
Chapter 24

Major Accidents and Disasters

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24. Major Accidents and Disasters

24.1. Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) identifies, describes, and presents an assessment of the likely significant effects on the environment arising from the vulnerability of the proposed Project to risks of major accidents and/or natural disasters. The assessment will examine the potential impacts during the construction and operational phases of the DART+ South West Project.

The assessment has been prepared in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (“the EIA Directive”). Coordination with and input from the relevant EIA experts and their respective discipline chapters of this EIAR has informed this assessment to ensure that the major accidents and disasters identified are adequately assessed.

The assessment presented is informed by the following EIAR chapters and supporting documents:

- Chapter 4 Project Description;
- Chapter 5 Construction Strategy;
- Chapter 6 Traffic and Transportation;
- Chapter 7 Population;
- Chapter 8 Biodiversity;
- Chapter 9 Land and Soils;
- Chapter 10 Water (including Hydrology & Flood Risk);
- Chapter 11 Hydrogeology;
- Chapter 12 Air Quality;
- Chapter 13 Climate;
- Chapter 14 Noise and Vibration;
- Chapter 18 Material Assets: Utilities;
- Chapter 19: Resource and Waste Management; and
- Flood Risk Assessment.

24.2. Legislation, Policy and Guidance

The key legislation and guidance referenced in the preparation of the EIAR is outlined in Chapter 1 (Sections 1.5, 1.6 and 1.7). Specific to the Major Accidents and Disaster chapter, the following legislation, policy and guidance has informed the assessment as outlined below.

24.2.1. Legislation

Specific to the Major Accidents and Disaster chapter, the following legislation has informed the assessment as outlined below.

European Legislation

- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment;
- Directive 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety;
- EU Regulation No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009; and
- Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (Seveso III Directive).

National Legislation

- European Union (Railway Safety) Regulations 2020, S.I. No. 476 of 2020;
- Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015); and
- Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013).

24.2.2. Policy

Relevant policy documents that have informed the assessment include:

- National Risk Assessment 2021/2022 Overview of Strategic Risks;
- A National Risk Assessment for Ireland 2020;
- Dublin City Development Plan 2022-2028;
- Dublin City Council Major Emergency Plan 2015;
- South Dublin County Council Major Emergency Plan 2016, Version 6.0;
- Kildare County Council, Major Emergency Plan 2010, Version 1.1;
- Dublin City Development Climate Change Action Plan 2019-2024;
- Kildare County Council Climate Change Adaption Strategy 2019-2024; and
- South Dublin County Council Climate Change Action Plan 2019-2024.

24.2.3. Guidance

There is no topic specific national guidance in relation to the assessment of major accidents and disasters in EIA, however the topic is included in the more general national EIA guidance, notably:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022) refers to ‘Accidents’, recommending that *“The potential for a project to cause risks to human health, cultural heritage or the environment due to its vulnerability to external accidents or disasters is considered where such risks are significant”*.

The Guidelines also state *“To address unforeseen or unplanned effects the Directive further requires that the EIAR takes account of the vulnerability of the project to risk of major accidents and/or disasters relevant to the project concerned and that the EIAR therefore explicitly addresses this issue. The extent to which the effects of major accidents and / or disasters are examined in the EIAR should be guided by an assessment of the likelihood of their occurrence (risk).”* (Section 3.7.3 of EPA, 2022).

- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018) which state that there are two key considerations under this requirement, namely:
 - *“The potential of the project to cause accidents and/or disasters, including implications for human health, cultural heritage, and the environment.*
 - *“The vulnerability of the project to potential disasters/accidents, including the risk to the project of both disasters (e.g. flooding) and man-made disasters (e.g. technological disasters).”*

The Guidelines also require that an EIAR include: *“... the expected effects arising from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project. Where appropriate, the description of expected significant effects should include details of the preparedness for and proposed response to such emergencies.”*

In the absence of a specific approach in national guidance, the approach used to carry out the risk assessment for this EIAR is based on that outlined in the following UK publication:

- Major Accidents and Disasters in EIA: A Primer (IEMA, September 2020).

In addition, consideration has been given to the following guidance related to risk assessment methodologies in the preparation of this chapter:

- Guidance on Technical Land-use Planning Advice for Planning Authorities and COMAH Establishment Operators, Health and Safety Authority (2022);
- Guidance on Assessing and Costing Environmental Liabilities (EPA, 2014);
- A Guide to Risk Assessment in Major Emergency Management (Department of Environment, Heritage and Local Government (DoEHLG, 2010); and
- A Framework for Major Emergency Management, Guidance Document 1, A Guide to Risk Assessment in Major Emergency Management (DoEHLG, 2010).

24.3. Methodology

24.3.1. Legislative Context

This Chapter of the EIAR has been prepared in accordance inter alia with the Transport (Railway Infrastructure) Act 2001 as amended. The European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations 2021 (S.I. No. 743 of 2021) gives further effect to the transposition of the EIA Directive (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 by amending the Transport (Railway Infrastructure) Act 2001 ('the 2001 Act'). Section 39 of the 2001 Act provides for the contents of an EIAR.

An examination, analysis and evaluation is carried out by An Bord Pleanála 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: population and human health; biodiversity, with particular attention to species and habitats protected under the Habitats and Birds Directives; land, soil, water, air and climate; material assets, cultural heritage and the landscape, and the interaction between the above factors.

Accordingly, Article 3 of the EIA Directive (as amended) requires the assessment of expected effects of major accidents and/or disasters within EIA. Article 3(2) of the Directive states that the:

“effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned”.

In addition, Annex IV (information for the EIAR) of the 2014 EIA Directive states than an EIAR shall contain:

“A description of the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.”

