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# **Chapter 25**

## **Interactions**

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## 25. INTERACTIONS

### 25.1 Introduction

This chapter assesses the potential ‘interactions’ or in-combination effects arising between one or more of the on individual environmental factors assessed in the previous chapters of this Environmental Impact Assessment Report (EIAR) for the proposed DART+ West development (hereafter referred to as “the proposed development”). Close co-ordination and discussion between the EIA team has informed the preparation of this chapter to ensure that interactions identified by each specialist is adequately assessed and incorporated as part of the mitigation measures by the respective specialists.

The chapter presents the legislation, policy and guidance used to inform the preparation of the interactions assessment (Section 25.2), a summary table is presented identifying the interacting environmental factors for both the construction and operation impacts of the proposed development. The main chapters of the respective environmental factors of the EIAR considers these interactions and details the associated mitigation measures to address the effects.

### 25.2 Legislation, policy, and guidance

#### 25.2.1 Legislation

The purpose the European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations 2021 in Statutory Instrument No. 743/2021 was to give further effect to the transposition of EU Directive 2011/92/EU as amended by Directive 2014/52/EU on the assessment of the effects of certain public private projects on the environment (“the EIA Directive”) by amending the Transport (Railway Infrastructure) Act 2001 (“the 2001 Act”). An Environmental Impact Assessment Report (“EIAR”) must be prepared in respect of proposed railway works and must accompany each application for a Railway Order that is made to An Bord Pleanála (“the Board”).

The EIA Directive was designed to assist in identifying and assessing the direct and indirect significant environmental effects of a specific project, including the climate change effects of such a project. Directive 2014/52/EU, for example, acknowledged the importance of climate change with Recital 13 of the 2014 Directive stating that “climate change will continue to cause damage to environment and compromise economic development. In this regard it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change.”

Similarly, Article 1(1) of the EIA Directive provides that it shall apply to an assessment of the environmental effects of those public and private projects which are likely to have significant effects on the environment. Article 3(1) of the consolidated EIA Directive requires that the effect of a proposed development in respect of climate must also now be considered and Recital 7 of that Directive provides that “development consent for public and private projects which are likely to have significant effects on the environment should be granted only after an assessment of the likely significant environmental effects of those projects has been carried out. That assessment should be conducted on the basis of the appropriate information supplied by the developer which may be supplemented by the authorities and by the public likely to be concerned by the project in question.”

DART+ West, the proposed development, will deliver a range of benefits to communities, commuters and the Irish economy and society, including a key deliverable under the *Climate Action Plan* to achieving Ireland’s targets for transport. The improvements in public transport, for example, which will arise from the granting of a Railway Order by An Bord Pleanála for DART+ West include *inter alia* 40 km of electrification and re-signalling of the Maynooth and M3 Parkway lines to the city centre.

The object of the EIA Directive is to ensure that the likely environmental impacts of the proposed railway works are considered and assessed before the Railway Order is granted. The outcome of that examination, analysis, evaluation and identification informs the decision of the Board and Article 5(1) of the EIA Directive describes the nature of the information to be included in the EIAR itself.

Article 3(1)(e) of the EIA Directive requires *inter alia* that the EIAR shall identify, describe and assess in an appropriate manner the direct and indirect significant effects of a project including the interaction of environmental factors and this chapter addresses 'interactions'.

For example, the environmental impact assessment ("the EIA") which is carried out by the Board in relation to the proposed railway works in the draft DART+ West Railway Order refers to a process which includes an examination, analysis and evaluation by the Board under sections 42B and 43 of the amended 2001 Act 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 the Habitats and Birds Directives.
- (iii) land, soil, water, air and climate.
- (iv) material assets, cultural heritage and the landscape.
- (v) the interaction between the above factors set out at (i) to (iv).

Where a proposed development is functionally or legally interdependent on further development(s) not included in the application for consent approval and where no EIA has been carried out, then the entire has to be subject of an EIA for the proposed development. Where, for example, off-site activities are so closely and functionally connected with the on-site development they should be classified as part of the project itself. Accordingly, where there is a clear and unbreakable inter-relationship between the proposed development itself and other activities, including for example off-site activities which are an integral part of the overall development such that a causal relationship between the construction or operation of the project and certain direct or indirect environmental consequences has been clearly established, then the entire has to be subject of an EIA for the proposed development and the cumulative effect of both must be assessed. An assessment of the cumulative effects of a proposed development and a future development is, therefore, required where there is a functional or legal interdependence between the development for which permission has been applied and the envisaged future development.

The indirect significant effects which require to be assessed include the indirect effects which the proposed development itself has on the environment *subject to the caveat* that where there is a causal connection, which is demonstrably strong and unbreakable, between any activities, including, for example, off-site activities and the operation and construction of the project itself, then the significant indirect environmental effects of such activities require to be identified and assessed.

### 25.2.2 Guidance

This Chapter has been prepared with reference to the following guidance documents:

- *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions* (European Commission 1999).
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment* (Department of Housing, Local Government and Heritage, 2018).
- *Guidelines on information to be contained in the Environmental Impact Assessment Report* - Environmental Protection Agency, May 2022.
- *Draft Advice Notes for preparing Environmental Impact Statements* - Environmental Protection Agency, 2015.
- *Guidelines on the information to be contained in Environmental Impact Statements* - Environmental Protection Agency, 2002.

- *Advice notes on current practice in the preparation of Environmental Impact Statements* - Environmental Protection Agency, 2003.
- *Environmental Impact Assessment of National Road Schemes - A practical Guide* - National Roads Authority/ Transport Infrastructure Ireland, Revision 1, November 2008.

## 25.3 Methodology

The European Commission Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions provide the following definition:

'Impacts that result from the incremental changes caused by other past, present or reasonably foreseeable actions together with the project.' (European Commission 1999).

The Department of Housing, Planning and Local Government's EIA guidance states: *"Effects are not to be considered in isolation but cumulatively i.e., when they are added to other effects. A single effect on its own may not be significant in terms of impact on the environment but, when considered together with other effects, may have a significant impact on the environment. Also, a single effect which may, on its own, have a significant effect, may have a reduced and insignificant impact when combined with other effects."* (DoHPLG, 2018, p. 40).

Interactions refers to interactions between effects of the proposed development (in isolation) which relate to two or more different environmental factors of this EIAR. Where a potential exists for significant environmental effects to arise as a result of interaction, the relevant EIAR specialist has considered this and assessed the impact. *"For example, where it is established in the Hydrology section that there will be an increase in suspended solids in discharged surface waters during construction, then the Biodiversity section should assess the effect of that on sensitive aquatic receptors"* (EPA, 2022, p. 56). Mitigation measures have been prescribed in the appropriate Chapter to address the associated direct, indirect and synergistic effects and therefore no additional mitigation measures are included as part of this chapter.

This chapter presents a summary of the interactions between different environmental topics which have been identified and addressed in this EIAR. The determination of interactions was facilitated through an iterative design process that included consultation between designers, environmental specialists and technical specialists. It also considers the potential for mitigation measures prescribed in respect of one particular environmental factor to give rise to unintended negative impacts in respect of one or more other factor, as appropriate.

The potential interactions between environmental factors arising from the proposed development are considered and are addressed in more detail within the applicable chapters of the EIAR and mitigation measures identified to address such interactions.

### 25.3.1 Consultation

This chapter was informed by various environmental specialists and project design members throughout the planning process. Numerous workshops and meetings were held between the aforementioned project team members to help identify the potential interactions between the various environmental factors. Where applicable, mitigation measures to ameliorate significant effects were identified.

