himalayan Balsam.

Scrub

The proposed Scheme's landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) for the Operational Phase will include the creation of new shrub areas (of varying height) scattered throughout the proposed Scheme, which will in part include maintenance-suitable scrub species. The landscaping will also prioritise the planting of shrub species that will provide multiple ecosystem services (e.g. refuge; nesting opportunities for birds; and wildlife commuting corridors) and be pollinator-friendly.

Ornamental / non-native shrub

The proposed Scheme's landscaping (see Urban Integration Report (Volume 5 - Appendix A21.2) will include the creation of new ornamental / non-native shrub areas scattered throughout the proposed Scheme. The planting of non-native shrub species that will provide multiple ecosystem services (e.g. refuge; nesting opportunities for birds; and wildlife commuting corridors) and are pollinator-friendly will be prioritised. This habitat will experience an increase to both its total area and floral diversity.

9.5.3.3 Operational Sustainable Drainage Systems (Design Incorporated Mitigation)

The proposed drainage design includes the adoption of SuDS for surface water collection and attenuation, which will provide environmental benefits, e.g. retention of urban run-off. SuDS are designed to manage stormwater locally (and as close to source as possible) to mimic natural drainage and encourage its infiltration attenuation and passive treatment. The SuDS proposed with Scheme's design include grass tracks; rain gardens; permeable paving; tree pits; roadside beds; and roadside directional beds. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons (Jurries, 2003; Anderson et al., 2016). The vegetation within the SuDS will provide refuge and foraging opportunities for a range of terrestrial invertebrates, which will have knock-on benefits for local bird, amphibian and mammal populations.

Additionally, pre-emptive mitigation measures, which are to be implemented for the sustained performance and protection of the Tolka Valley Park ICW will be started ahead of main construction works, and in advance

of the bridge construction. In order to facilitate the early commencement of works in this area, it is programmed that the ICW will be progressed as part of the proposed Scheme's enabling works.

9.5.3.4 Lighting Design and Specifications (Design Incorporated Mitigation) – Nocturnal Fauna

The below incorporated specifications within the lighting design described herein will ensure that operational lighting levels will not significantly affect the activities of nocturnal species, primarily the local bat species, though these design elements will also ensure no disruption to Otter and Hedgehog activities; as well as Badger and Pine Marten, in the event they expand their respective ranges into the proposed Scheme's area.

Light Levels and type

Operational site lighting that meets the lowest light levels permitted under health and safety is preferable for bats in the vicinity. The specification and colour of light treatments, such as single bandwidth lights and no UV light are essential. LED luminaires are ideal and will be used where possible due to their sharp cut-off, lower intensity, and dimming capability. A warm white spectrum (3000K) will be used in the lighting located along the adjacent to dark corridors within the proposed Scheme, to reduce the blue light component.

Column heights of lamp posts

In order to reduce the amount of light spillage where it is not needed, the height of lamp columns located adjacent to dark corridors will be restricted to a height of 5m to avert negative light spillage impacts.

9.5.3.5 Deadwood Piling

The logs / large branches that were used to provide Otter with a sheltered commuting corridor at the construction points along the Royal Canal and River Tolka will be re-used for habitat enhancement, as well as other native species felled adjacent to the woodland habitats. The logs and branches will be cut into shorter, more manageable segments. These shorter deadwood segments are to be incorporated into the new and existing woodland areas as discrete deadwood piles. The placement of these deadwood piles will be overseen by the appointed ECoW. The addition of the deadwood piles will be beneficial for local amphibians, which may utilise them as a hibernation location; as well as for terrestrial invertebrates, such as detritivore species and wood-burrowing solitary bee species.

9.5.3.6 Post-construction Monitoring of Flora and Fauna

Uncommon, Rare and Protected Macrophytes

An aquatic flora specialist will conduct a post-construction survey between the 7th and 8th locks of the Royal Canal to assess the status of the Tassel Stonewort, and any other rare or protected macrophytes, which may have established between the time of writing of this chapter and the post-construction period of the proposed Scheme. The subsequent survey report will be disseminated to relevant bodies, i.e. NPWS, Waterways Ireland and DCC Parks, Biodiversity and Landscape Services Division.

Otter

A 12-month post-construction monitoring period will be conducted by a suitably qualified ecologist on the Otter holt located along the southern bank of the Royal Canal. The data collected during this monitoring period will be compared with that of the existing baseline, the pre-construction surveys, and the construction-phase monitoring data, in order to establish whether the status of the Otter holt has changed across these time periods. The subsequent survey report will be disseminated to relevant bodies, i.e. NPWS, Waterways Ireland and DCC Parks, Biodiversity and Landscape Services Division.

Bats

A 24-month post-construction monitoring period will be conducted by a suitably qualified bat ecology team on the local bat populations. The bat activity data collected during this monitoring period will be compared with that of the existing baseline, and the pre-construction surveys, in order to establish whether the general activity levels, flight patterns and specific habitat utilisation has been altered during these time periods. The subsequent survey report will be disseminated to relevant bodies, i.e. NPWS, Waterways Ireland and DCC Parks, Biodiversity and Landscape Services Division.

Wintering Birds

A 24-month post-construction monitoring period will be conducted by a suitably qualified wintering bird ecology team on the migrant wintering bird species, in particular the Light-bellied Brent Goose, given their prevalence within the boundaries of the proposed Scheme during the winter period. The wintering bird data collected during this monitoring period will be compared with that of the existing baseline, the pre-construction surveys, and the construction-phase monitoring data, in order to establish whether there has been changes to frequency of occurrence and flock numbers within the proposed Scheme's area, which amenity grasslands they utilised for foraging; as well as the level of vigilance behaviour they display. The subsequent survey report will be disseminated to relevant bodies, i.e. NPWS and DCC Parks, Biodiversity and Landscape Services Division.

See Table 9-34 for a summary of KERs and their respective operational mitigations.

9.5.4 Residual Impacts

Residual ecological impacts are those that remain once the development proposals have been implemented. The main aim of ecological mitigation, remediation and enhancement is to minimise or eliminate negative residual impacts and promote positive residual impacts.

9.5.4.1 Designated Sites

Following the implementation of both Construction and Operational Phase mitigation measure, it is predicted that there will be a long-term neutral operational residual impact that is not significant for the designated sites and their respective KERs (barring ex-situ faunal species frequenting site of the proposed Scheme), located downstream of the proposed Scheme.

9.5.4.2 Habitats

The operational residual impacts for the below habitats described below is based on the proposed Scheme's landscape designs / planting plans (see Urban Integration Report (Volume 5 - Appendix A21.2), with the on-going maintenance, overseen by TII, DCC Parks and Waterways Ireland, ensuring that these proposed habitats reach and are maintained at their proposed condition, e.g. dry meadows and grassy verges, a habitat present within all three respective maintenance areas.

Stone walls and other stonework [Lower Local]

Following the implementation of both Construction and Operational Phase mitigation measures, a long-term neutral residual impact, that is not significant, is predicted for this linear artificial habitat.

Other artificial lakes and ponds [County]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, there will be a long-term neutral residual impact that is not significant for the artificial pond habitat.

Reed and large sedge swamps [Higher Local]

It is predicted that there will be a long-term negative residual impact that is not significant for the reed and large swamp habitats, following the implementation of both Construction and Operational Phase mitigation measures which will result in a negligible reduction in condition within the small shaded section, that will present under the new Tolka Valley Park light-rail bridge.

