



## Luas Finglas

# **Environmental Impact Assessment Report** 2024

Chapter 23: Interactions





Project Ireland 2040 Building Ireland's Future



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#### GLOSSARY OF FREQUENTLY USED TERMS

Acronym	Term
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GDA	Greater Dublin Area
GHG	Green House Gas
KER	Key Ecological Receptor
LRT	Light Rail Transit
LRV	Light Rail Vehicle
SuDS	Sustainable Drainage Systems



### SECTION 23: INTERACTIONS

#### 23.1 Introduction

#### 23.1.1 Purpose of this Report

The potential interactions amongst environmental factors arising from the Luas Finglas Scheme (hereafter referred to as the proposed Scheme) have been considered and are assessed in more detail in the applicable chapters of the Environmental Impact Assessment Report (EIAR). This EIAR has been prepared to address the requirements of the following:

- The Transport (Railway Infrastructure) Act, 2001 (as amended by the European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations 2021), hereafter referred to as the '2001 Act', and,
- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 (the 'EIA Directive').

In accordance with Article 3(1) of the EIA Directive, an Environmental Impact Assessment is required to identify, describe and assess the interaction amongst environmental factors. An interaction of impacts can occur when two or more types of environmental impact associated with a proposed development arise at a particular location or act upon an environmental resource. For example, a residential property may be subject to air quality and noise impacts, an area may experience temporary severance of local rights of way as well as increased construction vehicle movements on local roads, and a watercourse may be subject to alterations in flow regime, geomorphology and water quality, which would interact with the aquatic ecology of the watercourse.

For each environmental topic there will be certain interactions or interdependencies with other environmental topics, whereby impacts may interact to create a greater effect or different type of effect. An assessment of these interactions has been undertaken as required by sections 39 (1) and (2) of the 2001 Act. Section 2(1) of the 2001 Act defines Environmental Impact Assessment (EIA), in relation to the proposed Scheme, as a process:

'(b) including an examination, analysis and evaluation by the Board under sections 42B and 43 in order to identify, describe and assess, in the light of each individual case, the direct and indirect significant effects of the proposed railway works, including significant effects derived from the vulnerability of the activity to risks of major accidents and disasters relevant to it, on –

- (i) population and human health,
- (ii) biodiversity, with particular attention to species and habitats protected under Council Directive 92/43/EEC of 21 May 1992 and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009,
- (iii) land, soil, water, air and climate,
- (iv) material assets, cultural heritage and the landscape, and
- (v) the interaction between the factors referred to in subparagraphs (i) to (iv)'.

Throughout the EIA process and the preparation of the EIAR Chapters, impact interactions have been considered.

Some of the environmental topic assessments within this EIAR already address impact interactions. For example, Chapter 8 (Population) provides an assessment of effects on community amenity, which relates to the interaction of impacts on air quality; visual amenity; traffic and transport; and noise and vibration. Furthermore, Chapter 7 (Human Health) describes and assesses how a combination of impacts on health determinants (air quality; noise and vibration; community amenity; traffic and transport) can interact and influence health outcomes.





Section 23.3 of this Chapter sets out the main environmental interactions identified in the proposed Scheme, sign-posting chapters which already address environmental interactions and providing a description and assessment of environmental interactions which are not addressed elsewhere in this EIAR.

#### 23.1.2 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 integrate with the existing and future transport network, providing connections with bus services at all new Stops, 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- light rail transit (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 23-1 and Table 23-2. 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 23-1: 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 larnród 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, Ballyboggan Road, Tolka Valley Road, St. Helena's Road, Wellmount Road, Cappagh Road, Mellowes Road, North Road (N2), McKee Avenue, Jamestown Business Park





Scheme Key Features	Outline Description
	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 Margaret's Road, and ESB Networks.
Cycle Facilities	Cycle lanes are a core part of the proposed Scheme in order to facilitate multimodal "cycle-LRT 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 Road Stop will be provided with provision for 350 parking spaces and secure cycle storage to facilitate multimodal "cycle-LRT trips". The building will feature photovoltaic (PV) panel roofing and is the location for an additional radio antenna. This strategic Park and Ride facility will intercept traffic on the N/M2, before congestion begins to form.
	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 23-2: 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.



#### 23.2 Analysis of Interactions

The assessment has taken into account both the Construction and Operational Phases of the proposed Scheme. Table 23-3 illustrates environmental interactions in a matrix format in accordance with the Guidelines on the information to be included in EIARs (EPA, 2022). Foreseen interactions that occur between one or more environmental factors are outlined in section 23.3.