### 25.3.2 Difficulties encountered/ Limitations

There were no particular difficulties encountered compiling this assessment.

## 25.4 Potential Impacts

Table 25.1 shows the likely significant interactions identified for the proposed development which are described in sections 25.4.1 to 25.4.17.

Table 25-1 Matrix of Interactions

Interaction	Traffic and Transportation		Population		Biodiversity		Land and Soils		Water (incl Hydrology & flood risk)		Hydrogeology		Air Quality		Climate		Noise and Vibration		Landscape and Visual		MA: Agricultural properties		MA: Non-Agricultural Properties		MA: Utilities		MA: Resources and Waste Management		Archaeology and Cultural Heritage		Architectural Heritage		EMC & SC		Human Health	
	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.	Cons.	Op.		
Traffic and Transportation			✓	✓	✓	✓	✓	x	✓	✓	x	x	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	x	x	x	✓	x	x	x	x	x	x	x	✓	✓
Population					x	x	✓	x	x	x	x	x	x	x	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	x	✓	x	✓	x	x	x	x	x
Biodiversity							✓	x	✓	✓	✓	x	✓	✓	x	x	✓	✓	x	✓	x	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	✓
Land and Soils									✓	x	✓	x	✓	x	x	x	✓	x	✓	✓	✓	x	✓	x	x	x	✓	x	✓	x	x	x	x	x	✓	x
Water (incl Hydrology & flood risk)											✓	x	x	x	✓	✓	x	x	x	x	✓	✓	x	x	✓	x	x	x	x	x	x	x	x	x	✓	x
Hydrogeology													x	x	x	x	x	x	x	x	✓	x	✓	x	x	x	x	x	x	x	x	x	x	x	✓	x
Air Quality															✓	✓	x	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	x	x	x	✓	✓
Climate																	x	x	x	x	x	x	x	x	x	x	✓	✓	x	x	x	x	x	x	x	✓
Noise and Vibration																					✓	✓	✓	x	✓	✓	x	x	x	x	✓	x	✓	x	✓	✓
Landscape and Visual Amenity																							x	x	✓	✓	x	x	✓	x	✓	x	✓	x	x	✓
MA: Agricultural properties																							x	x	x	x	x	x	x	x	x	x	x	x	✓	✓
MA: Non-Agricultural Properties																											x	x	x	x	x	x	x	x	✓	✓
MA: Utilities																															x	x	x	x	✓	x



## 25.4.1 Traffic and Transportation

### 25.4.1.1 Construction phase

Traffic and Transportation will interact with the following during construction phase:

- Population.
- Biodiversity.
- Water (incl. hydrology & flood risk).
- Air Quality.
- Climate.
- Noise and Vibration.
- Landscape and Visual Amenity.

#### Population

The construction phase of proposed development will require the erection of temporary compound areas across the entire extent of the proposed development. HGV traffic will be generated to and from the compounds along designated haulage routes that will likely impact on the journey characteristics and journey amenities of road users. The majority of haulage routes for construction compounds consist of construction traffic being routed through existing urban and/or rural areas which includes residential, community, educational, medical, commercial, and accommodation facilities (hotels and B&Bs). Access to community infrastructure and amenities will be maintained as far as practicable during these short-term construction periods however, there is a potential for impacts to occur due to an increase in traffic as well as both daytime and night-time construction works.

#### Biodiversity

The construction phase of the proposed development will result in increased traffic and transportation within the study area. Vehicles, plant, and equipment required during the construction phase will rely on hydrocarbons, such as diesel, petrol, and lubricating oils, posing the risk of hydrocarbon leakages into waterbodies. In the absence of mitigation measures, there is potential for hydrocarbon leaks to wash into surface waters via construction site run-off, which has the potential to cause negative ecological impacts on freshwater habitats such as reducing organisms' ability to absorb water and nutrients. Hydrocarbon leaks also have the potential to alter the nutrient balance and microbiota of soils and water, which can be beneficial to certain species while detrimentally affecting others. Chapter 8 Biodiversity in Volume 2 and the Construction Environmental Management Plan (CEMP) in Volume 4 of this EIAR set out measures to prevent the runoff of contaminants during construction.

#### Water (incl. hydrology & flood risk)

The increased traffic and transportation levels associated with the proposed works increase the risk of hydrological contamination via diffuse and point sources such as road runoff or oil/fuel spills. Any such spills have the potential to negatively impact water quality in the surrounding hydrological regimes. This potential interaction is more likely during the construction stage. Chapter 10 Water in Volume 2 and the CEMP in Volume 4 of this EIAR set out measures to prevent pollution incidents to watercourses from movement of HGVs.

#### Air Quality

The generation of road traffic due to construction phase deliveries of materials, removal of waste or redistribution of other road users has the potential to impact air quality. HGV traffic leaving construction sites also has the potential to generate dust emissions due to trackout of dust from the vehicle wheels to public roads. Chapter 12 Air Quality in Volume 2 and the CEMP in Volume 4 of this EIAR set out measures to reduce construction dust emissions.

## Climate

The generation of road traffic due to construction phase deliveries of materials, removal of waste or redistribution of other road users has the potential to impact climate emissions. Chapter 13 Climate in Volume 2 and the CEMP in Volume 4 of this EIAR set out measures to reduce GHG emissions during the construction phase.

## Noise and Vibration

Traffic noise is likely to arise from movement of HGVs along haulage routes to deliver materials to construction compounds. Works are likely to take place at day and night time and will have an impact on the baseline noise levels. Chapter 14 Noise and Vibration in Volume 2 and the CEMP in Volume 4 of this EIAR set out measures to reduce the effect of HGV movements on sensitive noise receptors.

## Landscape and Visual

During the construction phase, HGV movements along haulage routes to and from construction sites are likely have temporary visual impacts on visual receptors.

## Human Health

The construction phase will require the removal of waste materials from the proposed development site, in addition to the importation of fill material to the site, resulting in increased traffic which may pose a risk to other road users. Mitigation measures outlined in the Construction Traffic Management Plan (CTMP) and the CEMP in Volume 4 of this EIAR will be implemented to reduce the risk to road users.

### 25.4.1.2 Operation Phase

Traffic and Transportation will interact with the following during operation phase:

- Population.
- Biodiversity.
- Water (incl. hydrology & flood risk).
- Air Quality.
- Climate.
- Noise and Vibration.
- Landscape and Visual Amenity.

## Population

The proposed development is a transport project and when operational, will have far reaching positive transportation effects for communities along the railway corridor. The DART+ Programme is consistent with the National Planning Framework, the National Development Plan 2017 to 2028, the Transport Strategy for the Greater Dublin Area 2016-2035 and the Climate Action Plan 2019 as well as the local development plans. DART+ is a key measure in the Climate Action Plan 2019 and supports the achievement of targets for modal shift from private car to public transport and sustainable modes.

The project will link good quality public transport to sustainable land use management and can also assist in local regeneration, economic development and support the development of existing and new communities along the route.

The proposed DART+ West development will significantly increase rail capacity and frequency along the existing Maynooth / Sligo rail line to Maynooth and M3 Parkway that is currently constrained on the network. It will transport passengers in high quality trains that are designed to best suit the needs of growing communities, providing all day capacity, but crucially during peak AM and PM commuter periods. The

frequency of trains along the rail line will also increase from 6 to 12 trains per hour allowing for more flexible use of the rail service.