The EIA Directive (as amended) also states:

“In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those

accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment.”

The Major Accidents (Seveso III) Directive (2012/18/EU) is an EU Directive that seeks to prevent major industrial accidents involving dangerous substances and to limit the consequences of such accidents on people and the environment. In Ireland, the Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (the “COMAH Regulations”), implements the Seveso III Directive.

The Seveso III Directive and the COMAH Regulations outline the legal obligations for operators of industrial establishments where dangerous substances are stored. These establishments are referred to as Seveso sites and are classified as Upper Tier or Lower Tier establishments. As per Regulation 25 of the COMAH Regulations, Upper Tier establishments are required to submit information regarding their operations to the Health and Safety Authority (HSA). Each Seveso site has a consultation zone which is the ‘area liable to be affected by a major accident’ at the site (Department of the Environment, Community and Local Government (DECLG, 2015)). Therefore, if a development falls within the specified consultation zone of a Seveso site, the HSA must be consulted.

24.3.2. Scope

The EIA Directive (2014/52/EU) sets out the requirement to carry out an assessment of the vulnerability of the proposed Project to major accidents and disasters. A detailed assessment of potential accidents and disasters in relation to surface water and groundwater pollution along with flooding events have been included in the relevant chapters in this EIAR.

The assessment will follow a risk-based approach in line with the recent publication from the Institute of Environmental Management and Assessment in relation to Major Accidents and Disasters in EIA (IEMA, 2020). The potential ‘Risk Events’ are grouped based on their likelihood and consequence and it is determined whether the risks are managed and/or mitigated to ‘as low as reasonably practicable (ALARP)’ level.

This chapter of the EIAR differs from other specialist chapters of the EIAR, in that this chapter follows a risk assessment methodology, while other specialist chapters identify the potential for “*likely significant effects*” of the Project on the environment. The scope of this chapter and assessment deals with associated risk events of the proposed Project that have a *low likelihood* to occur but will have a *potentially high consequence* on environment, human health, infrastructure, and/or cultural heritage. The IEMA (2020) approach defines a “*significant environmental effect*” as one which “*Could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration*” (refer to page 6 of IEMA Primer) and this approach has been adopted for the purposes of this assessment.

The events with high likelihood and high consequence (high risk) and the low impact events irrespective of the likelihood (low-risk) are scoped-out of the assessment as per the approach recommended by IEMA Primer (2020) . The summary of risk events considered in the scope of the assessment is outlined in Figure 24-1.

This chapter does not deal with the impacts of gradual trends associated with climate change, e.g. sea level rise or increasing annual rainfall volumes. It does, however, address sudden events whose frequency may be increased as a result of climate change related trends, e.g. extreme weather events.