Table 23-3, should be read vertically, beginning with the topics listed along the top row. Each topic is to be considered in relation to the others, with a checkmark indicating a notable interaction between them. Conversely, blank cells signify either no interaction or a weak one. Additionally, abbreviations such as 'Con.' And 'Op.' are provided denoting the construction and operational phases, respectively to assist in understanding the context of the interactions within the matrix.

Inter- Relationship Matrix – Favironmental		Population		Biodiv	versity	Water		Lands So	Lands and Soils		Land Take		r Quality		Climate		e and ation	Electrom Compatik Interfe	agnetic bility and rence	Infrastructure and Utilities		Traffic and Transport		Resource and Waste Management		d Cultural t Heritage		Landscape and Visua Amenity		
Environmental Elements	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Human Health																														
Population	✓	✓																												
Biodiversity																														
Water	✓	✓	~	✓	✓	✓																								
Lands and Soils	✓				✓		✓																							
Land Take			$\checkmark$	✓	✓		$\checkmark$		~																					
Air Quality	✓	✓	✓	✓	~	✓			~																					
Climate	✓	✓	✓	✓				~	~				~	✓																
Noise and Vibration	~	~	~	~	~																									
Electromagnetic Compatibility and Interference		~		~																										
Infrastructure and Utilities		~	~		~		~		~		~	~								✓										
Traffic and Transport	~	~	~	~	~		~	~					~	~	1	~	~	~			~									
Resource and Waste Management	~	~	~	~	~	~			~		✓				~	~					~									
Cultural Heritage			✓	~			~		~		~						~				✓									
Landscape and Visual Amenity	~	~	~	~	~	~			~		~	~	~	~		~	~	~			~	~					~	~		
N	lotes: Tł	his mat	rix shou	ld be r	ead dow	n, starti	ng with	each to	opic iden	ntified a	across th	e top 🗸	= Sigi	nificant	interac	tions be	etween t	opics. I	Blank cells inc	licate no or	weak intera	actions. C	on. = Co	nstructio	on Phase.	Op. = Op	erational	Phase.		

#### Table 23-3: Environmental Interactions Matrix





#### 23.3 Assessment of Interactions

#### 23.3.1 Introduction to Assessment of Interactions

The various subsections within the Assessment of Interactions draw directly from Table 23-3 presented above. Each subsection focuses on the relationships of topics identified in the matrix, reflecting the interconnected nature of environmental factors. Due to the inherent linkages between certain topics, there will be overlaps in notable interactions across different subsections. These overlaps underscore the complex relationships and dependencies within the environmental system being evaluated. By utilizing the matrix as a foundation, the assessment aims to comprehensively capture the intricate web of interactions and their potential implications across various environmental domains.

#### 23.3.2 Interactions between Human Health and Population

The topics of population, land use and human health are inextricably linked. Chapter 7 (Human Health) has considered how the wider determinants of health such as the social conditions, community networks and economic conditions within the proposed Scheme study area have an important influence on human health. Meanwhile, Chapter 8 (Population) delves into the potential effects of the proposed Scheme on communities and the local economy.

#### 23.3.2.1 Construction Phase

The impacts on Population and Human Health are associated with noise, vibration, changes to the landscape, and visual disturbances affecting residential areas and travel experiences. These impacts would be experienced both individually and at the community level. They are closely tied to disruptions caused by construction activities, including the need to acquire and sometimes demolish properties.

The Population Chapter has identified areas of community and commercial land take. Land take for the proposed Scheme would generally be modest in any one location, but will occur from existing industrial and commercial lands, amenity lands, road space, residential areas, and the Finglas Garda Station car park. Furthermore, there will be slight severance of parks, green space, footpaths and roads. This is associated with visual intrusion and noise that will impact on local people's residential amenity, general amenity, and use of community facilities.

In the absence of mitigation measures, health impacts associated with these construction impacts are related to emissions to air, noise and vibration and other emissions as well as psychosocial impacts, such as stress and anxiety. The mitigation measures outlined in other chapters, which specifically address these environmental effects, aim to reduce these net effects to a level where they do not significantly impact community well-being.

#### 23.3.2.2 Operational Phase

The assessments of population and human health both highlight the positive impacts on accessibility. The population assessment examines how this affects community and commercial receptors, while the human health assessment focuses on the potential health benefits linked to improved accessibility.

These benefits will lead to better and more equal access to healthcare, education, and other essential services. Additionally, this improved accessibility has wider social implications, as it contributes to better overall health outcomes by increasing opportunities for transportation and service access.