Furthermore, the proposed development will improve multimodal transport connectivity through the interchange with the Luas network at Broombridge and at the proposed Spencer Dock Station, and the future Metrolink project at Glasnevin / Phibsborough creating a linked and well-connected public transport system to meet future public transport demands in line with the projected increase in population within the Greater Dublin Area. The increased capacity and frequency offered by the Dart+ West development as well as its integration with other public transport systems may assist with uptake of public transportation options within the GDA.

The journey characteristics and general amenity of the population within the GDA will improve. For rail users, the proposed development will increase the capacity and frequency of rail services which may improve the level of comfort experiencing when travelling whilst reducing crowding on the Dublin to Maynooth and M3 Parkway rail lines, specifically during the peak AM and PM commuter periods.

For road users, the proposed development will induce local changes on journey amenity. By removing the rail-road interface at Coolmine, Porterstown, Clonsilla and Blakestown, the delays currently experienced by road users due to closures of the level crossing will be eliminated, however access to vehicular users will no longer be permitted at these locations. The traffic modelling analysis undertaken as part of Chapter 6 Traffic and Transportation determined that there will be a 'moderate' impact on vehicular traffic as a result of the level crossing closures.

### **Biodiversity**

During the operational phase of the proposed development, train fleet consisting of Electric Multiple Units (EMU) will be the primary train type operating on the rail line, Electric trains will use oils and oil-based lubricants, so some risk of pollution will remain. Diesel powered trains will remain in operation, albeit the proportion of these trains operating on the rail line will be reduced. Some risk of pollution from hydrocarbons will remain.

The operation of the proposed development will involve a doubling in frequency of trains. Increases in noise, vibration, lighting, and visual disturbance will lead to the disturbance of fauna including birds and bats.

A suite of best practice techniques, mitigation measures and guidelines have been outlined in Chapter 10 Water, Chapter 11 Hydrogeology, Chapter 8 Biodiversity in Volume 2 and the CEMP in Volume 4 of this EIAR to mitigate impacts on biodiversity.

### **Water (incl. hydrology & flood risk)**

The proposed development is likely to have a positive effect on hydrology by replacing diesel-powered rail fleets with an electrified rail fleet, reducing the risk of water contamination from accidental spillages / leaks. The removal of multiple existing level crossings will formalise the drainage network at certain locations, likely improving water quality of receiving waterbodies.

### **Air Quality**

Once operational, this proposed development will remove a source of localised air/climate pollution in the form of diesel-powered rail and replacing it with an electric rail unit. This has a beneficial impact on local air emissions. Changes in traffic volumes, speeds or alignments have the potential to alter the emissions from cars, buses, HGVs, and other motorized road users. Localised impacts on air quality are found to be negligible with respect to traffic emissions.

## Climate

The proposed development is removing a source of localised air pollution in the form of diesel-powered rail and replacing it with an electric rail unit. This has a beneficial impact on climate pollutants as well as air quality emissions as electricity can be powered by renewable sources rather than fossil fuels.

## Noise and Vibration

During operation, the proposed development will electrify the rail fleet and will increase the frequency of commuter services along the Dublin to Maynooth and M3 Parkway railway lines. Diesel-powered will also continue to operate along the railway line. According to Chapter 14 Noise and Vibration in Volume 2 of this EIAR, depending on the location, sensitive noise receptors are likely to experience no significant noise levels, a slight increase in noise levels or a slight decrease from the upgraded rail network. Where significant effects have been identified, mitigation measures proposed as part of the Chapter 14 Noise and Vibration' will be implemented.

In relation to noise traffic impacts, Chapter 14 Noise and Vibration concluded that the predicted increase in traffic noise levels associated with the development is less than 3 dB for both the opening and design years, as such the predicted increase is not significant. At some locations close to the level crossings being closed, the potential impact on sensitive noise locations in vicinity is positive as the traffic is rerouted to a different road network.

## Landscape and Visual

During the operation stage, the landscape and visual amenity may be impacted due to variations in traffic patterns arising from the closure of level crossings associated with the development. For instance, an increase in vehicles may be observed by visual receptors along the rerouted road network, while a decrease in traffic flow will be experienced by visual receptors in vicinity of the permanently closed level crossings.

## Human Health

The proposed development will see the electrification of the rail network in this area which will result in a phasing out of the emissions to air associated with diesel-powered vehicles and there will be a net localised benefit to air quality which would consequently have a positive long-term effect on human health.

### 25.4.2 Population

#### 25.4.2.1 Construction phase

Population will interact with the following during construction phase:

- Traffic and Transportation.

#### Traffic and Transport

The number of vehicles on roads within the GDA is likely to increase during the construction phase of the proposed development due to the movement of workforce to the works areas. The journeys associated with this workforce traveling to and from the area may increase traffic congestion. Some workers may temporarily relocate to the area for the duration of the works which may further increase traffic.

#### 25.4.2.2 Operation phase

Population will interact with the following during operation phase:

- Traffic and Transportation.

## **Traffic and Transportation**

During the operational phase, the proposed development may contribute to the change in journey characteristics for the population whereby by increasing the capacity and frequency of commuter rail services, the journeys made by private vehicles may decrease.

### **25.4.3 Biodiversity**

#### **25.4.3.1 Construction Phase**

Biodiversity will interact with the following during the construction phase:

- Landscape and Visual Amenity.

#### **Landscape and Visual Amenity**

The proposed development will require the removal of trees, shrubs and hedgerows throughout the study area, consequently impacting the surrounding landscape and leading to localised habitat loss. These impacts have been assessed as part of Chapter 15 Landscape and Visual. A suite of best practice techniques, mitigation measures and guidelines have been outlined in Chapter 15 Landscape and Visual Amenity and Chapter 8 Biodiversity, and the CEMP to mitigate against the loss of trees and vegetation.

#### **25.4.3.2 Operation Phase**

Biodiversity will interact with the following during the operation phase:

- Landscape and Visual Amenity.
- Human Health.

#### **Landscape and Visual Amenity**

Habitat enhancement works focussing on pond and wetland creation will be carried out on CIÉ owned land at Barberstown, East of Leixlip, between the new railway alignment at Jackson's Bridge and the Royal Canal and east of the Navan Road Parkway. The railway line that is being decommissioned at Jackson's Bridge and the Royal Canal will be allowed to revegetate naturally. Native trees will also be planted in this area, outside of the flood compensatory storage areas. All of these habitat enhancement works will have a positive effect on landscape and visual receptors.

#### **Human Health**

Increased biodiversity is linked may have an impact on the quality of life of those living in the receiving environment. Screen planting and landscape mitigation measures proposed as part of the DART+ West project will improve the views of residents and road / rail users having a positive impact.

### **25.4.4 Land and Soils**

#### **25.4.4.1 Construction phase**

Land and Soils will interact with the following during construction phase:

- Traffic and Transportation.
- Population.
- Biodiversity.
- Water (incl. hydrology & flood risk)
- Hydrogeology.
- Landscape and Visual Amenity.
- Air Quality.
- Noise and Vibration.

- Material Assets – Agricultural Properties.
- Material Assets – Non-Agricultural Properties.
- Material Assets – Resources and Waste Management.
- Archaeology and Cultural Heritage.
- Human Health.

### **Traffic and Transportation**

The removal and excavation of earthworks and other materials and provision of fill materials to construct the project will result in significant requirements for transportation during construction phase, which can lead to additional traffic volumes, congestion and risks to other road-users. These impacts have been assessed in Chapter 6 of this EIAR.