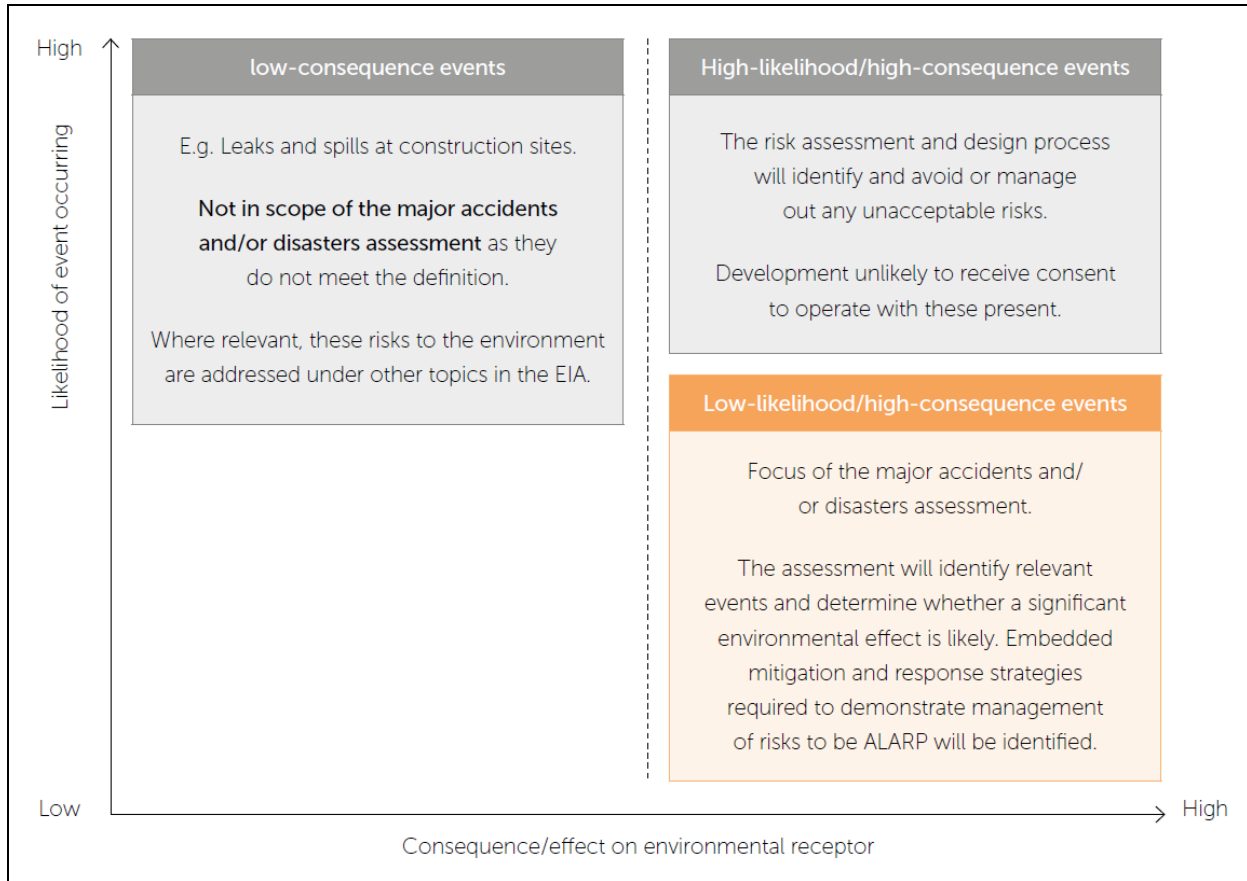


Figure 24-1 Summary of Risk Events Considered in the Scope of the impact Assessment in Relation to Major Accidents and Disasters (Source: IEMA Primer, 2020)

24.3.3. Definitions

For the purpose of this assessment, the following definitions from the Institute of Environmental Management and Assessment (IEMA) Major Accidents and Disasters in EIA: A Primer (hereafter referred to as the IEMA Primer) (IEMA 2020) as presented in Table 24.1 have been adopted.

Table 24.1 Key Definitions for the Assessment of MADs (adopted from IEMA Primer, 2020)

Term	Definition
Major Accident	Events that threaten immediate or delayed serious environmental effects to human health, welfare and/or the environment and require the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events.
Disaster	May be a natural hazard (e.g. earthquake) or a man-made/external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident.

Term	Definition
Hazard	<p>Something with the potential to cause harm.</p> <p>Hazards can be natural or man-made in nature. Natural hazards include, but are not limited to earthquake, flooding, landslide, high winds/storm, wildfire. Man-made hazards include, but are not limited to structural collapse, building collapse, explosion, terrorism, cyber-attack.</p>
Receptors	<p>The specific component of the environment that could be adversely affected if the source reaches it.</p> <p>Environmental receptor is specifically defined as: features of the environment that are subject to assessment under Article 3 of the EIA Directive, namely population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape.</p>
Vulnerability	<p>Describes the potential for harm as a result of an event, for example due to sensitivity or value of receptors. In the context of the EIA Directive, the term refers to the 'exposure and resilience' of the development to the risk of a major accident and/ or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.</p>
Sensitivity	<p>The sensitivity of a receptor is a function of its value, and capacity to accommodate change reflecting its ability to recover if it is affected. It is typically defined by the following factors:</p> <ul style="list-style-type: none"> • Adaptability – the degree to which a receptor can avoid, adapt to or recover from an effect; • Tolerance – the ability of a receptor to accommodate temporary or permanent change; and • Recoverability – the temporal scale over, and extent to, which a receptor will recover following an effect.
Magnitude of impact	<p>The magnitude of an impact is typically defined by the following factors:</p> <ul style="list-style-type: none"> • Geographic extent – the area over which the effect occurs; • Duration – the time for which the effect occurs; • Frequency – how often the effect occurs; and • Severity – the degree of change relative to existing environmental conditions.
Adaptive capacity	<p>The capacity of receptors to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.</p>
Risk	<p>The likelihood of an impact occurring, combined with the effect or consequence(s) of the impact on a receptor if it does occur.</p>
Source-pathway-receptor linkage	<p>For a risk to arise there must be hazard that consists of a 'source' (e.g. high rainfall); a 'receptor' (e.g. people, property, environment); and a pathway between the source and the receptor (e.g. flood routes).</p>
Likelihood	<p>In risk management terminology, the word 'likelihood' is used to refer to the chance of something happening.</p>
Significant environmental effect (in relation to a major accidents and/ or disasters assessment)	<p>Could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be remediated through minor clean-up and restoration.</p>
As Low As Reasonably Practicable (ALARP)	<p>Involves weighing a risk against the trouble, time and money needed to control it. Thus, ALARP describes the level to which risks are typically controlled.</p>

24.3.3.1. Receptors

The assessment of significant adverse effects considers all environmental factors defined in Article 3 of the 2014 EIA Directive (as amended). For the purpose of this assessment, an environmental receptor is therefore considered to be any of the following relevant receptors:

- The population located along the alignment of the existing railway line (from DART+ South West Project extents as outlined in Chapter 4 Project Description) and the proposed works of the Project consisting of members of the public, rail users, IÉ employees and local communities;
- Infrastructure and the built environment;
- The natural environment, including:
 - Biodiversity;
 - Land quality, soils and agriculture;
 - Air quality;
 - Water resources (hydrology and hydrogeology); and
 - Landscape and visual sensitive receptors;
- The historic environment, including:
 - Archaeology; and
 - Built heritage.

24.3.4. Sources of Information to Inform the Assessment

Information to inform the assessment was undertaken through a detailed desktop review of existing guidance, studies, datasets, and other chapters and assessments within this EIAR. The following publicly available data sources have been used to inform the assessment:

- EPA Maps <https://gis.epa.ie/EPAMaps/>
- Health and Safety Authority Notified Seveso Establishments https://www.hsa.ie/eng/Your_Industry/Chemicals/Legislation_Enforcement/COMAH/List_of_Establishments/

The following reports have also been used to inform the assessment:

- Railway Safety Performance in Ireland 2020 (Commission for Railway Regulation, 2020); and
- Iarnród Éireann Safety Report 2017 (Iarnród Éireann, 2017).

24.3.5. General Methodology

This assessment is based on a three-stage methodology in accordance with the approach presented in the IEMA Primer (IEMA, 2020) which includes the following:

- Stage 1- Screening for EIA;
- Stage 2- Scoping for EIA; and

- Stage 3- Assessment.