### 23.3.3 Interactions among Human Health, Population, Water, Land and Soils, Traffic and Transport.

#### 23.3.3.1 Construction Phase

The construction activities, such as excavations, increased traffic on roads, and runoff from dewatering, soil stripping, and stockpiling of soils, have the potential to impact surface water and subsequently groundwater. These impacts can indirectly affect communities and human health, especially those relying on domestic well supplies.





Chapter 10 (Water) discusses the potential impacts on surface water and groundwater resulting from the construction of the proposed Scheme, which is informed by the construction traffic modelling in Chapter 18 (Material Assets: Traffic & Transport), soil management measures in Chapter 11 (Land and Soils: Soils, Geology & Hydrogeology), and construction activities in Chapter 6 (Construction Activities). Chapter 8 (Population) and Chapter 7 (Human Health) consider the potential indirect impacts from construction activities on communities and health.

#### 23.3.3.2 Operational Phase

There is the potential for impacts on surface water and subsequently groundwater from operational activities. The drainage outfalls to rivers and streams will be point discharges and have the potential, if not adequately designed and mitigated, to change the current flow regime and water quality in the existing surface watercourses. This can indirectly impact on health and communities. Chapter 10 (Water) considers the drainage requirements of the Operational Phase, and how this will be managed.

### 23.3.4 Interactions among Human Health, Population, Air Quality, Climate, Noise and Vibration, and Traffic and Transport

Throughout both the Construction and Operational Phases, there is a significant interaction among these topics. The population assessment has carefully considered the impacts on accessibility, which directly interacts with traffic and transport. Additionally, the assessment has also looked at the effects on amenity, particularly in relation to traffic emissions relating to air and noise. The traffic and transport assessment has provided valuable insights for the evaluations of population, human health, air quality, climate, noise and vibration.

#### 23.3.4.1 Construction Phase

The human health assessment has delved into the potential health outcomes stemming from exposure to air pollution, noise from the Light Rail Transit (LRT), and changes to wider determinants of health, such as traffic and access to services. During construction, increases in traffic on the road network have the potential to directly impact air quality which can have indirect repercussions on communities, health, and climate. Consideration is given to aspects of the proposed Scheme and the GHG emissions that will arise during the Construction Phase, notably: direct emissions (including noise) from plant machinery and equipment used during the Construction Phase; and transport emissions from vehicles importing and exporting material to and from the construction site(s).

#### 23.3.4.2 Operational Phase

The proposed Scheme is expected to have a positive impact on access to sustainable travel within the Greater Dublin Area (GDA) and contribute positively to climate change through the reduction of carbon emissions during the Operational Phase.

It is evident that the key interactions for both the Construction and Operational Phases are comprehensively captured across Chapter 7 (Human Health), Chapter 8 (Population), Chapter 13 (Air Quality), Chapter 14 (Climate), Chapter 15 (Noise & Vibration), and Chapter 18 (Material Assets: Traffic & Transport).

## 23.3.5 Interactions among Human Health, Population, Air Quality, Climate, and Traffic and Transport

Chapter 14 (Climate) provides an assessment of the effects of the proposed Scheme on greenhouse gas emissions (GHGs). This assessment includes an evaluation of traffic and transport during the Operational Phase, highlighting the interaction between these factors. Maintenance of the proposed Scheme infrastructure, as detailed in Chapter 5 (Description of the proposed Scheme), is also considered in this phase. A comparison of GHG emissions between the Do-Minimum and Do-Something scenarios for the years 2035 and 2050 shows an overall decrease in annual road traffic CO<sub>2eq</sub> emissions due to the proposed Scheme. This reduction equates to approximately a 4% annual decrease in carbon emissions within the study area. By offering a more sustainable mode of transport, the proposed Scheme is expected to positively impact communities and health through improved accessibility, as well as contribute to climate benefits.





#### 23.3.5.1 Construction Phase

During construction, increases in traffic on the road network have the potential to directly impact air quality which can have indirect repercussions on communities, health, and climate. Consideration is given to aspects of the proposed Scheme and the GHG emissions that will arise during the Construction Phase, notably: direct emissions from plant machinery and equipment used during the Construction Phase; and transport emissions from vehicles importing and exporting material to and from the construction site(s). The TII Carbon Tool has been completed by the Luas Team for the proposed Scheme to estimate the carbon calculation for the Construction Phase. The TII Carbon Tool results indicate that the primary source of GHG emissions from the Construction Phase of the proposed Scheme is from emissions associated with the embodied carbon from the materials used in the construction of the proposed Scheme. Construction Phase. To put the total Construction Phase emissions in context versus the 3<sup>rd</sup> Carbon Budget (2031 to 2035), the GHG emissions contribution due to the Construction Phase of the proposed Scheme will be 0.0362% of the carbon budget emissions.