As a result of a net earthworks fill deficit, the construction of the proposed development will require the importation of large volumes, currently estimated at the order of 296,000m<sup>3</sup> of material, to be supplied from quarries or other suitable sources of soils within the region. Almost 310,000 m<sup>3</sup> shall also need to be removed and disposed from site if it cannot be treated and reused.

### **Population**

The removal and excavation of soils and rocks will result in noise and vibration and air quality impacts during construction phase. These impacts have been assessed in Chapters 12 and 13 in Volume 2 of this EIAR and with the implementation of the mitigation measures outlined, interactions will be short term and will not be significant. As a result of a net earthworks fill deficit, the construction of the proposed development will require the importation of large volumes, currently estimated at the order of 296,000m<sup>3</sup> of material, to be supplied from quarries or other suitable sources of soils within the region. Almost 310,000 m<sup>3</sup> shall also need to be removed and disposed from site if it cannot be treated and reused.

While this will result in moderate, negative effect due to transport on soils and geology in the study area, it will also give rise to significant positive economic benefits for the businesses in question. Borrow sources often recover depending on the materials deposited and the conditions present.

### **Biodiversity**

Earthworks during the construction phase have the potential to impact on the Royal Canal, a proposed National Heritage Area (pNHA) and other nearby watercourses through construction site runoff, the risk of release of contaminants from the ground, noise and vibration, and air quality impacts. The erection of some of the construction compounds on greenfield lands or local parks is likely to have an impact on the local biodiversity during construction. The potential impacts are likely to arise from soil sealing and from construction activities that require earthworks. A suite of best practice techniques, mitigation measures and guidelines have been outlined in Chapter 10 Water, Chapter 11 Hydrogeology, Chapter 8 Biodiversity in Volume 2 and the CEMP in Volume 3 of this EIAR to mitigate impacts on the European and nationally designated sites.

All construction works involving the movement of soils will consider the identified locations of Invasive Alien Species. A management plan for invasive species has been included in the EOP and will be implemented by the contractor.

### **Water (incl. hydrology & flood risk)**

The excavation of soils and rock for the proposed development, specifically to construct the underground train station at Spencer Dock, and the excavation works required to construct the underpass at Ashtown and the compensatory flood storage areas poses a potential risk to nearby watercourses as a result of sediment runoff. Earthworks associated with the diversion of Lyreen Stream pose a risk to this waterbody from sediment runoff. A suite of best practice techniques, mitigation measures and guidelines have been outlined in Chapter

9 Land and Soils, Chapter 10 Water, Chapter 11 Hydrogeology in Volume 2, and the CEMP in Volume 4 of this EIA to mitigate impacts on waterbodies will be implemented.

### **Hydrogeology**

Excavations and dewatering at Spencer Dock are likely to result in drawdown adjacent to the development and potentially interacts with the adjacent structures. A fall in the water levels around the perimeter of the site could potentially change the effect of loading on existing building foundations. It is noted that other deep foundations including tank structures are already present and would have resistance to variable water on account of the tidal influences. It is reasonable to expect such structures also incorporate anchors to stability and uplift. The constraints for management of any groundwater recharge during construction could be complicated by the presence of contaminated soils and liquids.

At Ashtown, the proposed underpass structure will involve a complex design requiring dewatering and protection of the construction from the adjacent canal. Detailed development of the construction sequence and dewatering systems designs will be required. It is expected that the lining of the canal may need to be renewed locally following removal of the intended construction platforms installed to protect the canal embankments and canal walls.

### **Air Quality**

The movement of soils during the construction phase has potential to result in the release of airborne dust particles and pollution associated with transporting the materials. Mitigation measures are provided in Chapter 12 Air Quality and Chapter 13 Climate in Volume 2 of this EIA to ensure appropriate actions are taken to prevent such impacts.

### **Noise and Vibration**

The interaction between lands and soils and noise and vibration is considered significant during the construction stage. The excavation and movement of soils and rock have the potential to cause noise and vibration impacts which have been assessed in Chapter 14 Noise and Vibration in Volume 2 of this EIA. Mitigation measures have been put in place to limit working hours and noise levels associated with soil and rock excavation along the proposed development. It is anticipated that blasting will not be permitted due to proximity of constraints such as residents, the adjacent canal construction, and the live railway corridor.

### **Landscape and Visual Amenity**

The proposed earthworks will affect the landscape of the surrounding area during both the construction phase and the operational phase of the project. The proposed change in landform and the visual effects have been considered in the design of the proposed development and mitigation measures have been incorporated into the design. The impact of earthworks is assessed fully in Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIA.

### **Material Assets – Agricultural Properties**

The movement of soils and rock excavation during the construction phase will result in noise and vibration levels which may affect neighbouring livestock. Therefore, significant interactions may occur between land and soils and material assets and land (agriculture). Impacts associated with this interaction have been assessed however in Chapter 16 Material Assets – Agricultural Properties in Volume 2 of this EIA. Good communication between the contractor and adjacent landowners during the construction phase will allow farm animals to be moved, avoiding undue disturbance.

### **Material Assets– Non-Agricultural Properties**

Impacts caused by excavations have the potential to cause significant interactions between land and soils and material assets and land (non-agriculture), particularly where required in rock. Excavations in rock which are

likely to require mechanical or chemical breaking, such as explosives, are not appropriate. Sufficient clearance should be provided to avoid causing instability of neighbouring lands. Impacts on residential properties due to noise and vibration from earthworks and movement of construction activities have been addressed in Chapter 14 Noise and Vibration. Mitigation measures have also been outlined in Chapter 17 Material Assets – Non-Agricultural Properties in Volume 2 of this EIAR.

### **Material Assets – Resources and Waste Management**

There is potential interaction between land and soils and waste management during the construction phase, particularly regarding earthworks that will require disposal at a suitable licensed facility. The excavations will result in material that will be reused on site as well as material that will require disposal or recovery at a licensed waste handling or landfill site. Impacts on waste management as a result of soils and geology works have been addressed in Chapter 19 Material Assets – Resources and Waste Management in Volume 2 of this EIAR. Further mitigation measures are provided in Chapter 19 to ensure appropriate actions are taken when transporting earthworks and waste resulting from construction works.

### **Archaeology and Cultural Heritage**

The disturbance of soil during the construction phase of the proposed development has the potential to uncover archaeological finds. A programme of archaeological test excavations will be carried out within the lands made available (LMA) for construction of the proposed development prior to construction going ahead and a Project Archaeologist will be assigned to the construction phase. Further mitigation measures are detailed in Chapter 20 Archaeology and Cultural Heritage in Volume 2 of this EIAR.

### **Human Health**

During construction works, there is potential for workers to come into contact with contaminated land. The impacts human health have been assessed in Chapter 9 Land and Soils and Chapter 23 Human Health in Volume 2 of this EIAR.

#### **25.4.4.2 Operation phase**

Land and Soils will interact with the following during operation phase:

- Water (incl. hydrology & flood risk).

#### **Water (incl. hydrology & flood risk)**

During the operation phase, the design of the track and associated side road drainage will ensure that existing conditions are not affected. The drainage design and mitigation measures have been developed as described in Chapter 10 Water in Volume 2 of this EIAR.

### **25.4.5 Water (incl. hydrology & flood risk)**

#### **25.4.5.1 Construction phase**

Water will interact with the following during construction phase:

- Biodiversity.
- Land and Soils.
- Hydrogeology.
- Material Assets – Agricultural Properties.
- Material Assets – Utilities.
- Human Health.