24.3.5.1. Stage 1 - Screening Stage

According to the IEMA Primer, at the EIA screening stage “it should be sufficient to identify if a development has a vulnerability to major accidents and/or disasters and to consider whether a development could lead to a significant effect”.

The following questions can be useful to guide the screening exercise (adapted from IEMA Primer, 2020):

- 1) Can the proposed project/development prove to be a source of hazard itself that can possibly lead to a major accident and/or disaster?
- 2) Is there any interaction that will occur between the proposed project/development and any sources of external hazards that may make it vulnerable to a major accident and/or disaster?
- 3) If an external major accident and/or disaster occurred, would the existence of the proposed project/development plausibly increase the risk of a significant effect to an environmental receptor occurring?

The proposed Project has screened in for mandatory EIA, as outlined in Chapter 1 of this EIAR (Refer to Section 1.8.1). The EIA Scoping Report included the topic of Major Accidents and Disasters. The assessment of hazard identification (source part of the source-pathway-receptor linkage) in relation to Major Accidents and Disasters was not considered at the time of writing of the EIA Scoping Report and as such, the screening exercise with respect to major accidents and disasters is presented within this chapter.

24.3.5.2. Stage 2 - Scoping Stage

This stage aims to determine in a more detailed manner whether there is any potential for significant effects of major accidents and/or disasters relating to the proposed development/Project that has been screened in at Stage 1.

In relation to the proposed Project, various hazard classes have been considered based on the Government of Ireland National Risk Assessment for Ireland 2020 (2021) and UK National Register of Civil Emergencies (2020 Edition). The baseline (i.e. the receiving) environment is described insofar as is relevant to the hazard class in question.

The IEMA Primer (IEMA 2020) state that “A major accidents and/or disasters assessment will be relevant to some developments more than others, and for many developments it is likely to be scoped out of the assessment”.

An impact assessment for major accidents and/or disasters can be scoped out if it can be demonstrated that:

- “There is no source-pathway-receptor linkage of a hazard that could trigger a major accident and / or disaster or potential for the scheme to lead to a significant environmental effect; or
- All possible major accidents and / or disasters are adequately covered elsewhere in the assessment or covered by existing design measures or compliance with legislation and best practice.” (IEMA, 2020; p. 12).

Figure 24-2 presents the infographic of the scoping process from IEMA Primer 2020.

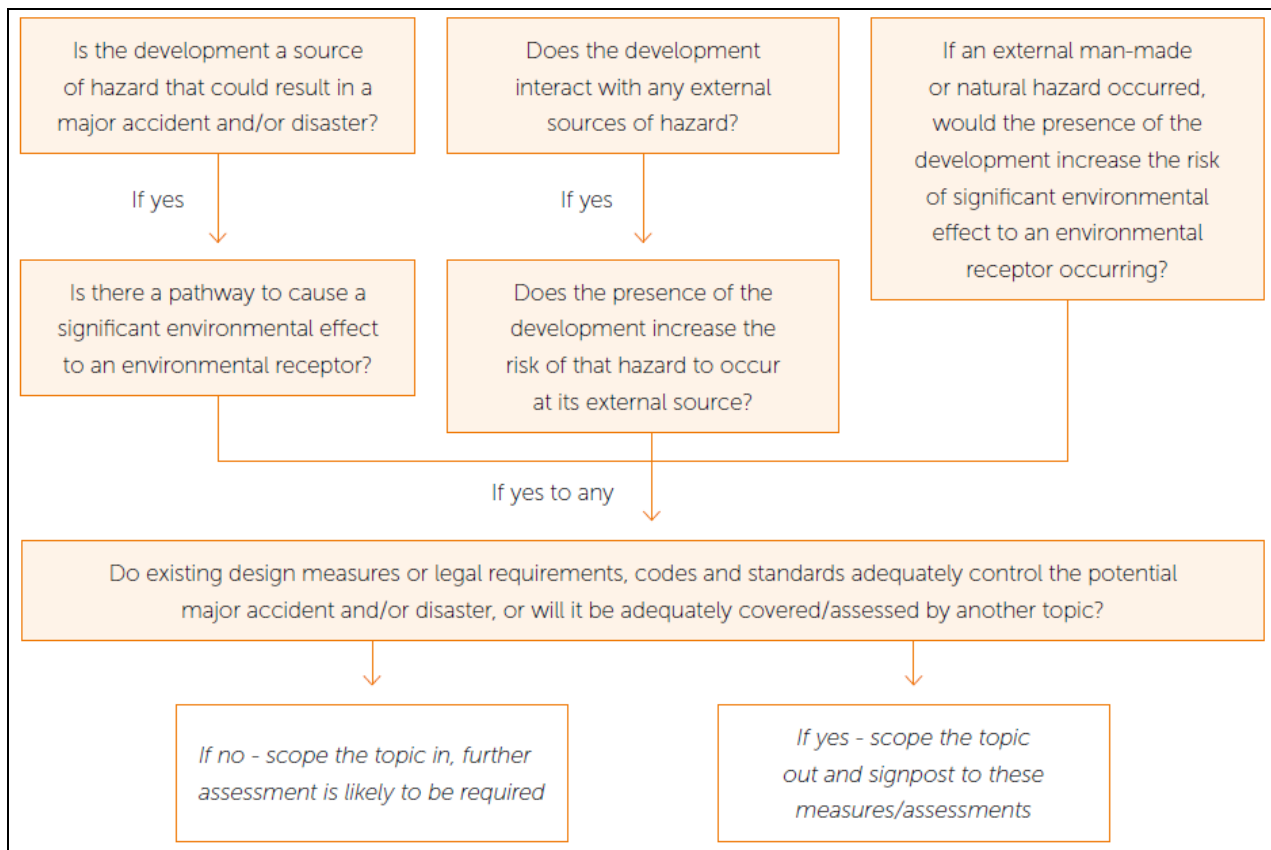


Figure 24-2 Scoping Decision Process Flow (Source: IEMA Primer, 2020)

The proposed Project has screened in for mandatory EIA, as outlined in Chapter 1 of this EIAR (Refer to Section 1.8.1).