Tall-herb swamps (Potential Annex I habitat: 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430)) [National]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and a short-term ecological lag to allow for the establishment of new tall-herb swamp flora on the southern bank of the Royal Canal, there will be a long-term positive residual impact of slight significance for the tall-herb swamp, given that it will see a minor increase to the ecological value (biodiversity and ecological beneficial species) of the lower quality southern bank flora.

Depositing / lowland rivers (River Tolka) [County]

Following the implementation of both Construction and Operational Phase mitigation measures, it is predicted that there will be a long-term neutral residual impact that is not significant for the River Tolka (depositing / lowland river habitat) present within and downstream of the proposed Scheme.

Canals (Royal Canal) [National]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, there will be a long-term neutral residual impact that is not significant for the canal habitat present within and downstream of the proposed Scheme.

Amenity grassland (improved) [County]

It is predicted that there will be a long-term negative residual impact that is not significance for the amenity grassland habitats, following the implementation of both Construction and Operational Phase mitigation measures, and a temporary ecological lag to allow for the establishment of new amenity grassland habitats, which will result in the reduction in the habitat's total area as a result of habitat loss, as well as conversion to higher quality ecological habitats.

Marsh [Higher Local]

Following the implementation of both Construction and Operational Phase mitigation measures, it is predicted that there will be a long-term term negative residual impact that is not significant for the marsh habitat, given the negligible reduction in condition as a result of the shading impact from the overhead Tolka Valley Park light-rail bridge.

Dry calcareous and neutral grassland [County]

It is predicted that, following the implementation of both construction and Operational Phase mitigation measures, and a short-term ecological lag to allow for the establishment of the dry grassland flora within their new locations within the Scheme, there will be a long-term neutral residual impact that is not significant for the dry calcareous and neutral grassland habitat, given that it will not undergo any decrease in total area or diversity.

Dry meadow and grassy verges [Higher Local]

Following the implementation of both Construction and Operational Phase mitigation measures, and a short-term ecological lag to allow for the establishment of the new dry meadow areas, it is predicted that there will be a long-term positive residual impact of moderate significant for the dry meadow and grass verges habitat, given that it will notably increase in its total area and frequency throughout the proposed Scheme area.

(Mixed) broadleaved woodland [Higher Local]

It is predicted that there will be long-term positive residual impact of slight significance for the mixed broadleaved woodland habitats located within the proposed Scheme's boundaries, following the implementation of both Construction and Operational Phase mitigation measures, and a medium-term ecological lag to allow for the maturation of the new broadleaved woodland copses, that will result in a minor increase in its area (frequency and spread) and ecological value (biodiversity and ecological beneficial species).

Scattered trees and parkland [Higher Local]

Following the implementation of both Construction and Operational Phase mitigation measures, and a medium-term ecological lag to allow for the maturation of the newly planted trees within the parkland habitats, it is predicted that there will be a long-term negative residual impact of slight significance for the scattered tree and parkland habitats given the reduction in the habitat's total area and associated trees as a result of conversion to higher quality ecological habitats.

Hedgerows [Higher Local]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and a short- to medium-term ecological lag to allow for the maturation of the new hedgerow

habitats, there will be a long-term positive residual impact of slight significance for the hedgerow habitats present within the site, given that it will see a minor increase in its area (frequency and spread) and ecological value (biodiversity and ecological beneficial species).

Treelines [Higher Local]

Following the implementation of both Construction and Operational Phase mitigation measures, and a medium-term ecological lag to allow for the maturation of the new treeline habitats, it is predicted that there will be a long-term positive residual impact of slight significance for the treeline habitats present within the Scheme's boundaries, given that it will result in a moderate increase in its area (frequency and spread) and ecological value (biodiversity and ecological beneficial species).

Wet willow-alder-ash woodland [Higher Local]

It is predicted that there will be a long-term neutral residual impact that is not significant for the wet willow-alder-ash woodland habitats present within the Scheme's boundaries, following the implementation of both Construction and Operational Phase mitigation measures, and a medium-term ecological lag to allow for the maturation of the new trees and understorey vegetation, that will undergo full remediation / reinstatement under the proposed landscape design (see Urban Integration Report (Volume 5 - Appendix A21.2).

Scrub [Higher Local]

Following the implementation of both Construction and Operational Phase mitigation measures, and a short-term ecological lag to allow for the maturation of scrub flora, it is predicted that there will be a long-term positive residual impact of slight significance for the scrub habitat present within the site, given that it will see a minor increase in its area and ecological value (biodiversity and ecological beneficial species).

Ornamental / non-native shrub [Lower Local]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and a short-term ecological lag to allow for the maturation of ornamental / non-native shrub flora, there will be a long-term positive residual impact of slight significance for the ornamental / non-native shrub habitat present within the site, given that it will see a minor increase in its area and ecological value (biodiversity and ecological beneficial species).

9.5.4.3 Rare and Protected Flora

The operational residual impacts for the below rare and protected flora species is based on the proposed Scheme's landscape designs / planting plans (see Urban Integration Report (Volume 5 - Appendix A21.2), with the on-going maintenance, overseen by TII, DCC Parks and Waterways Ireland ensuring that these proposed habitats reach and are maintained at their proposed condition. The operational habitat maintenance is intrinsically linked to the below flora described below.

Opposite-leaved Pondweed [National]

Following the implementation of both Construction and Operational Phase mitigation measures, it is predicted that there will be a long-term neutral impact that is not significant for the Opposite-leaved Pondweed population, given the SuDS features within the proposed Scheme's drainage / landscape designs.

Tassel Stonewort [National]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, there will be a long-term neutral impact that is not significant for the Tassel Stonewort population, given the SuDS features within the proposed Scheme's drainage / landscape designs.

Pointed Stonewort [County]

It is predicted that there will be a long-term neutral impact that is not significant for the downstream Pointed Stonewort population, following the implementation of both construction and Operational Phase mitigation measures, and given the SuDS features within the Scheme's proposed drainage / landscape designs.

Rare / Uncommon Freshwater Macrophytes: Clustered Stonewort [Higher Local]

It is predicted that, following the implementation of both construction and Operational Phase mitigation measures, there will be a long-term neutral impact that is not significant for the downstream Clustered Stonewort population, given the SuDS features within the Scheme's proposed drainage / landscape designs.

Uncommon / Rare Terrestrial Flora: Pyramidal Orchid and Bee Orchid [Higher Local]

Following the implementation of both Construction and Operational Phase mitigation measures, it is predicted that there will be a long-term neutral impact that is not significant for the Pyramidal Orchid and Bee Orchid populations, given the proposed landscape designs.

9.5.4.4 Rare and Protected Fauna

The operational residual impacts for the below rare and protected fauna species are based on the proposed Scheme's proposed landscape designs / planting plans, with the on-going maintenance, overseen by TII, DCC Parks and Waterways Ireland ensuring that these proposed habitats reach and are maintained at their proposed condition. The operational habitat maintenance is intrinsically linked to the below fauna described below.

Otter [International]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and a short-term ecological, there will be a long-term neutral residual impact that is not significant for the local Otter population, given the remedial planting of commuting routes, negligible noise-based disturbance impacts from operations and SuDS features.

Bats [County]

Following the implementation of both Construction and Operational Phase mitigation measures, and a short-term ecological lag, it is predicted that there will be an adverse residual impact that is not significant for bat species, as the proposed habitats and their associated increase in the provision and diversity of terrestrial invertebrate species (prey items) will help remedy the negative effects of the additional operational lighting, which reduce the total area available for bat foraging and commuting that are not impacted by light (bottle-necking of dark corridors).