## **Biodiversity**

Construction activities have potential to pose a risk to watercourses, particularly if contaminated surface water from construction activities was to enter the receiving waterbodies. Chapter 8 Biodiversity in Volume 2 and the CEMP in Volume 4 of this EIAR set out measures to prevent the runoff of contaminants during construction. These measures will mitigate the risk to biodiversity within Dublin Bay and the European sites.

## **Land and Soils**

During the construction earthworks, heavy rainfall events have the potential for run-off to impact on the usability of materials stored onsite. This could therefore require the importation of additional material from external sources. Mitigation measures to reduce the risk of damage of construction materials from heavy rainfall and flood events is outlined in Chapter 10 Water in Volume 2 of this EIAR.

## **Hydrogeology**

During construction phase, the dewatering and earthworks for the construction of the Spencer Dock station poses a potential risk to receiving waterbodies. Mitigation measures to reduce silt laden waters discharging to the surrounding surface water bodies are detailed in Chapter 11 Hydrogeology in Volume 2 of this EIAR.

## **Material Assets – Agricultural Properties**

Field drainage systems currently in situ will be disturbed and in places impacted by the construction works. These systems will be restored as part of the proposed development works. However, there may be temporary impaired drainage in the period of time between initial disturbance and final reinstatement of such drainage works. In cases where impeded drainage during construction will cause obvious difficulty to a particular landowner, temporary measures will be employed on a site-specific basis. This may include allowing waters to drain to less critical areas, so as to minimise the impact.

## **Material Assets - Utilities**

There is potential for the build-up of excess silts in the existing drainage networks derived from construction runoff that could limit the network capacity. However, standard pollution control measures will be implemented to manage contaminated runoff and ensure the existing drainage pathways are maintained during the construction phase.

## **Human Health**

The construction works for the proposed development will increase the number of people near a known source of flooding, namely at the Royal Canal, Lyreen River, and other waterbodies, increasing the potential for flood risk related impacts on human health during both the construction phase of the development. Weather forecasting will be regularly monitored to ensure that the conditions are favourable for construction works. An Incident Response Plan (IRP) will be prepared and implemented in an event of an accident.

### **25.4.5.2 Operation phase**

Water will interact with the following during operation phase:

- Climate.
- Material Assets – Agricultural Properties.

## **Climate**

The provision of compensatory flood storage areas during construction stages west of Maynooth will require the excavation of a considerable volume of soils reducing carbon sequestration capacity. This impact is reduced by the provision of wetland features which will re-sequester a portion of carbon, as discussed in Chapter 10 Water in Volume 2 of this EIAR.

## **Material Assets – Agricultural Properties**

During operation phase, the potential risk of flooding of adjacent agricultural fields to the proposed depot will be mitigated through the construction of compensatory flood storage areas. No significant impacts on agricultural lands from flooding are likely.

### **25.4.6 Hydrogeology**

#### **25.4.6.1 Construction phase**

Hydrogeology will interact with the following during construction phase:

- Biodiversity.
- Land and Soils.
- Water (incl. hydrology & flood risk).
- Material Assets – Agricultural Properties.
- Material Assets – Non-agricultural Properties.
- Human Health.

#### **Biodiversity**

The hydrogeological environment supports groundwater dependent ecosystems. Those within the Ryewater SAC have been assessed in Chapter 11 Hydrogeology in Volume 2 of this EIAR and impacts have been assessed as not significant.

#### **Land and Soils**

Significant excavations such as at Spencer Dock will require dewatering and the drawdown of the surrounding groundwater. The constraints for management of any groundwater recharge during construction could be complicated by the presence of contaminated soils and liquids.

#### **Water (incl. hydrology & flood risk)**

Changes to infiltration and shallow groundwater patterns have the potential to affect baseflow inputs into the local river network. Groundwater can also form a pathway between a source of pollution and surface water receptors. The proposed DART+ West project will be designed to have limited impact on the groundwater environment and thus limited potential impacts to the surface water environment through a groundwater pathway. Remediation of potentially contaminated pumped groundwater from excavation works at Spencer Docks will mitigate impacts upon water quality within receiving surface water bodies (see Chapter 11 Hydrogeology in Volume 2 of this EIAR for further details) during the construction phase.

## **Material Assets – Agricultural Properties**

The excavation works in the construction phase have the potential to affect water resources used for agricultural purposes. The impact mechanisms and mitigation are as set out in Chapter 11 Hydrogeology in Volume 2 of this EIAR.

## **Material Assets – Non-Agricultural Properties**

Excavations and dewatering during the construction at Spencer Dock are likely to result in temporary drawdown in groundwater levels adjacent to the development and the potential interaction with the adjacent structures. A fall in the water levels around the perimeter of the site could potentially change the effect of loading on existing building foundations. It is noted that other deep foundations including tank structures are already present and would have resistance to variable water on account of the tidal influences. It is reasonable to expect such structures also incorporate anchors to stability and uplift. Chapter 11 Hydrogeology in Volume

2 of this EIAR outlines the requirements of embedded mitigation required to mitigate potential impacts arising from groundwater control during construction works at Spencer Dock.

Interactions are not envisaged between hydrogeology and the material assets (non-agriculture) during the operational stage of the development.

## **Human Health**

The works have the potential to reduce water quality and quantity to potable water supplies during the construction phase. Mitigation measures have been developed in Chapter 11 Hydrogeology in Volume 2 of this EIAR reduce the risk of contamination of groundwater, thereby reducing the potential impact on human health.

### **25.4.6.2 Operation phase**

There are no interactions between hydrogeology and other environmental factors during the operational phase of the development.

## **25.4.7 Air Quality**

### **25.4.7.1 Construction phase**

Air Quality will interact with the following during the construction phase:

- Biodiversity.
- Climate.
- Human Health.

## **Biodiversity**

Emissions from diesel rail engines and road users have the potential to impact sensitive ecology. There is sensitive ecology in the form of the Royal Canal pNHA near a significant area of the redline boundary. In addition, there is the potential for construction dust impacts on sensitive ecology during the construction phase.

## **Climate**

Air quality and climate emissions can be generated from the same sources which includes diesel rail engines and road users during the construction phase.

## **Human Health**

Air quality limit values are set for the protection of human health. Any changes in concentrations have the potential to impact on human health adversely or beneficially during both the construction and operational phase. Air quality may be impacted by dust particles and traffic fumes during the construction phase. When the dust minimisation measures detailed in Chapter 12 Air Quality in Volume 2 of this EIAR are implemented, fugitive emissions of dust from the site are not predicted to be significant and pose no nuisance to human health to nearby receptors.

### **25.4.7.2 Operation phase**

Air Quality will interact with the following during the operation phase:

- Biodiversity.
- Climate.
- Human Health.
- Traffic and Transportation.

## **Biodiversity**

Emissions from diesel rail engines and road users have the potential to impact sensitive ecology if they occur within 200 m. There is sensitive ecology in the form of the Royal Canal pNHA near a significant area of the redline boundary. The proposed change from diesel to electric trains may remove rail emissions as a source impacting sensitive biodiversity in proximity to the rail line. Such an improvement on air quality may support local biodiversity.

## **Climate**

During the operational phase, the proposed development will remove a source of localised air and climate emissions in the form of diesel-powered rail system by replacing it with an electric rail unit. While climate emissions occur from fossil fuel derived electricity, during the operational phase 80% of electricity will be from renewable sources. This will have a beneficial impact on climate pollutants as well as air quality emissions due to the cleaner electricity supported rail line which decouples fossil fuels and transport systems.

## **Human Health**

The air dispersion modelling assessment undertaken as part of Chapter 12 Air Quality in Volume 2 of this EIAR has found that in 2028 and 2043 all receptors will have ambient air quality in compliance with the ambient air quality standards during the operation phase of the proposed development.