Following Stage 1, the Project screened in for mandatory EIA. An EIA Scoping Report was prepared on DART+ South West and issued to environmental stakeholders in November 2021, as outlined in Chapter 1 of this EIAR (Refer to Section 1.8.2). The EIA Scoping Report included the topic of Major Accidents and Disasters and the proposed scope and level of detail that should be considered. The assessment of hazard identification (source part of the source-pathway-receptor linkage) in relation to Major Accidents and Disasters was not considered at the time of writing of the EIA Scoping Report and is presented herein.

24.3.5.3. Stage 3 - Assessment Stage

Risk Identification

The assessment stage provides further understanding on the likelihood of a risk event occurring and identifies the requirement for further mitigation. The screened in hazard classes from Stage 2 are brought forward to Stage 3 for further detailed assessment. The following steps are carried out in accordance with the IEMA Primer (IEMA 2020) :

- Based on the baseline information and scale of development/Project, hazards are identified as high level 'Risk Events' and grouped together if they have the same potential consequence. This is usually presented as a Risk Register or Hazard Identification Record

(HIR). Risk Events with no valid receptors will require further assessment. Such hazards will be reported in the HIR but will be disregarded for any further reference.

- Each grouped Risk Event with a valid receptor is further assessed by identifying the *'reasonable worst-case environmental impact'* that will conceivably occur. This is a qualitative exercise using professional judgement. Uncertainty at this stage is to be acknowledged. Any Risk Event that does not have a source-receptor linkage or if the receptor does not fall within the scope, then the Risk Event is screened out of further detailed assessment. Furthermore, if a risk has high likelihood and consequence or if the consequence cannot be considered as a significant environmental impact, then the Risk Event is screened out.
- The above evaluation should be carried out with consideration of primary (mitigation by design) and tertiary (good practice) mitigation measures already proposed where these are not sufficient to adequately manage the associated risk levels to be as low as reasonably practicable (ALARP).

Following the completion of the above steps, if hazard groups remain which may potentially give rise to significant effects as a result of either the proposed Project itself or interaction with the proposed Project, secondary (additional mitigation to reduce effects) mitigation measures can be examined and incorporated into the design of the proposed Project which would help mitigate the associated risk to as low as reasonably practicable (ALARP).

Risk Classification

The remaining hazard classes with associated risks are evaluated using criteria outlined in Table 24.2 and Table 24.3, which is based on the criteria applied by the Department of Defence in 'A National Risk Assessment for Ireland 2020'. Table 24.2 presents the classification of the likelihood of events to occur and the assigned rating (adapted from DoD, 2020).

Table 24.2: Classification of Likelihood (adapted from DoD, 2020)

Rating	Classification	Description
1	Extremely Unlikely	The likelihood of occurrence is 100 or more years between events.
2	Very Unlikely	The likelihood of of occurrence is 51-100 years between events.
3	Unlikely	The likelihood of occurrence is 11-50 years between events.
4	Likely	The likelihood of occurrence is 1-10 years between events.
5	Very Likely	Ongoing / less than one year between occurrences.

Table 24.3 outlines the classification of potential impacts resulting from MADs based on 'A National Risk Assessment for Ireland 2020' by the Department of Defence and the EPA Guidelines (EPA 2022).

Table 24.3: Classification of Potential Impact (adapted from DoD, 2020 and EPA, 2022)

Rating	Classification of Potential Impact (Department of Defence, 2020)	Significance of Effects (EPA, 2022)	Description
1	Very Low Impact	Slight	<ul style="list-style-type: none"> Human Health: minor injuries only, or chance of deaths/ critical injury less than 1 in 250,000 people, or serious injuries less than 1 in 100,000 or minor injuries only; Environment: simple, localised impact; Economic: up to 1% of Annual Budget; and Socio-economic: Limited disruption to community.
2	Low Impact	Moderate	<ul style="list-style-type: none"> Human Health: chance of deaths/ critical injury greater than 1 in 250,000 people, or serious injuries greater than 1 in 100,000; Environment: simple, regional impact, short-term impacts; Economic: greater than 1% of Annual Budget; and Socio-economic: affected community is functioning with considerable inconvenience.
3	Moderate Impact	Significant	<ul style="list-style-type: none"> Human Health: chance of deaths/ critical injury greater than 1 in 100,000 people, or serious injuries greater than 1 in 40,000; Environment: heavy contamination, localised effects of extended duration; Economic: greater than 2% of Annual Budget; and Socio-economic: affected community is functioning poorly.
4	High Impact	Very Significant	<ul style="list-style-type: none"> Human Health: chance of deaths/ critical injury greater than 1 in 40,000 people, or serious injuries greater than 1 in 20,000; Environment: heavy contamination, widespread and/or long- term impacts; Economic: greater than 4% of Annual Budget; and Socio-economic: affected community is partially functioning.
5	Very High Impact	Profound	<ul style="list-style-type: none"> Human Health: chance of deaths/ critical injury greater than 1 in 20,000 people; Environment: very heavy contamination, widespread and/or long-term impacts; Economic: greater than 8% of Annual Budget; and Socio-economic: affected community cannot function without significant support.