Other Terrestrial Mammals [Higher Local]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and short-term ecological lag, there will be a long-term positive residual impact of slight significance for Badger, Pine Marten, Irish Hare, Irish Stoat, Hedgehog, and Pygmy Shrew populations, Following the implementation of both construction and Operational Phase mitigation measures, and short-term ecological lag given the remedial planting and enhancement of existing wildlife corridors and the creation of new corridors; negligible noise-based disturbance impacts from operations; habitat-safeguarding SuDS features; and no significant increase in collision risk mortality.

Marine Mammals [County]

In regard to marine mammals, it is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, there will be a long-term neutral residual impact that is not significant for the marine mammal populations of the Tolka Estuary and Dublin Bay, given the proposed SuDS features, which safeguard the aquatic habitats that hydrologically connect the proposed Scheme area to the above estuarine and coastal waterbodies.

Breeding Birds [Higher Local; County; Regional]

Following the implementation of both Construction and Operational Phase mitigation measures, and a short- to medium-term lag, it is predicted that there will be a long-term positive residual impact of slight significance for local breeding bird populations, given the remedial planting and enhancement of existing wildlife corridors and the creation of new corridors (nesting sites); negligible noise-based disturbance impacts from operations; habitat-safeguarding SuDS features; no significant increase in collision risk mortality with LRVs; and no overhead wire collision given the provision of visual deflectors within the design.

Wintering Birds [Higher Local; County; International]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and a short- to medium-term lag, there will be a long-term positive operational impact of slight significance for frugivorous wintering bird populations (i.e. Redwing), given the planting of new berry-producing tree species throughout the proposed Scheme; no significant noise-based disturbance impacts from operations; associated habitat-safeguarding via SuDS features; and no significant increase in collision risk mortality with LRVs. Whereas it is predicted that there will only be a long-term negative residual impact that is not significant for insectivorous, herbivorous and omnivorous wintering bird populations.

Reptiles [Higher Local]

Regarding reptiles, i.e. Common Lizard, it is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and short-term ecological lag, there will be a long-term positive residual impact of slight significance for local Common Lizard population, given the remedial planting of cleared habitats; enhancement of existing wildlife corridors and the creation of new corridors and basking areas; minimal collision mortality risk; and the habitat-safeguarding SuDS features.

Amphibians [Higher Local]

Following the implementation of both Construction and Operational Phase mitigation measures, and short-term ecological lag, it is predicted that there will be a long-term positive residual impact of slight significance for local Common Frog and Smooth Newt populations, given the remedial planting of cleared habitats; enhancement of existing wildlife corridors and the creation of new corridors; minimal collision mortality risk; and the habitat-safeguarding SuDS features.

Fish [Higher Local, National, International]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, there will be a long-term neutral residual impact that is not significant for the local and downstream fish populations of the Royal Canal and Tolka Valley Park pond, given the proposed SuDS features, which safeguard the aquatic habitats within and adjacent to the proposed Scheme. Whereas it is predicted that there will be long-term positive residual impact that is not significant for the fish population within the River Tolka, as a result of the proposed SuDS features and increased shading, which will aid stabilising river temperature during future extreme high temperature events as result of climate change.

Terrestrial Invertebrates [Higer Local]

In regard to terrestrial invertebrates, it is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, and short-term ecological lag, there will be a long-term positive residual impact of slight significance for local terrestrial invertebrate populations, given the remedial planting of cleared habitats; enhancement of existing wildlife corridors and the creation of new corridors with pollinator-friendly planting; and the habitat-safeguarding SuDS features.

Protected Freshwater Invertebrates: Glutinous Snail [National]

Following the implementation of both Construction and Operational Phase mitigation measures, it is predicted that there will be a long-term neutral residual impact that is not significant for the Royal Canal's downstream Glutinous Snail population, given the proposed SuDS features, which safeguard the canal habitat.

Other Freshwater Invertebrates [Higher Local]

It is predicted that, following the implementation of both Construction and Operational Phase mitigation measures, there will be a long-term neutral residual impact that is not significant for the local freshwater invertebrate populations of the Royal Canal, River Tolka and Tolka Valley Park pond, given the proposed SuDS features, which safeguard the aquatic habitats within and adjacent to the proposed Scheme.

9.5.4.5 Summary of Residual Impacts

Table 9-34 overleaf presents an overall summary of the KERs and their respective ecological valuations; potential impacts; significance of impact in the absence of mitigations measures; prescribed mitigations measures and the significance of their residual impacts.

Table 9-34: Summary KERs and their respective valuations, potential impact; significance of unmitigated impacts; required mitigations; and significance of residual impacts