### **25.4.8 Climate**

#### **25.4.8.1 Construction phase**

Climate will interact with the following during construction phase:

- Water (incl. hydrology & flood risk).
- Major Accidents and Disasters.

#### **Water (incl. hydrology & flood risk)**

The impact of climate changes on hydrology increases the potential for future flood risk and drought periods. The impact of climate change has been assessed as part of the Site Specific Flood Risk Assessment (see Supporting Documents) prepared for the proposed development, Chapter 13 Climate and Chapter 24 Major Accidents and Disasters in Volume 2 of this EIAR.

#### **Major Accidents and Disasters**

The impact of future potential climate change on the project creates an interrelationship with Risk of Major Accidents and Disasters. Chapter 24 Major Accidents and Disasters in Volume 2 of this EIAR considers the impact of natural disasters such as storms, droughts, and flooding on the proposed development, all of which can be the result of climate change. While the impact of future climate change may not be as significant during the construction phase, consideration should be made for increased risk in the future.

#### **25.4.8.2 Operation phase**

Climate will interact with the following during operational phase:

- Traffic and Transportation.
- Water (incl. hydrology & flood risk).
- Material Assets: Resource and Waste Management.
- Major Accidents and Disasters.

## Traffic and Transportation

During the operational phase, the proposed development will remove a source of localised air and climate emissions in the form of diesel-powered rail system by replacing it with an electric rail unit. While climate emissions occur from fossil fuel derived electricity, during the operational phase 80% of electricity will be from renewable sources. This will have a beneficial impact on climate due to the cleaner electricity source used to power the rail line, which contributes to the decoupling of fossil fuels and transport systems.

## Water (incl. hydrology & flood risk)

The impact of climate changes on hydrology increases the potential for future flood risk and drought periods due to increasing extreme weather patterns. The impact of climate change has been assessed as part of the Scheme Site Specific Flood Risk Assessment (see Supporting Documents), Chapter 13 Climate and Chapter 24 Major Accidents and Disasters in Volume 2 of this EIAR.

## Material Assets: Resources and Waste Management

During the operational phase, the maintenance of material chosen during the construction phase will have an associated embodied carbon. Embodied carbon and the longevity of materials should be considered when selecting construction materials.

The degradation of waste generated during the operational phase has the potential to emit climate pollutants. Emissions due to waste can be mitigated through waste prevention practices, reuse on site, reuse off site, recycling or incineration rather than sending the waste directly to landfill.

## Major Accidents and Disasters

The impact of future potential climate change on the proposed development creates an interrelationship with Risk of Major Accidents and Disasters. This chapter considers the impact of natural disasters such as storms, droughts and flooding on the proposed development, all of which can be the result of climate change.

### 25.4.9 Noise and Vibration

#### 25.4.9.1 Construction phase

Noise and vibration will interact with the following during construction phase:

- Traffic and Transportation.
- Biodiversity.
- Material Assets: Agricultural Properties.
- Material Assets: Non-Agricultural Properties.
- Archaeology and Cultural Heritage.
- Architectural Heritage.
- Human Health.

## Traffic and Transportation

Construction works will take place close to the Luas line tracks which is vulnerable to vibration. TII provides the Code of engineering practice for works on, near, or adjacent to the Luas light rail system (TII 2016), which details maximum allowable vibration values on the line to prevent damage. Further details on this interaction is provided in Chapter 14 Noise and Vibration in Volume 2 of this EIAR.

## **Biodiversity**

Noise and Vibration impacts arising in the construction phase from machinery and excavation have the potential to impact on local biodiversity. Aquatic and semi aquatic species must similarly be considered as the Royal Canal runs parallel to much of the proposed development.

## **Material Assets: Agricultural Properties**

Noise impacts during the construction phase may impact on sensitive agricultural receptors including several equine enterprises. The removal of soils and rock excavation could affect neighbouring livestock. Effective communication between the contractor and adjacent landowners during the construction phase will allow farm animals to be moved, avoiding undue disturbance.

## **Material Assets: Non- Agricultural Properties**

Noise and vibration impact to property will be mitigated by means of physical mitigation measures and utilising low noise and vibration methods where practicable as detailed in Chapter 14 in Volume 2 of this EIAR. Good communication between the contractor and adjacent property owners during the construction phase will minimise disturbance. Affected properties may include hotels, businesses, and schools etc. Protected structures often due to their style and age can be susceptible to damage from vibrations.

## **Archaeology and Cultural Heritage**

Undiscovered archaeological remains or artifacts that may be unearthed during the construction phase of the project could be susceptible to damage from exposure to vibration associated with the works. Appropriate mitigation measures have been outlined in Chapter 20 Archaeology and Cultural Heritage. Vibration and settlement have the potential to damage known and unknown archaeological and cultural heritage sites. However, no such potential impacts have been identified in relation to the sites assessed in Chapter 20 Archaeology and Cultural Heritage. Chapter 14 Noise and Vibration in Volume 2 of this EIAR determined that there would not be any significant vibration levels generated from the construction, and are below the criteria set for this scheme for significant effects to people within buildings or to protected or vulnerable structures.

## **Architectural Heritage**

Vibration and settlement have the potential to damage buildings, including those of architectural heritage significance and hence there is a need for interaction with the disciplines that assess those factors. In the context of the present project the most likely sources of vibration or settlement damage would arise from the demolition of railway bridge arches that are part of the same structure as an adjacent canal bridge, the cutting of holes through the vaults at Connolly Station to facilitate the repurposing of vaults as a new station entrance and digging or blasting for the purpose of lowering the level of the track. Chapter 14 Noise and Vibration in Volume 2 of this EIAR determined that there would not be any significant vibration levels generated from the construction, and are below the criteria set for this scheme for significant effects to people within buildings or to protected or vulnerable structures.

## **Human Health**

Human health may be impacted during the construction phase of the proposed works due to excessive noise and vibration. Noise and vibration impacts may arise from excavation machinery, increased HGV traffic and other construction related activities. Mitigation measures have been identified in Chapter 14 Noise and Vibration in Volume 2 of this EIAR to reduce the risk to human health.

### **25.4.9.2 Operation phase**

Noise and vibration will interact with the following during operation phase:

- Biodiversity.
- Landscape and Visual Amenity.

- Material Assets: Non- Agricultural Properties.
- Human Health.

### **Biodiversity**

During the operational phase of the development, noise and vibration impacts arising from the increased trainline frequency may impact on the biodiversity in the surrounding regions via deterrence and disturbance.

### **Landscape and Visual**

Noise barriers will be constructed in localised locations to reduce the noise levels between the railway line and the noise receptors. These noise barriers are likely to have localised, negative, long-term effects on visual receptors by obstructing the view onto the railway line.

### **Material Assets: Non- Agricultural Properties**

Noise and vibration impacts during operation of the proposed development varies depending on location. In general a slight noise impact is predicted once mitigation identified in Chapter 14 Noise and Vibration in Volume 2 of this EIAR is provided. In some areas a positive impact is predicted, in particular close to level crossing closures and on Zone D of the route. Affected properties may include hotels, businesses, and schools etc.

### **Human Health**

In relation to noise impacts arising from the proposed development, Chapter 14 Noise and Vibration in Volume 2 of this EIAR concluded that the predicted operation noise impact associated with the proposed development is generally slight, but significant in localised areas due to the increased frequency in train services. Mitigation measures in the form of noise barriers will be implemented at these locations as detailed in Chapter 14 Noise and Vibration in Volume 2 of this EIAR.