Risk Evaluation

The evaluation of risks is carried out by means of a risk matrix. A risk matrix is created to assign a “Level of Significance” rating to each Risk/ Event based on the likelihood and the consequence of the impacts. The matrix is colour coded to provide an indication of the critical nature of the risks under assessment. The matrix has been developed following the guidelines from the Department of Defence (DoD, 2020) and amended by the provisions established in the IEMA Primer (IEMA 2020) and EPA Guidelines (EPA, 2022).

The assessed risks have been grouped into three categories outlined below, and as shown in Table 24.4:

- Red Zone: High Risk Scenarios that have an evaluation score of 15 to 25;
- Orange Zone: Medium Risk Scenarios that have an evaluation score of 8 to 12; and
- Green Zone: Low Risk Scenarios that have an evaluation score 1 to 6.

Table 24.4: Evaluation of the Level of Significance

Likelihood	5 – V. Likely	5	10	15	20	25
	4 – Likely	4	8	12	16	20
	3 – Unlikely	3	6	9	12	16
	2 – V. Unlikely	2	4	6	8	10
	1 – Ext. Unlikely	1	2	3	4	5
		1 – Slight	2 – Moderate	3 – Significant	4 – Very Significant	5 – Profound
Impact Consequence						

The major accidents and disasters are categorised based on the above three categories and the level of significance rating are presented in Table 24.7 and Table 24.8. The IEMA Primer (IEMA 2020) recommends that the aim of the major accident and disaster assessment is to identify and assess the *hazard types which are of low likelihood but potentially high consequence* events. These are generally represented by the Orange Zone.

The Red Zone consists of hazard types / events which are high likelihood and high consequence events. Events that have a high likelihood and a high consequence rating are considered to be unacceptable. A development/Project is unlikely to receive planning consent to operate with such high levels of significance and these risk events would be managed by the design process.

Hazard types within the Green Zone are considered to have achieved ALARP and therefore are not assessed further.

24.3.6. Study Area

The potential effect of the proposed Project to cause accidents and/or disasters and the vulnerability of the project to potential disasters/accidents, both natural disasters and man-made disasters represents the principal consideration for this assessment.

The spatial scope of the study area will be sufficiently large to enable identifying risk of major accidents and disasters and as such it includes the extent of the proposed Project, as well as any haul routes to and from the proposed Project during the construction phase. Consideration has also been given to sites that have potential for major accident hazard under the Chemical Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015).

There are three Seveso sites in proximity to the existing railway line, one upper tier site and two lower tier sites are identified within County Dublin:

- BOC Gases Ireland Ltd. PO Box 201, Bluebell Industrial Estate, Dublin 12 (Upper Tier);
- Iarnród Éireann. Iarnród Éireann Maintenance Works, Inchicore, Dublin 8 (Lower Tier); and
- Kayfoam Woolfson. Bluebell Industrial Estate, Naas Road, Dublin 12 (Lower Tier).

Regarding Seveso sites there is a need to account for consultation distances and consultation with the Health and Safety Authority (HSA) as a result.

There are several EPA licensed facilities in proximity to the existing railway line as well which are as follows:

- Industrial Emissions facility: Henkel Ireland Operations and Research Limited (Ballyfermot) [EPA Licence: P0078-01];
- Industrial Emissions/ Waste Facility: Thorntons Recycling Centre (Ballyfermot) [EPA Licence: W0044-02];
- Industrial Emissions/ Waste Facility: Greyhound Recycling & Recovery [EPA Licence: W0205-01]; and
- Industrial Emissions facility: Metal Processors Limited [P0401-01].

24.3.7. Survey Methodology

24.3.7.1. Desk Surveys

This assessment was completed by detailed desktop analysis. In addition, data from the desktop studies and field surveys undertaken as part of the inter-related technical disciplines have informed this assessment.

24.3.7.2. Field Surveys

No additional field surveys have informed this assessment.

24.3.7.3. Models / Tools Used in Assessment

No modelling software/tools were used in the major accidents and disaster assessment included in this EIAR.

24.3.8. Consultation

The overall project stakeholder and public consultation undertaken in respect of the Project is set out in the Public Consultation No. 1 Findings Report (for PC1) and Public Consultation No. 2 Findings Report (for PC2) which are included in Volume 4, Appendix 1.3 and 1.4. All feedback was collated,

including feedback specific to the EIAR topic ‘Major Accidents and Disasters’. This feedback has informed this chapter including the baseline and impact assessment presented.

Specific consultation was also undertaken with key stakeholders in relation to EIA Scoping. A summary of the issues raised in relation to the scope of the EIA is included in Volume 4, Appendix 1.2. Feedback on the scope and level of detail of the assessment, data sources and methodologies as they pertain to the EIAR topic ‘Major Accidents and Disasters’ have been reviewed and have influenced this chapter of the EIAR.

Specific consultation was also undertaken with representatives of various Departments in Kildare, South Dublin and Dublin City Councils. This included a combination of presentations, workshops and meetings to discuss the project, technical design issues and environment and planning matters.

Nine pre-application meetings were held with ABP to explain the project and present technical and environmental information. A summary of the information presented and the environmental issues discussed at the nine meetings is provided in Volume 4, Appendix 1.6. Feedback relevant to the topic ‘Major Accidents and Disasters’ has been reviewed and has influenced this chapter of the EIAR.

24.3.9. Difficulties Encountered / Limitations

This Chapter of the EIAR has been prepared based upon the best available information and in accordance with current best practice and relevant guidelines. There were no technical difficulties or otherwise encountered in the preparation of this chapter of the EIAR.