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Designated Sites					
North Dublin Bay SAC [000206]	International	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the vegetation of Annex I habitats as a result of pollutants such as hydrocarbon. Air (dust) pollution has the potential to negatively impact habitats, adversely impacting photosynthesis and the biological functions of valued flora. The spread of invasive species such as Japanese Knotweed, from the construction site into this Natura 2000 site via the River Tolka may have serious adverse impacts on present Annex habitats, displacing native species. **Operational Phase:** None predicted.	**Construction Phase:** Short- to medium-term adverse impact of moderate significance **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term neutral residual impact that is not significant
South Dublin Bay SAC [000210]	International	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites.	**Construction Phase:** Short- to medium-term adverse impact of moderate significance.	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2;	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Potential direct impacts include the degradation of overall water quality and the vegetation of Annex I habitats as a result of pollutants such as hydrocarbon. The spread of invasive species such as Japanese Knotweed, from the construction site into this Natura 2000 site via the River Tolka may have serious adverse impacts on present Annex habitats, displacing native species. **Operational Phase:** None predicted.	**Operational Phase:** Long-term neutral operational impact that is not significant	The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Rockabill to Dalkey Island SAC [003000]	International	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the vegetation of Annex I habitats because of hydrocarbon pollution. Potential hydrocarbon pollutants have the potential to degrade the dermal layers of KER mammal species, as well as negatively impact the health of these species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER mammal species by negatively impacting the local food chain.	**Construction Phase:** Short- to medium-term adverse impact of moderate significance. **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Operational Phase: None predicted.		**Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
North Bull Island SPA [004006]	International	**Construction Phase:** The River Tolka and Royal Canal have the potential to transport pollutants downstream to the SPA. Potential direct impacts include the degradation of overall water quality and the vegetation of associated wetland habitats as a result of hydrocarbon pollution. Hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the health of KER bird species via ingestion. Water pollution impacts to this SPA have the potential to indirectly impact KER bird species by negatively impacting the local food chain. Air (dust) pollution has the potential to negatively impact amenity grasslands. This has the potential to have knock on impacts for KER bird species, which are supported by these ex-situ habitats. Visual and audible disturbance arising during construction work, disrupting the foraging, commuting and roosting activities of KER bird species during the winter period. The spread of invasive species such as Japanese Knotweed, from the construction site into this SPA via the River Tolka may have adverse impacts on the wetland	**Construction Phase:** Short- to medium-term adverse impact of moderate significance. **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to wintering bird species within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31 and 32 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		habitats, which support the KER bird species. **Operational Phase:** None predicted.		The prescribed post-construction monitoring programme for wintering bird species as detailed in sub-section 9.5.3.6.	
South Dublin Bay and River Tolka Estuary SPA [004024]	International	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the vegetation of associated wetland habitats as a result of hydrocarbon pollution. Potential hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the health of KER bird species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER bird species by negatively impacting the local food chain. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact amenity grasslands, adversely impacting photosynthesis and the biological functions of plants. This has the potential to have knock on impacts for KER bird species, which are supported by these ex-situ habitats. Potential visible and audible disturbance arising during construction work have the potential to disrupt the foraging, commuting	**Construction Phase:** Short- to medium-term adverse impact of moderate significance **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		and roosting activities of KER bird species within or adjacent to the proposed construction works during the winter period. The spread of invasive species such as Japanese Knotweed, from the construction site into this Natura 2000 site via the River Tolka may have serious adverse impacts on the wetland habitats, which support the KER bird species. **Operational Phase:** None predicted.			
North-West Irish Sea SPA [004236]	International	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the vegetation of associated habitats as a result of hydrocarbon pollution. Potential hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the health of KER bird species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER bird species by negatively impacting the local food chain. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact amenity grasslands, adversely impacting photosynthesis and the	**Construction Phase:** Short- to medium-term adverse impact of moderate significance. **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		biological functions of plants. This has the potential to have knock on impacts for KER bird species, which are supported by these ex-situ habitats. Potential visible and audible disturbance arising during construction work have the potential to disrupt the foraging, commuting and roosting activities of KER bird species within or adjacent to the proposed construction works during the winter period. **Operational Phase:** None predicted.			
Royal Canal pNHA [002103]	National	**Construction Phase:** Potential direct impacts include the degradation of overall water quality and the vegetation of associated habitats as a result of hydrocarbon pollution. Potential hydrocarbon pollutants have the potential to degrade the plumage and furs of KER bird and mammal species, as well as negatively impact the health of all KER faunal species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER bird and mammal species by negatively impacting the local food chain. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact local protected / rare flora, adversely impacting photosynthesis and the biological functions of plants. This has the potential to have knock on impacts for KER	**Construction Phase:** Short- to medium-term adverse impact of moderate significance. **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to all groups of rare and protected floral species within sub-section 9.5.2.6; The measures specific to all groups of rare and protected faunal species within sub-section 9.5.2.7; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		bird species, which are supported by these ex-situ habitats. Potential visible and audible disturbance arising during construction work have the potential to disrupt the foraging, commuting and roosting activities of KER bird and mammal species within or adjacent to the proposed construction works. Vulnerable to physical degradation of its associated habitats, as well the disturbance to and accidental fatalities of associated fauna. **Operational Phase:** None predicted.		**Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for rare and protected macrophyte species as detailed in sub-section 9.5.3.6.	
North Dublin Bay pNHA [000206]	National	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the vegetation of Annex I habitats as result of pollutants, such as hydrocarbons. Potential hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the health of KER mammal and bird species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact	**Construction Phase:** Short- to medium-term adverse impact of moderate significance. **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to wintering bird species within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31 and 32 within the Area Specific Mitigation Measures sub-section 9.5.2.8.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		KER species by negatively impacting the local food chain. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact amenity grasslands, adversely impacting photosynthesis and the biological functions of plants. This has the potential to have knock on impacts for KER bird species, which are supported by these ex-situ habitats. Potential visible and audible disturbance arising during construction work have the potential to disrupt the foraging, commuting and roosting activities of KER bird species within or adjacent to the proposed construction works during the winter period. The spread of invasive species such as Japanese Knotweed, from the construction site into this Natura 2000 site via the River Tolka may have serious adverse impacts on present Annex habitats, displacing native species. **Operational Phase:** None predicted.		**Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for wintering bird species as detailed in sub-section 9.5.3.6.	
South Dublin Bay pNHA [(000210]	National	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the	**Construction Phase:** In the absence of mitigation during the Construction Phase, it is predicted that will be short- to medium-term adverse impact of moderate significance.	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3;	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		vegetation of Annex I habitats as a result of pollutants, such as hydrocarbons. Potential hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the health of KER mammal and bird species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER bird and mammal species by negatively impacting the local food chain. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact amenity grasslands, adversely impacting photosynthesis and the biological functions of plants. This has the potential to have knock on impacts for KER bird species, which are supported by these ex-situ habitats. Potential visible and audible disturbance arising during construction work have the potential to disrupt the foraging, commuting and roosting activities of KER bird species within or adjacent to the proposed construction works during the winter period. The spread of invasive species such as Japanese Knotweed, from the construction site into this Natura 2000 site via the River Tolka may have serious adverse impacts on present Annex habitats, displacing native species. **Operational Phase:** None predicted.	**Operational Phase:** Long-term neutral operational impact that is not significant	The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Booterstown Marsh pNHA [001205]	National	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the vegetation of Annex I habitats as a result of pollutants, such as hydrocarbons. Potential hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the health of KER bird species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER bird and mammal species by negatively impacting the local food chain. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact amenity grasslands, adversely impacting photosynthesis and the biological functions of plants. Potential visible and audible disturbance arising during construction work have the potential to disrupt the foraging, commuting and roosting activities of KER bird species within or adjacent to the proposed construction works during the winter period. **Operational Phase:** None predicted.	**Construction Phase:** In the absence of mitigation during the Construction Phase, it is predicted that will be short- to medium-term adverse impact of moderate significance. **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Dolphins, Dublin Docks pNHA [000201]	National	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the health of KER bird species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER bird species by negatively impacting the local food chain. **Operational Phase:** None predicted.	**Construction Phase:** In the absence of mitigation during the Construction Phase, it is predicted that will be short- to medium-term adverse impact of moderate significance. **Operational Phase:** Long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term neutral residual impact that is not significant
UNESCO Dublin Bay Biosphere	International	**Construction Phase:** The natural (River Tolka) and artificial (Royal Canal) watercourses have the potential to transport pollutants (e.g. hydrocarbons) downstream to the Dublin Bay-based Natura 2000 sites. Potential direct impacts include the degradation of overall water quality and the vegetation of Annex I habitats as a result of pollutants, such as hydrocarbons. Potential hydrocarbon pollutants have the potential to degrade the plumage of KER bird species, as well as negatively impact the	**Construction Phase:** In the absence of mitigation during the Construction Phase, it is predicted that will be short- to medium-term adverse impact of moderate significance. **Operational Phase:**	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to wintering bird species within sub-section 9.5.2.7; and	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		health of KER mammal and bird species via ingestion. Water pollution impacts to this Natura 2000 site have the potential to indirectly impact KER bird and mammal species by negatively impacting the local food chain. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact amenity grasslands, adversely impacting photosynthesis and the biological functions of plants. This has the potential to have knock on impacts for KER bird species, which are supported by these ex-situ habitats. Potential visible and audible disturbance arising during construction work have the potential to disrupt the foraging, commuting and roosting activities of KER bird species within or adjacent to the proposed construction works during the winter period. The spread of invasive species such as Japanese Knotweed, from the construction site into this Natura 2000 site via the River Tolka may have serious adverse impacts on present Annex habitats, displacing native species. **Operational Phase:** None predicted.	Long-term neutral operational impact that is not significant	The safeguards detailed for Areas 30, 31 and 32 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for wintering bird species as detailed in sub-section 9.5.3.6.	
Habitats					
Stone walls and other stonework	Lower Local	**Construction Phase:**	**Construction Phase:** Short-term adverse impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1;	Long-term neutral residual impact