#### 23.3.5.2 Operational Phase

The assessment of climate impacts, as detailed in Chapter 14 (Climate), inherently includes the traffic and transportation during the Operational Phase. Consequently, this interaction is addressed within that chapter. The Operational Phase of the proposed Scheme includes maintenance of the proposed Scheme infrastructure as outlined in Chapter 5 (Description of the proposed Scheme). The comparison between the Do-Minimum and Do-Something GHG emissions in the opening year 2035 and the design year 2050 indicates that there is an overall decrease in annual road traffic CO<sub>2</sub>eq emissions due to the proposed project. This indicates that there will be an approximate 4% decrease in carbon emissions per annum within the study area with the proposed Scheme in operation. The proposed Scheme will offer a more sustainable mode of transport, leading to positive effects on communities and health by improving accessibility and benefiting the climate.

### 23.3.6 Interactions among Human Health, Population, Electromagnetic Compatibility and Interference, and Infrastructure and Utilities.

Chapter 16 (Electromagnetic Compatibility and Interference) assesses electromagnetic emissions. Electromagnetic emissions can have direct interactions with the population, and human health. High levels of electromagnetic radiation have the potential to cause adverse health effects in individuals and can also interfere with the operation of sensitive equipment in research and healthcare facilities.

#### 23.3.6.1 Construction Phase

No impacts from an Electromagnetic Interference, Electromagnetic Fields or stray current perspective are likely during the Construction Phase of the proposed Scheme and therefore no detailed investigation was deemed necessary for this aspect of the Scheme.

#### 23.3.6.2 Operational Phase

During operation, the power supply and distribution system and new tractions systems required to operate the proposed Scheme could interfere with identified land uses at specialised research facilities. Chapter 16 (Electromagnetic Compatibility and Interference) considers the likely levels of emissions and receptors and indicated that levels would be below guideline exposure levels with appropriate mitigation measures. Although unlikely, future developments such as extensions and new building at locations including theatres, musical venues, stadiums, domestic or commercial premises that bring unapproved audio equipment within 20m of the lines could potentially experience interference in the audio frequency range.

Despite applied mitigation measures to minimise the magnitude of stray current, it is an inevitable phenomenon associated with DC rail systems. Continued monitoring of the performance of the traction circuit with respect to current returns to the substation will be required.





### 23.3.7 Interactions among Human Health, Population, Air Quality, Climate and Landscape and Visual

The assessment of human health has an indirect interaction with the landscape via the assessment of amenity in Chapter 8 (Population). The condition of the landscape and built environment can impact individuals' perceptions of a location and is therefore connected with mental wellbeing. Impacts to the public realm have a possible pathway to health outcomes.

#### 23.3.7.1 Construction Phase

The negative effects of construction on the landscape can result in the loss of valuable landscape features and the introduction of uncharacteristic new elements or features. This can impact community amenity and subsequently, wellbeing. Additionally, the removal of trees, hedgerows, and other habitat types acting as carbon sinks can have a small-scale negative effect on air quality during the Construction Phase and subsequently on climate. These impacts are detailed in Chapter 13 (Air Quality), Chapter 14 (Climate), and Chapter 21 (Landscape & Visual Amenity).

#### 23.3.7.2 Operational Phase

The landscape will be modified during the Operational Phase, as detailed in Chapter 21 (Landscape and Visual). These modifications include the addition of distinct new elements or features that contribute to an overall change of the landscape in terms of character, value and quality. Some areas have high landscape sensitivity because they contain elements that contribute to the landscape character and are protected at a national level. However, these changes will include improvements to the accessibility, attractiveness, and the experience of recreational provision, leading to positive effects on human health. The introduction of new or replacement planting will also contribute to improved air quality and climate interactions among Biodiversity, Traffic and Transport, Noise and Vibration, Climate, Lands and Soils, Water, Air Quality, Land Take, Infrastructure and Utilities and Landscape and Visual.