24.4. Description of Potential Impacts

24.4.1. Stage 1 - Screening

The proposed Project based has been screened in for impact assessment in relation to major accidents and disasters on the basis of consideration of the elements of the proposed Project (its nature, scale and construction duration) and the receiving environment. The screening has determined that it is conceivable (although highly unlikely) that:

- The proposed Project/development could result in a major accident and/or disaster;
- The proposed Project/development could interact with external sources of hazards (non-project related) that could plausibly make it vulnerable to a major accident and/or disaster; and
- Should an external (non-project related) major accident or disaster occur, the proposed Project/development could plausibly exacerbate the associated risk of significant impacts.

24.4.2. Stage 2 - Scoping

Major accident and disaster events related to the proposed Project generally fall under three categories:

- Events that could not realistically occur, due to the type of development or its location;
- Events that could realistically occur, but for which the proposed development, and associated receptors, are no more vulnerable than any other development; and

- Events that could occur, and to which the proposed development is particularly vulnerable, or which the proposed development has a particular capacity to exacerbate.

The scoping stage has identified the risk events and those that need to be brought forward to Stage 3 for further detailed assessment. The broad categories of the National Risk Assessment for Ireland (2020) were reviewed, and events that could not realistically occur due to the type of scheme, or its location, were discounted to bring forward to Stage 3. The Stage 2 scoping exercise undertaken for the long list of events is presented in Table 24.5 (construction phase) and Table 24.6 (operational phase).

Table 24.5: Scoping Assessment of Potential Sources of Major Accidents and Disasters During the Construction Phase (Adapted from IEMA Primer, 2020)

Hazard Type	Relevant for Long list?	Why? (Note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Transport Accidents				
Major Road Traffic Accidents	Yes	<p>There is a risk of a road traffic accident occurring during construction stage along haulage routes due to increased levels of Heavy Goods Vehicles (HGVs) on motorways, national & urban roads.</p> <p>There is considered to be limited risk from the proposed Project to cause a major road traffic accident along haulage routes due to increased levels of construction traffic HGVs on motorways, national and urban roads, congestion, and traffic management during the construction stage. The risk of major traffic accidents occurring during the construction phase of the proposed Project would be no different to other national routes.</p> <p>There is considered to be limited risk to the proposed Project from other road users / the public causing a major road traffic accident along haulage routes due to increased levels of construction traffic HGVs on motorways, national and urban roads, congestion, and traffic management during the construction stage. The risk of major traffic accidents occurring during the construction phase of the proposed Project would be no different to other national routes.</p>	<ul style="list-style-type: none"> Human Health Population 	Yes
Train derailment	Yes	The proposed Project involves works on and adjacent to a live rail corridor. There is potential for rail accidents / derailment to occur during the construction of the proposed Project from objects accidentally falling onto the train / rail track during construction.	<ul style="list-style-type: none"> Human Health Population Material Assets Non-Agricultural 	Yes
Accidents when working with electrical equipment and / or in vicinity of rail line	Yes	The electrification of the railway line involves the construction of OHLE equipment and provision of traction power substations along the c.20km section of the rail line. There is a risk of electrical accidents during construction phase when handling electrical equipment.	<ul style="list-style-type: none"> Human Health 	Yes

Hazard Type	Relevant for Long list?	Why? (Note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Infrastructure				
Impact on Critical Infrastructure	Yes	Construction activities of proposed Project may impact on existing overground and underground utilities.	<ul style="list-style-type: none"> Population Human Health Hydrology Hydrogeology Material Assets Utilities Material Assets -Agricultural 	Yes
Collapse / Damage to structures	Yes	There are buildings and bridge structures in vicinity of the proposed construction works. Works to existing structures will also be required. There is a risk of existing buildings / structures to be damaged during the adjacent works or when works are to be carried out on structures, particularly on protected structures.	<ul style="list-style-type: none"> Human Health Material Assets Non-Agricultural Architectural Heritage 	Yes
Collapse / Tunnel Failure	Yes	The proposed Project involves the electrification of the Phoenix Park Tunnel. The works required to the tunnel involve the replacement of ballast with slab track and drainage improvements, implementation of the ETCS1 train protection system and signalling and telecommunications infrastructure accommodation works to support the projected capacity increase for the route. There is risk of the tunnel to be damaged when the works are being carried out.	<ul style="list-style-type: none"> Human Health Material Assets Non-Agricultural Architectural Heritage 	Yes
Closure of railway line due construction accidents	Yes	There is potential for unplanned closures of railway services in an event of an accident when working on or in close proximity to an active railway line. The railway line will remain closed until the railway line is clear which may affect commuter and freight services. This does not constitute a major accident or a disaster.	<ul style="list-style-type: none"> Population 	No
Construction accidents				
Ground Collapse	Yes	The proposed Project consists of works mainly within the existing railway line or within an urban environment. Extensive earthworks will be required during the construction phase.	<ul style="list-style-type: none"> Human Health Land & Soils Material Assets Non-Agricultural 	Yes