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Potential to be physically degraded or damaged during the construction works on the light rail bridge crossing. Air (dust) pollution during construction works within Tolka Valley Park has the potential to negatively impact vegetation associated with this habitat **Operational Phase:** None predicted	**Operational Phase:** Initial long-term neutral operational impact that is not significant	The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	that is not significant
Other artificial lakes and ponds	County	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Air (dust) pollution generated during the Construction Phase has the potential to degrade the vegetation associated with this habitat, degrading the biodiversity value. Installation of falsework for the construction of the light rail bridge has the potential to result in physical degradation of flora species in this habitat. The potential to accidentally spread invasive species from where they currently are in Tolka Valley Park, to this habitat along Royal	**Construction Phase:** Short-term adverse impact of moderate significance **Operational Phase:** Initial long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:**	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Canal may result in displacement of native species. **Operational Phase:** None predicted.		The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Reed and large sedge swamps	Higher Local	**Construction phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Air (dust) pollution generated during the Construction Phase has the potential to degrade the vegetation associated with this habitat, degrading the biodiversity value. Installation of falsework for the construction of the light rail bridge has the potential to result in physical degradation of flora species in this habitat. **Operational Phase:** Negative shading impact on vegetation as a result of the new light-rail bridge within Tolka Valley Park.	**Construction Phase:** Short-term adverse impact of slight significance **Operational Phase:** Initial short-term term negative impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term negative residual impact that is not significant
Tall-herb swamps (Potential Annex I	National	**Construction Phase:** Potential direct impacts include the degradation of overall water quality and the	**Construction Phase:** Short-term negative impact of moderate significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1;	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
habitat: 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430))		vegetation associated with this habitat because of hydrocarbon pollution. Water pollution impacts to this habitat have the potential to indirectly impact bird and mammal species by negatively impacting the local food chain. Groundwater to surface water pollution may occur due to the Tolka Valley site previously being a landfill. Disturbance to the ground during excavations may expose the historic waste, any water introduced has the potential to produce a harmful leachate that will flow into the pond due to the topography of the site. Air (dust) pollution generated during the construction may harm floating and emergent flora within the pond. Alkaline cement-based dusts have the potential to affect the pond's pH levels, potentially harming pH sensitive aquatic flora and fauna. **Operational Phase:** None predicted.	**Operational Phase:** Initial short-term neutral impact that is not significant	The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Depositing / lowland rivers (River Tolka)	County	**Construction Phase:** Potential direct impacts include the degradation of overall water quality and the vegetation associated with this habitat because of hydrocarbon pollution. Water pollution impacts to this habitat have the potential to indirectly impact bird and mammal species by negatively impacting the local food chain. Air (dust) pollution generated during the construction may harm floating and emergent	**Construction Phase:** Short-term negative impact of moderate significance **Operational Phase:** Initial long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3;	Long-term neutral residual impact of that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		flora within the pond. Alkaline cement-based dusts have the potential to affect the pond's pH levels, potentially harming pH sensitive aquatic flora and fauna. **Operational Phase:** Shading as a result of the new light-rail bridge within the Tolka Valley Park, though this is considered to be positive as it will help stabilise water temperatures within the River Tolka during prolonged high temperatures periods brough about by future climate change.		The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Canals (Royal Canal)	National	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Air (dust) pollution generated during the Construction Phase has the potential to degrade the vegetation associated with this habitat, degrading the biodiversity value. **Operational Phase:** Shading impact as a result of the new light - rail bridge, though this is considered to be a neutral impact given the lack of emergence and floating vegetation flora in this section of the Royal Canal.	**Construction Phase:** Significant temporary to medium-term adverse impact **Operational Phase:** Initial long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:**	Long-term neutral residual impact of that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
				The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Amenity grassland (improved)	County	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Air (dust) pollution generated during the Construction Phase has the potential to degrade the vegetation associated with this habitat, degrading the biodiversity value. Installation of falsework for the construction of the light rail bridge has the potential to result in physical degradation of flora species in this habitat. Both from compaction via the temporary foundations and the trampling from works on-site. The potential to accidentally spread invasive species (e.g. Himalayan Balsam, Japanese Knotweed and Giant Hogweed) from adjacent locations in Tolka Valley Park, to this habitat may result in displacement of native species. **Operational Phase:** Habitat loss as a result of new light-rail, road and pedestrian infrastructure, as well as conversion to higher quality habitats.	**Construction Phase:** Short-term adverse impact of slight significance **Operational Phase:** Initial short-term negative operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term negative residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Amenity grasslands associated with wintering bird species will remain intact.			
Marsh	Higher Local	**Construction Phase:** Potential introduction of harmful substances (e.g. hydrocarbons and solvent) by spillages, which will adversely impact the health of the grassland flora. Potential physical degradation from the excessive footfall of workers and compaction from machinery on-site during construction. This degradation may allow invasives species (e.g. Butterfly Bush) nearby to colonise this habitat. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact grasslands, adversely impacting photosynthesis and the biological functions of plants. **Operational Phase:** Negative shading impact on vegetation as a result of the new light-rail bridge within Tolka Valley Park.	**Construction Phase:** Short-term adverse impact of slight significance **Operational Phase:** Initial short-term negative operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term negative residual impact that is not significant
Dry calcareous and neutral grassland	County	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Potential physical degradation from the excessive footfall of workers and compaction	**Construction Phase:** Short-term adverse impact of moderate significance **Operational Phase:** Initial short-term negative operational impact of moderate significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3;	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		from machinery on-site during construction. This degradation may allow invasives species (e.g. Butterfly Bush) nearby to colonise this habitat. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact grasslands, adversely impacting photosynthesis and the biological functions of plants. The potential to accidentally spread invasive species (e.g. Himalayan Balsam, Japanese Knotweed and Giant Hogweed) from nearby locations in Tolka Valley Park, to this habitat may result in displacement of native species. **Operational Phase:** Habitat loss during early Operational Phase.		The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 32 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Dry meadow and grassy verges	Higher Local	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Potential root compaction or limb damage from machinery operating adjacent to the woodlands, degrading the health of tree species. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact this habitat, adversely impacting photosynthesis and the biological functions of plants.	**Construction Phase:** Short-term adverse impact of moderate significance **Operational Phase:** Initial short-term negative operational impact of moderate significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The safeguards detailed for Areas 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:**	Long-term positive residual impact of moderate significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		The potential to accidentally spread invasive species (e.g. Himalayan Balsam, Japanese Knotweed and Giant Hogweed) from nearby locations in Tolka Valley Park, to this habitat may result in displacement of native species. **Operational Phase:** Habitat loss during early Operational Phase.		The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
(Mixed) broadleaved woodland	Higher Local	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Potential root compaction or limb damage from machinery operating adjacent to the hedgerow, degrading the health of tree species. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact this habitat, adversely impacting photosynthesis and the biological functions of plants. **Operational Phase:** Initially only neutral impacts predicted.	**Construction Phase:** Short- to long-term adverse impact of slight significance **Operational Phase:** Initial medium-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; and The safeguards detailed for Areas 31 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Scattered trees and parkland	Higher Local	**Construction Phase:** Direct habitat loss due to the footprint of the Scheme. Potential introduction of deleterious substances (e.g. hydrocarbons, solvents and cement leachate) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Potential root compaction or limb damage from machinery operating adjacent to trees within the habitat, degrading the health of the tree species. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact this habitat, adversely impacting photosynthesis and the biological functions of plants. **Operational Phase:** Habitat loss as a result of new light-rail, road and pedestrian infrastructure, as well as conversion to other habitat types.	**Construction Phase:** Short-term to long-term impact of moderate significance **Operational Phase:** Initial medium-term negative operational impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; and The safeguards detailed for Areas 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term negative residual impact of slight significance
Hedgerows	Higher Local	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons, solvents and cement leachate) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Habitat loss and fragmentation.	**Construction Phase:** Short- to long-term adverse impact of moderate significance **Operational Phase:**	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3;	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Potential root compaction or limb damage from machinery operating adjacent to treelines, degrading the health of tree species. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact this habitat, adversely impacting photosynthesis and the biological functions of plants. **Operational Phase:** Habitat loss during early Operational Phase.	Initial medium-term negative operational impact of slight significance	The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; and The safeguards detailed for Areas 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Treelines	Higher Local	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons, solvents and cement leachate) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Habitat loss and fragmentation. Potential root compaction or limb damage from machinery operating adjacent to treelines, degrading the health of tree species. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact this habitat, adversely impacting photosynthesis and the biological functions of plants.	**Construction Phase:** Short- to long-term adverse impact of moderate significance **Operational Phase:** Initial medium-term negative operational impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; and The safeguards detailed for Areas 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8.	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Operational Phase: Habitat loss during early Operational Phase.		**Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Wet willow-alder-ash woodland	Higher Local	**Construction Phase:** Three trees will be lost from this habitat due to the footprint of the Scheme. Potential introduction of deleterious substances (e.g. hydrocarbons, solvents and cement leachate) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Potential root compaction or limb damage from machinery operating adjacent to the woodland, degrading the health of the tree species. Air (dust) pollution generated during the Construction Phase has the potential to negatively impact this habitat, adversely impacting photosynthesis and the biological functions of plants. **Operational Phase:** Habitat loss during early Operational Phase.	**Construction Phase:** Short- to long-term adverse impact of moderate significance. **Operational Phase:** Initial medium-term negative operational impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; and The safeguards detailed for Areas 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Scrub	Higher Local	**Construction Phase:** Approximately 82% of this habitat will be lost due to the footprint of the Scheme. Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) into the habitat resulting in the degradation of the floral communities, lowering the biodiversity value of the habitat. Air (dust) pollution generated during the Construction Phase has the potential to degrade the vegetation associated with this habitat, degrading the biodiversity value. The potential to accidentally spread invasive species (e.g. Himalayan Balsam, Japanese Knotweed and Giant Hogweed) from nearby locations in Tolka Valley Park, to this habitat may result in displacement of native species. **Operational Phase:** Habitat loss during early Operational Phase.	**Construction Phase:** Very significant short- to long-term adverse impact **Operational Phase:** Initial short-term negative operational impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term positive residual impact of slight significance
Ornamental / non-native shrub	Lower Local	**Construction Phase:** This habitat will be entirely removed in order to facilitate the proposed Scheme. **Operational Phase:** Habitat loss during early Operational Phase.	**Construction Phase:** Permanent adverse impact of profound significance **Operational Phase:** Initial long-term negative operational impact of profound significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; and	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
				The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Flora					
Opposite-leaved Pondweed	National	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) resulting in the degradation of the species population. Introduction of sedimentation may lead to eutrophication which will be detrimental to the species. **Operational Phase:** None predicted.	**Construction Phase:** Temporary to short-term adverse impact of moderate significance **Operational Phase:** Initial long-term neutral impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to uncommon and rare freshwater macrophytes within sub-section 9.5.2.6; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:**	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
				The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for macrophytes as detailed in sub-section 9.5.3.6.	
Tassel Stonewort	National	**Construction Phase:** Tassel Stonewort is a pollution sensitive species and is particularly vulnerable to pollution spills (e.g. hydrocarbons) into the Royal Canal which may degrade the local population. This species is also vulnerable to excessive nutrient-based pollution. Sediment entering the canal via spills or dust settlement into the Royal Canal during construction works will prove detrimental. **Operational Phase:** None predicted.	**Construction Phase:** Temporary to short-term adverse impacts of moderate significance **Operational Phase:** Initial long-term neutral impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to uncommon and rare freshwater macrophytes within sub-section 9.5.2.6; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for macrophytes as detailed in sub-section 9.5.3.6.	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Pointed Stonewort	County	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) resulting in the degradation of the species population. **Operational Phase:** None predicted.	**Construction Phase:** Temporary to short-term adverse impact of moderate significance **Operational Phase:** Initial long-term neutral impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to uncommon and rare freshwater macrophytes within sub-section 9.5.2.6; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for macrophytes as detailed in sub-section 9.5.3.6.	Long-term neutral residual impact that is not significant
Rare / Uncommon Freshwater Macrophytes: Clustered Stonewort	Higher Local	**Construction Phase:** Potential introduction of deleterious substances (e.g. hydrocarbons and solvents) resulting in the degradation of the species population. **Operational Phase:**	**Construction Phase:** Temporary to short-term adverse impact of slight significance **Operational Phase:**	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2;	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		None predicted.	Initial long-term neutral impact that is not significant	The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to uncommon and rare freshwater macrophytes within sub-section 9.5.2.6; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for macrophytes as detailed in sub-section 9.5.3.6.	