#### 23.3.8 Interactions among Human Health, Population, Land and Soils, Air Quality, Climate, Infrastructure and Utilities, Traffic and Transport, and Waste Management

#### 23.3.8.1 Construction Phase

During the Construction Phase, construction activities will involve excavations and the production of waste from the removal of soils, installation of foundations and diversion of utilities. The generation of waste and the stockpiling of materials on-site can have an impact on communities and human health via air quality. This is due to the heightened risk of exposing construction workers and residents to sub-surface materials that may contain contaminants and generate dust, as well as the increased traffic volumes needed to transport materials and waste. The generation of waste and the stockpiling of materials on-site can attract vermin if not managed correctly. In addition, construction materials and waste during the Construction Phase will have associated embodied carbon emissions which can impact climate.

Chapter 14 (Climate) presents interactions among climate, infrastructure and utilities, and waste management, as the amount of material to be imported, and waste generated during construction of the proposed Scheme, will influence the embodied carbon footprint of the proposed Scheme. The redistribution of traffic associated during construction, will also generate GHGs, which have informed the assessment in Chapter 14 (Climate)

#### 23.3.8.2 Operational Phase

During the Operational Phase, new energy demands from new infrastructure and materials required for the operation of the proposed Scheme are considered under Chapter 14 (Climate). In addition, during operation, the provision of new LRT infrastructure is assessed and will have a positive impact on communities through increased access to sustainable public transport, and the provision of more sustainable travel is anticipated to have a positive effect on both climate and human health, as outlined in Chapter 7 (Human Health) and Chapter 8 (Population). There will be minor, but long-term instances of maintenance waste, however all wastes generated during this phase will be managed in accordance with the waste hierarchy. Operational





waste plans will be prepared by the future Operator in order to ensure that the aims of the proposed Scheme Sustainability Plans are met. The future Operator will be required to have a Sustainability Plan, linked to the ISO 14001 accreditation (or similar).

#### 23.3.9 Interactions between Population and Land Take

There is a direct interaction between population, land use, and land take during both the Construction Phase (temporary land take) and the Operational Phase (permanent land take).

#### 23.3.9.1 Construction Phase

The temporary loss of commercial properties during Construction Phase will also have an impact on business activity. Land take requirements (temporary) are outlined in Chapter 12 (Land Take).

#### 23.3.9.2 Operational Phase

The permanent loss of commercial properties during Operational Phase will also have an impact on business activity. Land take requirements (permanent) are outlined in Chapter 12 (Land Take).

Chapter 8 (Population) outlines the potential impacts to be felt locally in terms of local journeys, use of community facilities, and the social and economic well-being of people at a community.

### 23.3.10 Interactions among Population, Land Take, Infrastructure and Utilities, and Cultural Heritage

#### 23.3.10.1 Construction Phase

During the Construction Phase, there is the potential for direct impacts on heritage features and indirect impacts on the setting of heritage features identified in Chapter 20 (Cultural Heritage); as well as on community amenity, due to construction activities such as utility installations / diversions and temporary land take. Chapter 12 (Land Take) and Chapter 17 (Material Assets: Infrastructure & Utilities) outline where land take will be required and where utility installation / diversions are proposed, and these have informed the assessment of potential impacts on heritage features and their setting.

#### 23.3.10.2 Operational Phase

During the Operational Phase, there is the potential for indirect impacts on heritage features and their setting which are identified in Chapter 20 (Cultural Heritage), due to changes in land use as a result of the proposed Scheme. Chapter 8 (Population) discusses changes in land use and impacts to community amenity. Chapter 12 (Land Take) outlines permanent land take required to facilitate the operation of the proposed Scheme, and these have informed the assessment of potential impacts on heritage features and their setting.

#### 23.3.11 Interactions among Biodiversity, Water, Land and Soils, and Waste Management

#### 23.3.11.1 Construction Phase

There are potential interactions between waste management and water environment which can have a potential impact on key ecological receptors during construction, as outlined in Chapter 9 (Biodiversity). This includes groundwater to surface water pollution which may occur due to the Tolka Valley site previously being a landfill. Disturbance to the ground during excavations may expose the historic waste, and any water introduced could produce a harmful leachate that would flow into the pond due to the topography of the site. In addition, the removal of invasive species during the Construction Phase involves collected biomass (pulled stems/roots and bagged flower heads). If this biomass is not disposed of immediately at a facility authorized to accept such waste, it could travel to waterways if not handled appropriately before disposal with similar Non-native Invasive Species waste at an authorized facility.

#### 23.3.11.2 Operational Phase

The Operational Phase interactions among Biodiversity, Water, and Waste Management, are due to the potential for run off from the proposed Scheme. 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 the proposed Scheme's design include grass tracks, rain gardens, permeable paving, tree pits, roadside beds, roadside directional beds, and green roofs. These SuDS features will collectively provide surface water run-off attenuation, infiltration, and in-situ retention of sediments (and associated nutrients), metals, and hydrocarbons. 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.