This comparison finds that there are small changes to the health impacts in all zones and changes in noise level are slight. At some locations close to the level crossings being closed, the potential impact on human health in vicinity is positive as the traffic is rerouted to a different road network.

## **25.4.10 Landscape and Visual Amenity**

### **25.4.10.1 Construction phase**

Landscape and Visual will interact with the following during construction phase:

- Population.
- Biodiversity.
- Noise and Vibration.
- Material Assets: Agricultural Properties.
- Material Assets: Non- Agricultural Properties.
- Archaeology and Cultural Heritage.
- Architectural Heritage.

### **Population**

Construction compounds and hoarding will be required during the construction phase which will alter the landscape for local populations. A series of mitigation measures are outlined in Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIAR.

## **Biodiversity**

During the construction phase of the proposed development, the removal of trees, shrubs, hedgerows and vegetation will be required which will impact biodiversity. Mitigation measures proposed in Chapter 15 'Landscape and Visual Amenity' will be implemented to reduce the impact to biodiversity.

## **Noise and Vibration**

Hoarding proposed around the construction sites as part of Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIA to reduce impacts on visual receptors will also service as acoustic barriers between the construction activities and the noise receptors during construction phase.

## **Material Assets: Agricultural Properties**

The construction phase will impact agricultural properties as a result of the removal of trees, shrubs and hedgerows and a subsequent impact on the field pattern in specific areas. The construction phase will also cause visual clutter in a rural landscape.

## **Material Assets: Non-Agricultural Properties**

The proposed construction works will also convert an area of agricultural land into a built-up area which will impact views from nearby residential properties.

## **Archaeology and Cultural Heritage**

The impact on the settings of sites of archaeological and cultural heritage significance represents an interaction with landscape and visual assessment, as does the siting of landscaping as a means of mitigating the visual impact of certain elements of the proposed works. The siting of hoardings during construction may, in some cases, have a visual impact sites and areas of archaeological and cultural heritage significance.

## **Architectural Heritage**

Many of the indirect impacts on architectural heritage during construction arise from the visual impact on the settings of the structures of architectural heritage significance and mitigation measures proposed in Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIA will be implemented in these instances.

The impact on the settings of structures of architectural heritage significance represents an interaction with landscape and visual assessment, as does the siting of landscaping as a means of mitigating the visual impact of certain of the proposed works. The siting of hoardings during construction will in some cases have a short-term visual impact on buildings and other structures of architectural heritage significance.

### **25.4.10.2 Operation phase**

Landscape and Visual will interact with the following during operation phase:

- Population.
- Biodiversity.
- Noise and Vibration.
- Material Assets: Agricultural Properties.
- Material Assets: Non- Agricultural Properties.
- Architectural Heritage.

## **Population**

Landscape and visual impacts will occur as a result of the proposed development as it will alter the views and setting for local residents. The provision of new elevated structures, OHLE, signalling bridges, embankments, retaining walls, fences, barriers, and gantries will present a visual intrusion for property owners. Provision of

new public realm areas at Preston Street near Connolly Station and at Clonsilla level crossing will have beneficial effects on population by enhancing the general amenity areas.

### **Biodiversity**

The proposed works include retaining vegetation and trees wherever possible. Where trees, hedges and/or planting are removed, new planting will be provided. New planting will match the removed planting where possible. Mitigation measures set out in Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIAR include planting to mitigate impacts to the landscape. Landscape mitigation will also have regard to recommendations made in Chapter 8 Biodiversity in Volume 2 of this EIAR.

### **Noise and Vibration**

Landscaping in the form of trees, shrubs, vegetation etc is as part of the mitigation measures in Chapter 15 Landscape and Visual in Volume 2 of this EIAR. These will form natural noise barriers natural noise barriers between the residential properties and the railway line and the road network, where applicable. Positive long-term effect on noise receptors is envisaged.

### **Material Assets: Agricultural Properties**

The proposed development will require changes to areas of private properties and land acquisition which may alter the townscape fabric and streetscape character on a local level in certain areas. Appropriate mitigation measures have been outlined in Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIAR.

### **Material Assets: Non-Agricultural Properties**

The proposed development will require changes to areas of private properties and land acquisition which may alter the townscape fabric and streetscape character on a local level in certain areas. Appropriate mitigation measures have been outlined in Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIAR.

### **Architectural Heritage**

The visual impact on the settings of structures of architectural heritage significance at operation phase will be mitigated in accordance with measures proposed in Chapter 15 Landscape and Visual Amenity in Volume 2 of this EIAR.

## **25.4.11 Material Assets: Agricultural Properties**

### **25.4.11.1 Construction phase**

Material assets: agricultural properties will interact with the following during construction phase:

- Population.
- Human Health.

#### **Population**

Primary impacts on population due to Material Assets Agricultural Properties will entail temporary landtake and impacts on land use and access to property. These may impact upon the operation of agricultural enterprises. Potential impacts on human beings will be mitigated by measures including the provision of new accesses and the reinstatement of temporarily acquired lands.

#### **Human Health**

The proposed development will require temporary land take of agricultural lands which may have negative psychosocial impacts on the landowners. Monetary compensation will be provided and will be subject to negotiation with all relevant parties from whom land, or property is acquired for the proposed development.

#### **25.4.11.2 Operation phase**

The impacts on material assets: agricultural property will interact with the following during operation phases:

- Population.
- Human Health.

##### **Population**

Primary impacts on population due to material assets and land will entail landtake and other agricultural property impacts during the operational stage of the development. Potential impacts on human beings will be mitigated by measures including the provision of new accesses and replacement boundaries to affected properties. Monetary compensation will be subject to negotiation with all relevant parties from whom land, or property is acquired for the proposed development.

##### **Human Health**

The proposed development will require permanent land take of agricultural assets which may have negative psychosocial impacts on the landowners. Monetary compensation will be provided and will be subject to negotiation with all relevant parties from whom land, or property is acquired for the proposed development.

#### **25.4.12 Material Assets: Non-Agricultural Properties**

##### **25.4.12.1 Construction phase**

Material assets: non-agricultural properties will interact with the following during construction phase:

- Population.
- Human Health.

##### **Population**

Primary impacts on population due to Material Assets Non-Agricultural Properties will entail temporary landtake and other impacts on non-agricultural property including impacts on land use and access to property. These may impact upon the operation of community organisations and commercial businesses. Potential impacts on human beings will be mitigated by measures including the provision of new accesses and replacement boundaries to affected properties.

##### **Human Health**

The proposed development will require temporary land take of non-agricultural assets which may have negative psychosocial impacts on the property owners. Monetary compensation will be provided and will be subject to negotiation with all relevant parties from whom land, or property is acquired for the proposed development.

##### **25.4.12.2 Operation phase**

Material assets: non-agricultural properties will interact with the following during construction phase:

- Population.
- Human Health.

##### **Population**

Primary impacts on population due to Material Assets & Land (Non-Agriculture) will entail permanent landtake on non-agricultural property. These may impact upon the operation and staffing of commercial businesses. Monetary compensation will be provided and will be subject to negotiation with all relevant parties from whom land, or property is acquired for the proposed development.

## Human Health

The proposed development will require permanent land take of non-agricultural assets which may have negative psychosocial impacts on the property owners. Monetary compensation will be provided and will be subject to negotiation with all relevant parties from whom land, or property is acquired for the proposed development.

### 25.4.13 Material Assets: Utilities

#### 25.4.13.1 Construction phase

Material assets: utilities will interact with the following during construction phase:

- Population.
- Water (incl. hydrology & flood risk).
- Human Health.