Uncommon / Rare Flora: Pyramidal Orchid Bee Orchid	Higher Local	**Construction Phase:** Both species are at risk of potential trampling underfoot or compaction from machinery. The Pyramidal Orchid is present within the red line boundary and present within close proximity to the construction works, making it vulnerable to degradation via pollutant spills. Both rare orchid species has the potential to be impacted by dust-based pollution during the Construction Phase, with cement-based dusts being of particular concern given their ability to degrade the species' cellular structures.	**Construction Phase:** Temporary to short-term adverse impacts of slight significance **Operational Phase:** Initial long-term neutral impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The measures specific to uncommon and rare flora within sub-section 9.5.2.6; and	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Operational Phase: None predicted.		The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	
Fauna					
Otter	International	**Construction Phase:** Adverse impacts during the Construction Phase may arise in the form of disturbance to foraging, resting (holt) and commuting activities. Potential loss of life to Otter in the case of accidents within the construction site and detrimental impacts to health of Otter from hydrocarbon pollutants. **Operational Phase:** None predicted.	**Construction Phase:** Temporary to short-term adverse impact of moderate significance **Operational Phase:** Initial long-term neutral impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to Otter within sub-section 9.5.2.7; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:**	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
				The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for Otter as detailed in sub-section 9.5.3.6.	
Bats	County	**Construction Phase:** Direct and indirect impacts likely to occur on foraging and commuting bats located within the scheme, resulting from the temporary or permanent land take and/or artificial light/noise/vibration pollution during this phase. Removal of mature and dark zones may impact commuting. **Operational Phase:** Bottle-necking of existing dark corridors present within the boundaries of the proposed Scheme.	**Construction Phase:** Temporary to short-term adverse impact of moderate significance **Operational Phase:** Initial long-term adverse impact of moderate significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to bat species within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2;	Long-term negative residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
				The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; The design specifications within the lighting plan ensuring minimal light pollution impacts for nocturnal species, as outlined in sub-section 9.5.3.4; and The prescribed post-construction monitoring programme for bat species as detailed in sub-section 9.5.3.6.	
Other Terrestrial Mammals - Badger - Pine Marten - Irish Hare - Stoat - Hedgehog - Pygmy Shrew	Higher Local	**Construction Phase:** Physiological impact via ingestion / contact with deleterious substances leading to potential fatalities. Adverse impacts to terrestrial mammals such as Hare, Badger, and Hedgehog may arise in the form of disturbance to foraging and commuting activities. Potential loss of life in the case of accidents within the construction site. Surface water and groundwater-to-surface water-based pollution have the potential to impact mammals via the deterioration of prey items in the food chain and have the potential to lead to the bioaccumulation of toxic substances within local mammal populations. **Operational Phase:** Low collision mortality risk.	**Construction Phase:** Temporary to short-term adverse impact of slight significance **Operational Phase:** Initial short-term negative operational impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to terrestrial mammals within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2;	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
				The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The design specifications within the lighting plan ensuring minimal light pollution impacts for nocturnal species, as outlined in sub-section 9.5.3.4.	
Marine Mammals	County	**Construction Phase:** Adverse impacts may arise in the form of accidental introduction of pollutants, such as hydrocarbons, into the local surface water network, which can degrade the insulative qualities of mammals furs living in the River Tolka Estuary. Surface water and groundwater-to-surface water-based pollution have the potential to impact mammals via the deterioration of prey items in the food chain and have the potential to lead to the bioaccumulation of toxic substances within local marine mammal populations. **Operational Phase:** None predicted.	**Construction Phase:** Temporary to short-term adverse impact of moderate significance **Operational Phase:** Initial long-term neutral impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; and The measures specific to marine mammals within sub-section 9.5.2.7; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term neutral residual impact that is not significant
Breeding birds: - Kingfisher	Regional County	**Construction Phase:** Removal of trees will result in the loss of four or five active nests. Impacts to grasslands and woodlands will also have knock-on effect	**Construction Phase:** Temporary to medium-term adverse impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1;	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
- Other Annex, Red and Amber-listed breeding bird species - Green-listed breeding bird species	Higher Local	of availability of nesting for bird species in the area. Environmental pollutants accidentally introduced via surface water, groundwater and/or air pathways into the on-site and adjacent habitats during the Construction Phase will reduce the capacity of these habitats to support foraging activities of breeding birds. Breeding bird species using the site for foraging purposes may be visually and/or audibly disturbed by construction works. Surface water and groundwater-to-surface water-based pollution have the potential to impact breeding birds via the deterioration of prey items in the food chain and have the potential to lead to the bioaccumulation of toxic substances within local breeding bird populations. Pollution have the potential to indirectly impact breeding birds via the deterioration of food / prey items. As well potential for bioaccumulation of toxic elements up the food chain. Audible and visual disturbance may also disturb breeding bird species, causing them to vacate the site during works. **Operational Phase:** Low collision (LRV and overhead cables) mortality risk. Loss of habitats providing foraging and nesting during early Operational Phase.	**Operational Phase:** Initial medium-term negative operational impact of slight significance	The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to wintering birds within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Herbivorous Wintering birds: Light-bellied Brent Goose Other Red- and Amber-listed wintering bird species Green-listed wintering bird species	International County Higher Local	**Construction Phase:** Environmental pollutants accidentally introduced via surface water, groundwater and/or air pathways into the on-site and adjacent habitats during the Construction Phase will reduce the capacity of these habitats to support foraging activities of wintering birds. Wintering bird species using the site for foraging purposes may be visually and/or audibly disturbed by construction works. Surface water and groundwater-to-surface water-based pollution have the potential to impact wintering birds via the deterioration of the food chain and have the potential to lead to the bioaccumulation of toxic substances within local wintering bird populations. Physiological impact via ingestion or contact with polluted water. Pollution impacts have the potential to indirectly impact wintering birds via the deterioration of food. As well potential for bioaccumulation of toxic elements up the food chain. **Operational Phase:** Low collision (LRV and overhead cables) mortality risk. Minimal noise disturbance impact (LRV) Minor visual disturbance (humans and dogs) at Farnham green area.	**Construction Phase:** Temporary to short-term adverse impact of slight significance for wintering bird species, bar the Light-bellied Brent Goose which will experience temporary to short-term adverse impacts of moderate significance **Operational Phase:** Initial long-term negative operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to wintering birds within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for wintering bird species as detailed in sub-section 9.5.3.6.	Long-term negative residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Frugivorous Wintering Birds: Redwing (Red-listed) Green-listed wintering bird species	County Higher Local	**Construction Phase:** Environmental pollutants accidentally introduced via surface water, groundwater and/or air pathways into the on-site and adjacent habitats during the Construction Phase will reduce the capacity of these habitats to support foraging activities of wintering birds. Wintering bird species using the site for foraging purposes may be visually and/or audibly disturbed by construction works. Surface water and groundwater-to-surface water-based pollution have the potential to impact wintering birds via the deterioration of the food chain and have the potential to lead to the bioaccumulation of toxic substances within local wintering bird populations. Physiological impact via ingestion or contact with polluted water. Pollution impacts have the potential to indirectly impact wintering birds via the deterioration of food items. As well potential for bioaccumulation of toxic elements up the food chain. **Operational Phase:** Low collision (LRV and overhead cables) mortality risk. Minimal noise disturbance impact (LRV) Minor visual disturbance (humans and dogs) at Farnham green area.	**Construction Phase:** Temporary to short-term adverse impact of slight significance for frugivorous wintering bird species **Operational phase:** Initial long-term negative operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to wintering birds within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for wintering bird species as detailed in sub-section 9.5.3.6.	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Insectivorous Wintering Birds: Black-headed Gull Green-listed wintering bird species	International Higher Local	**Construction Phase:** Environmental pollutants accidentally introduced via surface water, groundwater and/or air pathways into the on-site and adjacent habitats during the Construction Phase will reduce the capacity of these habitats to support foraging activities of wintering birds. Wintering bird species using the site for foraging purposes may be visually and/or audibly disturbed by construction works. Surface water and groundwater-to-surface water-based pollution have the potential to impact wintering birds via the deterioration of prey items in the food chain and have the potential to lead to the bioaccumulation of toxic substances within local wintering bird populations. Physiological impact via ingestion or contact with polluted water. Pollution impacts have the potential to indirectly impact wintering birds via the deterioration of food / prey items. As well potential for bioaccumulation of toxic elements up the food chain. **Operational Phase:** Low collision (LRV and overhead cables) mortality risk. Minimal noise disturbance impact (LRV) Minor visual disturbance (humans and dogs) at Farnham green area.	**Construction Phase:** Temporary to short-term adverse impact of slight significance for wintering bird species, bar the Black-headed Gull which will experience temporary to short-term adverse impacts of moderate significance **Operational Phase:** Initial long-term negative operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to wintering birds within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for wintering bird species as detailed in sub-section 9.5.3.6.	Long-term negative residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Omnivorous Wintering Birds: Amber- and Red-listed species Green-listed wintering bird species	County Higher Local	**Construction Phase:** Environmental pollutants accidentally introduced via surface water, groundwater and/or air pathways into the on-site and adjacent habitats during the Construction Phase will reduce the capacity of these habitats to support foraging activities of wintering birds. Wintering bird species using the site for foraging purposes may be visually and/or audibly disturbed by construction works. Surface water and groundwater-to-surface water-based pollution have the potential to impact wintering birds via the deterioration of prey items in the food chain and have the potential to lead to the bioaccumulation of toxic substances within local wintering bird populations. Physiological impact via ingestion or contact with polluted water. Pollution impacts have the potential to indirectly impact wintering birds via the deterioration of food / prey items. As well potential for bioaccumulation of toxic elements up the food chain. **Operational Phase:** Low collision (LRV and overhead cables) mortality risk. Minimal noise disturbance impact (LRV) Minor visual disturbance (humans and dogs) at Farnham green area.	**Construction Phase:** Temporary to short-term adverse impact of slight significance for omnivorous wintering bird species **Operational Phase:** Initial long-term negative operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to wintering birds within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The installation of bord deflectors on overhead lines to minimise collision-based fatalities for KER bird species, as outlined in sub-section 9.5.3.1; The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; and The prescribed post-construction monitoring programme for wintering bird species as detailed in sub-section 9.5.3.6.	Long-term negative residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
Reptiles	Higher Local	**Construction Phase:** Deleterious pollutants accidentally introduced via surface water pathways into the on-site and adjacent habitats during the Construction Phase will reduce the capacity of these habitats to support foraging activities of local Common Lizard populations. Common Lizard using the site for foraging activities may be visually/audibly disturbed by construction works leading to them vacating sections of the site. Surface water and groundwater-to-surface water-based pollution have the potential to impact Common Lizard via the deterioration of prey items in the food chain and have the potential to lead to the bioaccumulation of toxic substances within local Common Lizard populations. Common Lizard may be subjected to disturbance-based impacts, which have the potential to disrupt their foraging and commuting activities, as well as potential loss of life for individuals within the construction site. **Operational Phase:** Low collision (LRV) mortality risk.	**Construction Phase:** Temporary to short-term adverse impact of slight significance **Operational Phase:** Initial long-term neutral operational impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to Common Lizard within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	Long-term positive residual impact of slight significance
Amphibians	Higher Local	**Construction Phase:** Deleterious pollutants accidentally introduced via surface water pathways into the on-site and adjacent habitats during the Construction Phase will reduce the capacity	**Construction Phase:** Temporary to short-term adverse impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2;	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		of these habitats to support foraging activities of amphibians. Common Frog and Smooth Newt may be subjected to disturbance-based impacts, which have the potential to disrupt their foraging and commuting activities, as well as potential loss of life for individuals within the construction site. **Operational Phase:** Low collision (LRV) mortality risk.	**Operational Phase:** Initial long-term negative operational impact that is not significant	The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to amphibians within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; The design specifications within the lighting plan ensuring minimal light pollution impacts for nocturnal species, as outlined in sub-section 9.5.3.4; and The measures outlining the creation of beneficial deadwood piles within woodland habitat, as described in sub-section 9.5.3.5.	
Fish: - Atlantic Salmon - Lamprey species	National National International	**Construction Phase:** Adverse impacts may arise from the accidental introduction of pollutants, such as hydrocarbons, into the local surface water network.	**Construction Phase:** Temporary to short-term adverse impact from slight (Brown Trout, Three-spined Stickleback, Minnow and Stone Loach)	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2;	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
- European Eel - Other fish species	Higher Local	Increase in vehicle presence adjacent to local waterbodies will increase nitrogen oxides resulting in acidification of the surface water network, increasing mortality of fish species. Several fish species within the marine and freshwater environment are known to bioaccumulate pollutants, which can damage their physiological health and introduce toxins into the lowest trophic level of the food web. **Operational Phase:** Minor increase in shading for the River Tolka and Royal Canal.	to moderate (Atlantic Salmon, Lamprey spp. and European Eel) significance **Operational Phase:** Initial long-term positive impact of slight significance (River Tolka) Initial long-term neutral impact that is not significant (Royal Canal)	The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5; The measures specific to fish species within sub-section 9.5.2.7; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	(Royal Canal and Tolka Valley Park Pond populations) Long-term positive residual impact that is not significant (River Tolka populations)
Terrestrial Invertebrates	Higher Local	**Construction Phase:** The accidental introduction of environmental pollutants via surface water, groundwater and air (dust) pathways, into the terrestrial and semi-aquatic/wetland habitats present within and adjacent to the proposed scheme may notably degrade the foraging resources of local terrestrial invertebrates, including the red-listed Large Red-tailed Bumblebee and Moss Carder-bee. Several invertebrate groups (e.g. Lumbricina – earthworms) are known to bioaccumulate pollutants, damaging their physiological	**Construction Phase:** Temporary to short-term adverse impact of slight significance **Operational Phase:** Initial long-term negative operational impact of slight significance	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5;	Long-term positive residual impact of slight significance