#### 23.3.12 Interactions among Biodiversity, Noise and Vibration, and Traffic and Trasport

There will be interactions between biodiversity and the Noise and Vibration associated with Traffic and Transport across the Construction Phase of the proposed Scheme.

#### 23.3.12.1 Construction Phase

During the Construction Phase, the biodiversity assessment has examined how key ecological receptors, such as species and habitats, interact with various environmental factors. Specifically, there is an interaction between traffic and transport and mortality risk for species. Airborne noise from construction activities, including vehicles, can interact with biodiversity as any increase in noise levels has the potential to impact on sensitive ecological receptors. An example of this interaction is the direct and indirect impacts likely to occur on foraging and commuting bats located within the scheme, resulting from the temporary noise and vibration pollution during this phase. Further, noise generated by the construction works has the potential to effect Avian 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.

#### 23.3.12.2 Operational Phase

No impacts among Biodiversity, Noise and Vibration, and Traffic and Trasport are likely during the Operational Phase of the proposed Scheme, due to the suitable operational noise levels of the LRT network within the disturbance buffers of the KER bird species within the Farnham area.

Therefore, no detailed investigation was deemed necessary for this aspect of the proposed Scheme and the suitable operational noise levels of the LRT network within the disturbance buffers of the KER bird species within the Farnham area.

#### 23.3.13 Interactions among Biodiversity, Water, Air Quality, and Landscape and Visual Amenity

There is an interaction among water, air quality and biodiversity, as any reduction in the quality of surface water or in air quality can contribute to habitat degradation. In addition, there is an interaction between soils and geology and biodiversity, as non-native invasive plant species can be spread through soils and can also contribute to habitat degradation.

#### 23.3.13.1 Construction Phase

During the Construction Phase, there will be an interaction between the landscape and biodiversity. As outlined in both Chapter 9 (Biodiversity) and Chapter 21 (Landscape & Visual), the proposed Scheme will mitigate the spread of invasive species, where possible. This includes the spread of invasive species such as Japanese Knotweed, from the construction site into and via the River Tolka which will have serious adverse impacts on any present Annex habitats, displacing native species. During the Construction Phase, there will also be an interaction between Air Quality and biodiversity. Air (dust) pollution generated during the Construction Phase could adversely impact photosynthesis and the biological functions of valued flora.

#### 23.3.13.2 Operational Phase

During the Operational Phase, there will be an interaction between the landscape and biodiversity. As outlined in Chapter 21 (Landscape & Visual), the proposed Scheme will include replanting, where possible.





The proposed planting will be multi-functional with all plant types chosen with reference to their adaptability, robustness and ease of maintenance. The planting strategy will prioritise pollinator friendly species and species that provide multiple ecosystem services and functions which offer an opportunity for enhancement of local biodiversity. In addition, the landscape strategy will include provisions for low maintenance planted ground cover, including reduced herbicide use and permitting a degree of landscape wildness. Likewise, there will be a minor increase in habitat total area for key aquatic ecological receptors such as Hydrophilous tall herb fringe as a result of proposed landscape plan.

Chapter 9 (Biodiversity) describes and assesses how different impacts of the proposed Scheme on water, soils, air quality, airborne noise and landscape will interact with biodiversity. Reference should be made to Chapter 9 (Biodiversity) to understand those interactions.

#### 23.3.14 Interactions between Biodiversity, Land Take, and Infrastructure and Utilities

There will be interactions between Biodiversity, Land Take, and Infrastructure and Utilities across the Construction Phase of the proposed Scheme

#### 23.3.14.1 Construction Phase

The impact of temporary land take for infrastructure and utilities on biodiversity and on loss of public open space and amenity value (including parks and sports grounds) is assessed and further referred to within the following chapters and their appendices: Chapter 8 (Population) and Chapter 9 (Biodiversity) of this EIAR.

#### 23.3.14.2 Operational Phase

No impacts among Biodiversity, Land Take, and Infrastructure and Utilities are likely during the Operational Phase of the proposed Scheme and therefore no detailed investigation was deemed necessary for this aspect of the Scheme.

#### 23.3.15 Interactions between Water and Climate

#### 23.3.15.1 Construction Phase

No impacts between Water and Climate are likely during the Climate Phase of the proposed Scheme and therefore no detailed investigation was deemed necessary for this aspect of the Scheme.