#### Population

During construction phase, power outages may occur in an event of damage to utilities, or during rerouting works. There is potential for local communities to be temporarily effected by these power outages. If works on utilities are to take place, all affected communities will be notified prior to the works commencing.

#### Water (incl. hydrology & flood risk).

Utility diversion works may have an impact on the public water supply during the construction phase. Mitigation measures outlined in Chapter 18 Material Assets – Utilities in Volume 2 of this EIAR will be implemented to ensure that disruption to the public water supply is minimised.

#### Human Health

During construction phase, power, water, energy, or communication outages may occur in an event of damage to utilities, or during utility diversion works. As these are essential services that support healthy lives, there is potential for human health to be temporarily affected by these outages. If works on utilities are to take place, all affected communities will be notified prior to the works commencing. Chapter 18 Material Assets: Utilities and Chapter 23 Human Health in Volume 2 of this EIAR provide mitigation measures to minimise impacts on human health as a result of utility diversions.

#### 25.4.13.2 Operation phase

There are no interactions between material assets: utilities and other environmental factors during the operational phase of the development.

### 25.4.14 Archaeology and Cultural Heritage

#### 25.4.14.1 Construction phase

Archaeology and cultural heritage will interact with the following during construction phase:

- Population.

#### Population

During construction phase, the proposed development will consist of works and in vicinity of sites or features of cultural heritage significance. Some of these sites are of interest and importance to the communities and may be used as general amenity areas. Mitigation measures proposed as part of Chapter 8 'Population and Chapter 20 Archaeology and Cultural Heritage in Volume 2 of this EIAR will be implemented.

#### **25.4.14.2 Operation phase**

There are no interactions between archaeology and cultural heritage and other environmental factors during the operational phase of the development.

### **25.4.15 Architectural Heritage**

#### **25.4.15.1 Construction phase**

Architectural Heritage will interact with the following during construction phase:

- Population.
- Archaeology and Cultural Heritage.

#### **Population**

During construction phase, the proposed development will consist of works and in vicinity of sites or features of architectural heritage significance. Some of these sites are of interest and importance to the communities and may be used as general amenity areas. Mitigation measures proposed as part of Chapter 8 'Population and Chapter 21 'Architectural Heritage' will be implemented during construction phase to reduce the impact on population.

#### **Archaeology and cultural heritage**

Some structures of architectural heritage significance are also of archaeological or cultural heritage significance. Mitigation measures proposed as part of Chapter 20 Archaeology and Cultural Heritage in Volume 2 of this EIA that also relate to architectural heritage will be implemented at construction phase.

#### **25.4.15.2 Operation phase**

There are no interactions between architectural heritage and other environmental factors during the operational phase of the development.

### **25.4.16 Material Assets: Resources and Waste Management**

#### **25.4.16.1 Construction phase**

Material assets and waste management will interact with the following during construction phase:

- Traffic and Transportation.
- Land and Soils.
- Air Quality.
- Climate.

#### **Traffic and Transportation**

A potential interaction between resource and waste management and traffic and transport effects during the construction phase of the proposed development is identified. The transportation of resources and waste to and from site has the potential to affect traffic and transport during the construction phase. Materials will require transport from the construction compounds to the various construction sites and there will also be material requiring transport for disposal or recovery at a suitably licensed facility, and/or will have potential for reuse on another construction site. Following the mitigation measures there will be a slight negative short-term residual effect on traffic and transport.

## **Land and Soils**

There is a potential interaction identified between land and soils and resource and waste management during the construction phase. The earthworks will result in material that will be reused on site, as well as material that will require disposal or recovery at a suitability licensed facility and/or will have potential for reuse on another construction site. This will result in slight, negative and short-term effects to resource and waste management during the construction phase due to an increased demand on waste recovery and/or disposal sites.

## **Air Quality**

There is potential interaction between material assets and waste management and air quality effects during the construction phase. Dust generated from the demolitions and the HGV movement of materials to and from site(s) will have the potential to affect air quality. Following mitigation measures (i.e. Dust Minimisation Plan) there will be short term, imperceptible negative residual effect on air quality.

## **Climate**

A potential interaction between material assets and waste management and climate effects during the construction phase of the proposed development is identified. There is embodied carbon associated with resources required and the waste generated during the construction phase with a consequential negative but not significant effect on climate. Embodied carbon will be considered when selecting construction materials. The proposed development will also have a demand for large quantities of material required, increasing the volume of HGVs on the road network, increasing the release of GHG emissions during construction phase. There are no significant residual negative effects on climate expected due to the proposed development.

### **25.4.16.2 Operation phase**

Material assets and waste management will interact with the following during operation phase:

- Climate.

The degradation of waste generated during the operational phase has the potential to emit climate pollutants. Emissions due to waste can be mitigated through waste prevention practices, reuse on site, reuse off site, recycling or incineration rather than sending the waste directly to landfill.

### **25.4.17 Electromagnetic Compatibility and Stray Current**

#### **25.4.17.1 Construction phase**

There are no interactions envisaged between electromagnetic compatibility and stray current and other environmental factors during the construction phase of the development

#### **25.4.17.2 Operation phase**

Electromagnetic Compatibility and Stray Current will interact with the following during operation phase:

- Material Assets: Non- Agricultural Properties.
- Human Health.

#### **MA: Non- Agricultural Properties**

Buildings with sensitive equipment such as Intel may be affected by EMC during the operation phase of the proposed DART+ West project. Chapter 22 Electromagnetic Compatibility and Stray Current in Volume 2 of this EIAR determined that no equipment used in buildings within 100 m of the railway line will be impacted by DC and Quasi DC magnetic field interference from the proposed development. Should any impacts manifest during the operation phase, mitigation measures specified in Chapter 22 of this EIAR will be implemented.

## Human Health

The proposed development will be an electrified 1,500 voltage Direct Current (DC) rail system. Potential hazards/sources of EMF during the operational phase include the railway itself, substations and associated feeder powerlines. The operation of the system poses the potential for EMI on sensitive receptors including human beings. The following potentially sensitive receptors within 100m study area are considered as part of Chapter 22 of this EIAR and include:

- Local residents and the community.
- Domestic and industrial electrical equipment.
- Telecommunications infrastructure (including wireless radio services).
- Sensitive medical and research equipment.
- Utilities.
- Mainline rail, suburban rail, and light rail system.

The EMF Directive specifies limits for human exposure to electromagnetic fields. This level is set from 4,000  $\mu\text{T}$  at DC to 800  $\mu\text{T}$  at 5 Hz. Chapter 22 of this EIAR details the criteria for assessing EMI and Stray current effects on human health. Modelling was undertaken to examine these potential effects and found that these levels will not be exceeded at any location that the public has access to and therefore the significance of the effects arising from DC and near DC magnetic fields for members of the public, including passengers, is classed as *imperceptible* with the quality of effect classed as *neutral*. Low level DC and near DC fields well below the limits set out in the EMF Directive will persist permanently once the traction supply remains energised.

## 25.5 Mitigation Measures

As described in the previous sections, interactions occur between many of the environmental factors. The assessments for each of these environmental factors undertaken in this EIAR have considered, and taken cognisance of these direct, indirect, cumulative and synergistic interactions during both the construction and operation phase of the project. The individual environmental assessments have identified appropriate mitigation measures to address these interactions to avoid, reduce or mitigate likely significant environmental effects which are described and residual effects identified in the respective specialist chapters of this EIAR. Therefore, no further mitigation is proposed.