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		health and introducing toxins to the lowest trophic level of the food web. Negative impacts have the potential to arise for local terrestrial invertebrates in the form of disturbance to foraging and commuting activities during the Construction Phase. Removal of vegetation will remove a notable section of foraging grounds as well as create habitat fragmentation for terrestrial invertebrates. **Operational Phase:** None predicted.		The measures specific to terrestrial invertebrates within sub-section 9.5.2.7; and The safeguards detailed for Areas 30, 31, 32 and 33 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3; The design specifications within the lighting plan ensuring minimal light pollution impacts for nocturnal species, as outlined in sub-section 9.5.3.4; and The measures outlining the creation of beneficial deadwood piles within woodland habitat, as described in sub-section 9.5.3.5.	
Protected Freshwater Invertebrates: Glutinous Snail Other Freshwater Invertebrates	National Higher Local	**Construction Phase:** Glutinous snail has a very low tolerance to pollution, particularly eutrophication and biodegradable pollution. It is believed that this species' glutinous mantle allows for greater absorption, making it more susceptible to changes in its environment. Potential introduction of deleterious substances (e.g. hydrocarbons, solvents and cement leachate) have the potential to lead to physiological decline or fatalities for this species.	**Construction Phase:** Temporary to short-term adverse impact of slight (Other Freshwater Invertebrates) to moderate (Glutinous Snail) significance **Operational Phase:** Initial long-term neutral impact that is not significant	**Construction Phase:** The standard environmental best practice guidance outlined in sub-section 9.5.2.1; The environmental management procedures for site compounds as outlined in 9.5.2.2; The measures within the surface water management; pollution control; and dust management plans in sub-section 9.5.2.3; The detailed measures within invasive species management plan as outlined within sub-section 9.5.2.4; The tree protection measures outlined in sub-section 9.5.2.5;	Long-term neutral residual impact that is not significant