#### 23.3.15.2 Operational Phase

Changes to the hydrological baseline would occur due to climate change. it is considered the largest potential impact will be increased rainfall intensity and occurrence of rainfall events due to climate change. The proposed design maximises the use of green track, for landscaping, infiltration, visual amenity and reducing of urban heat intensity. The impact of climate change is considered in the Flood Risk Assessment Report (Appendix A10.2 of the EIAR) which is summarised in Chapter 10 (Water) and Chapter 14 (Climate). The interaction between climate change and flood risk is therefore captured in these assessments.

## 23.3.16 Interactions among Water, Land and Soils, Land Take, Infrastructure and Utilities and Cultural Heritage

#### 23.3.16.1 Construction Phase

Construction activities such as dewatering can result in settlement which can have a direct impact on geological heritage features which can also be of cultural heritage, as well as on adjacent sensitive heritage structures. Construction activities can result in the exposure of archaeological remains, which if confirmed, would merit archaeological mitigation such as preservation in-situ or full archaeological excavation.

Chapter 10 (Water) and Chapter 11 (Land and Soils: Soils, Geology and Hydrogeology) consider the potential for settlement as a result of construction activities and these assessments are used to inform the assessment of impacts on heritage.





Requirements for infrastructure and utilities and associated land take is considered in Chapter 12 (Land Take) and Chapter 17 (Material Assets: Infrastructure and Utilities) and impacts on soils are considered in Chapter 11 (Land and Soils: Soils, Geology and Hydrogeology).

#### 23.3.16.2 Operational Phase

No impacts among Water, Land and Soils, Land Take, Infrastructure and Utilities and Cultural Heritage are likely during the Operational Phase of the proposed Scheme and therefore no detailed investigation was deemed necessary for this aspect of the Scheme.

### 23.3.17 Interactions among Land and Soils, Land Take, Infrastructure and Utilities, Waste Management, Cultural Heritage and Landscape and Visual.

The main interaction among these topics will be during the Construction Phase.

#### 23.3.17.1 Construction Phase

Chapter 19 (Material Assets: Resource & Waste Management) assesses the impact of imported materials and use of site won materials which can be reused within the proposed Scheme in accordance with Article 27 of the Waste Directive Regulations. The amount of material to be imported will depend on the amount of material which can be recovered and reused on-site.

Chapter 11 (Land and Soils: Soils, Geology and Hydrogeology) provides an assessment of impacts on soils, including potentially contaminated land. There is an interaction between this issue and waste because the likelihood of excavated materials being suitable for use on-site will depend on whether it is contaminated, and the extent of contamination. This is established through detailed ground investigations as set out in Chapter 11 (Land and Soils: Soils, Geology and Hydrogeology). Construction activities can result in the exposure of archaeological remains, which if confirmed, would merit archaeological mitigation such as preservation in situ or full archaeological excavation, which is further discussed in Chapter 20 (Cultural Heritage).

The proposed Scheme will involve excavation of bulk materials. The likelihood of encountering contaminated materials from various excavation activities is assessed in Chapter 11 (Land and Soils: Soils, Geology and Hydrogeology).

Requirements for infrastructure and utilities and associated land take is considered in Chapter 12 (Land Take) and Chapter 17 (Material Assets: Infrastructure and Utilities) and impacts on soils are considered in Chapter 11 (Land and Soils: Soils, Geology and Hydrogeology).

#### 23.3.17.2 Operational Phase

No impacts between Land and Soils, Land Take, Infrastructure and Utilities, Waste Management and Cultural Heritage are likely during the Operational Phase of the proposed Scheme and therefore no detailed investigation was deemed necessary for this aspect of the Scheme.

### 23.3.18 Interactions among Land Take, Infrastructure and Utilities and Landscape and Visual

Impacts associated with the permanent and temporary land take for the proposed Scheme and associated with the diversion (permanent and / or temporary) of overhead lines and utilities is considered under Chapter 21 (Landscape and Visual Amenity). The interactions are due to the introduction of uncharacteristic new elements or features that will lead to changes in landscape character, and quality. Construction activities involve a considerable degree of visual clutter or disharmony which is likely to be generated, appreciably reducing the visual amenity of the scene, However, these interactions are temporary.





### 23.3.19 Interactions between Noise and Vibration, Cultural Heritage, and Landscape and Visual

#### 23.3.19.1 Construction Phase

Temporary to short term indirect interactions on Cultural Heritage features with above ground registers could potentially arise as the result of construction dust and noise as well as vibration impacts from the use of heavy plant and machinery, construction traffic, directional drilling and foundation piling. Likewise, above ground cultural heritage features often rely on their setting and landscape as part of their value.