Key Ecological Receptors	Ecological Valuation	Potential Impacts	Significance of Impact without Mitigation	Mitigation	Significance of Residual Impacts
		Operational phase: None predicted.		The measures specific to Glutinous Snail and other freshwater invertebrate species within sub-section 9.5.2.7; and The safeguards detailed for Areas 30 and 31 within the Area Specific Mitigation Measures sub-section 9.5.2.8. **Operational Phase:** The completion of all remedial and enhancement planting as detailed in sub-section 9.5.3.2; and The functioning of all the elements operational SuDS design as outlined in sub-section 9.5.3.3.	

9.6 Cumulative Impacts

The cumulative assessment of relevant plans and projects has been undertaken separately in Chapter 24 of this EIAR.

9.7 Difficulties Encountered in Compiling Information

Some minor difficulties were encounter during the collection of static bat data during the 2022 and 2023 bat activity seasons, with each season having a survey week at a single location impacted as result of the deployed static recording device having a software malfunction or being knowingly, or unknowingly, interfered with by a member of the public. However, given that there are three years of bat activity data collected across multiple static surveys within these affected locations, the Luas Team had more than enough sufficient data to accurately assess the potential ecological impacts on local bat species.

9.8 Conclusion

Based upon the information supplied, regarding the site layout, drainage, landscape and lighting design plans along with remedial and enhancement planting; and provided that the Scheme is constructed in accordance with the mitigation measures outlined above, there will be no negative significant impacts alone, as result of the proposed Scheme and associated works on the ecology and local species of the area and on any designated conservation sites.

Given the ecologically beneficial Urban Integration Plan proposed (refer to Volume 5 – Appendix A21.2), the local habitats, flora and fauna are predicted to have their respective diversity and frequency improved, as result of both direct and indirect ecological benefits brought about the planting plan and future habitat management (overseen by TII, Waterways Ireland and DCC Parks, Biodiversity and Landscape Services Division).

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