#### 23.3.19.2 Operational Phase

Indirect interaction during the Operational Phase of the proposed Scheme will be permanent and may include visual impacts on constraints with above ground registers arising from the alteration of the existing landscape/townscape and the degradation and/or enhancement of a constraint's setting and amenity resulting from. No likely vibration interactions on cultural heritage are predicted to arise during the Operational Phase of the proposed Scheme (see also Chapter 15: Noise and Vibration).

#### 23.3.20 Interactions among Infrastructure and Utilities, Population, Traffic and Transport, Waste Management, and Waste Management

#### 23.3.20.1 Construction Phase

Chapter 18 (Material Assets: Traffic & Transport) evaluates the condition of roads and traffic flow. The interactions of traffic and transport and infrastructure and utilities are included as part of the proposed Scheme with infrastructure and utilities captured in Chapter 17 (Material Assets: Infrastructure & Utilities). When utility diversions and new installations are needed, lane closures may be necessary, potentially affecting the road network.

In Chapter 19 (Material Assets: Resource & Waste Management), the transportation of waste materials during the Construction Phase is addressed, which will directly impact traffic due to the increased presence of construction vehicles on the roads. These factors can indirectly affect communities, as discussed in Chapter 8 (Population).

#### 23.3.20.2 Operational Phase

No impacts among Infrastructure and Utilities, Population, Traffic and Transport, Waste Management, and Waste Management are likely during the Operational Phase of the proposed Scheme and therefore no detailed investigation was deemed necessary for this aspect of the Scheme.

#### 23.3.21 Interactions between Cultural Heritage and Landscape and Visual Amenity

#### 23.3.21.1 Construction Phase

Visual and landscape impacts on features / properties of cultural heritage value have been assessed in Chapter 21 (Landscape and Visual Amenity). The main impacts on cultural heritage would take place during the Construction Phase. The interactions are due to the introduction of uncharacteristic new elements or features that will lead to changes in landscape character, and quality. Construction activities involve a considerable degree of visual clutter or disharmony which is likely to be generated, appreciably reducing the visual amenity of the scene, However, these interactions are temporary. Relevant interactions are captured in Chapter 20 (Cultural Heritage)

#### 23.3.21.2 Operational Phase

The interactions between Cultural Heritage and Landscape and Visual Amenity are due to the introduction of uncharacteristic new elements or features that will lead to changes in landscape character, and quality. The proposed Luas Rail bridge over the Royal Canal, will dominate the environment of the canal towpath and riparian edge to create an urban, built character. It will intrude upon the east-west views towards the arched façade of Broome Bridge and create a sense of enclosure in the space. The other key landscape features including mature hedgerow along the canal towpath, the riparian vegetation and the watercourse,





and the channelled views along the water feature will remain but will be altered due to the proposed built elements.

#### 23.4 Conclusion

Potential impacts from interactions were identified early in the design process and EIAR preparation, allowing for them to be addressed in the proposed Scheme and impact assessment studies. This proactive approach resulted in impacts being avoided through design measures or mitigated with specific measures as summarised in Chapter 25 (Summary of Mitigation Measures, Monitoring & Residual Impacts) of this EIAR. Identifying and addressing these potential impacts early on helped minimise their significance, while mitigation proposals targeted specific environmental aspects to reduce impact interactions as far as practicable.

Significant positive environmental interactions occur among the topics of Human Health, Population, Air quality, Noise and Vibration, as well as Traffic and Transport. The assessments made for each of those topics consider those interactions both directly and indirectly. Landscape and Visual, as an environmental topic has innate relationships with all other environmental factors. Some are direct relationships (e.g., Population and Visual Amenity; Biodiversity and Landscape; Land and Soils or Water and Landscape around features of Cultural Heritage etc.). Others will be indirect (e.g. Human Health, Air Quality and Landscape, Infrastructure and Utilities and Landscape and Visual Amenities). Wherever practical, these potential interactions have been incorporated into the relevant assessments.

In summary, the proposed Scheme will address the urgent need of sustainable transport infrastructure in the area while, increasing the effectiveness of the GDA public Transport system, which will result in more people availing of public transport due to the faster journey times and reliability improvements which the proposed Scheme will provide. Furthermore, the safety improvements to walking and cycling infrastructure will enhance sustainable travel along the proposed route. This will accommodate higher levels of future population and employment growth in the surrounding areas.

#### 23.5 References

European Commission, 1999. *the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions,* Luxembourg: Office for Official Publications of the European Communities.

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