Hazard Type	Relevant for Long list?	Why? (Note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Release of asbestos	Yes	<p>The proposed Project will require the demolition of buildings which may have asbestos containing materials (ACM) present, presenting a risk of release of asbestos, if present, during construction phase.</p> <p>There is considered to be a risk from the proposed Project to cause release of asbestos during the construction phase.</p> <p>There is considered to be no risk to the proposed Project from other sources or activity causing release of asbestos during the construction phase.</p>	<ul style="list-style-type: none"> Human Health Air Quality 	Yes
Fire / explosion	Yes	<p>The proposed Project will require the use of flammable substances such as fuel storage areas at construction compounds and working with electricity.</p> <p>There is considered to be limited risk from the proposed Project to cause major accident by fire/explosion caused by fuel/flammable liquids present or in use on site during the construction phase.</p> <p>There is considered to be limited risk to the proposed Project from other sources or activities in the vicinity to cause major accident by fire or explosion during the construction phase (risk of explosion or fire from Seveso Sites considered separately).</p>	<ul style="list-style-type: none"> Human Health Population Material Assets Non-Agricultural 	Yes
Works near surface and groundwater bodies	Yes	<p>The existing railway line crosses a number of streams and river waterbodies. Works near water pose a potential health and safety risk to construction workers and the general public.</p>	<ul style="list-style-type: none"> Human Health Population Hydrology Biodiversity 	Yes
Industrial accidents				
Industrial Accidents (works near Seveso site)	Yes	<p>The proposed Project is in vicinity of three Seveso sites in proximity to the existing railway line (Refer to Section 24.3.7). Works will be confined to the existing railway corridor and are not likely to cause damage to the Seveso site in an event of an accident. However, an explosion / fire from the Seveso site can present a risk to the development and construction workers.</p> <p>There is considered to be low risk to the Proposed Project from accidents/disasters caused by nearby COMAH Establishments (Seveso Sites) due to the safety, health and management systems and procedures in place as required under the COMAH Regulations. In the event of an accident, the</p>	<ul style="list-style-type: none"> Human Health Population 	Yes

Hazard Type	Relevant for Long list?	Why? (Note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
		Seveso site will have an emergency response plan registered with the HAS.		
Hydrological Disasters				
Extreme Weather (Flooding) Events	Yes	<p>Extreme flood events (heavy rainfall events, storms, prolonged flooding of the Hazelhatch and Shinkeen Streams, Coneyburrow Steam, Lucan Stream, River Griffeen, River Camac, River Liffey and the Royal Canal) have the potential to flood. This has the potential to impact on the construction sites which store construction material and equipment which are potential sources of contaminants.</p> <p>The project can exacerbate the risk of flooding during construction by temporarily increasing hard standing in areas that are currently greenfield. The construction works could increase the number of people working near known sources of flooding, thus increasing the potential for flood risk related impacts on human health.</p>	<ul style="list-style-type: none"> • Biodiversity, • Material assets agricultural • Material Assets Non-Agricultural • Population • Human Health • Hydrology • Hydrogeology 	Yes
Groundwater Contamination	Yes	<p>The proposed Project will require ground disturbance activities and will require the excavation of a substantial amount of earthworks required during construction.</p> <p>There is considered to be a potential risk from the proposed Project to cause accidental spillage of hazardous materials (e.g. construction plant fuels, oils etc.) which has the potential to accidentally contaminate groundwater abstraction points such as public water supply wells, and aquifers traversed by the extents of the proposed Project during the construction phase.</p> <p>There is considered to be limited risk to the proposed Project from other sources or activity causing accident/impact in terms of groundwater contamination during the construction phase.</p>	<ul style="list-style-type: none"> • Human Health • Population • Hydrology • Hydrogeology • Biodiversity 	Yes
Spillage or long-term seepage of pollutants into a watercourse	Yes	The existing railway line crosses a number of streams and river waterbodies. There is potential for accidental release of sediment-laden run-off or pollutants from machinery and plant to the watercourses during the construction phase	<ul style="list-style-type: none"> • Population • Human Health • Hydrology • Hydrogeology • Biodiversity 	Yes

Hazard Type	Relevant for Long list?	Why? (Note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Disease				
Animal and Plant disease	Yes	Invasive species have been identified within the railway corridor. The likelihood of spread and the potential impact on native species varies. Depending on the likelihood of spread of these invasive species and the potential impact to native species, there is a risk of spread of invasive species during construction. This does not constitute a major accident or a disaster.	<ul style="list-style-type: none"> • Biodiversity • Human Health • Material Assets Agricultural • Material Assets Non-Agricultural 	Yes
Human disease	Yes	There is a risk of spread of human disease such as Covid-19 amongst construction workers.	<ul style="list-style-type: none"> • Human Health • Population 	Yes

Table 24.6: Scoping Assessment of Potential Sources of Major Accidents and Disasters During the Operation Phase (Adapted from IEMA Primer, 2020)

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Transport				
Major Road Traffic Accidents	Yes	There is a risk of major traffic accidents to occur during the operation phase of the proposed Project due to the proposed bridge reconstructions. The Project will replace or enhance (where practicable) pedestrian and cycle facilities in the immediate vicinity of bridge reconstruction works.	<ul style="list-style-type: none"> Human Health Population Hydrology Biodiversity 	Yes
Rail accidents / Train derailment	Yes	The proposed Project involves works within an existing rail corridor. There is a risk of rail accidents to occur during the operational phase of the proposed Project.	<ul style="list-style-type: none"> Human Health Population Architectural Heritage Material Assets Non-Agricultural 	Yes
Electrical Accidents	Yes	The electrification of the railway line involves the construction of OHLE equipment and substations along the c.20km section of the railway line. The existing bridges were originally designed as non-electrified lines. The electrification of line requires special interventions to maintain the safe operation of the railway. The existing bridges must comply with necessary safety requirements by providing suitable protection for the general public to prevent accidental contact with the OHLE.	<ul style="list-style-type: none"> Human Health 	Yes
Aircraft Disasters	No	The proposed Project does not have the potential to cause such an event. The Project would not be affected negatively by a major disruption of air travel, nor is it likely to exacerbate such an event.	N/A	No
Maritime Disasters	Yes	The proposed Project is not considered to be particularly vulnerable to the effects of such an event, nor does it have the potential to exacerbate such an event.	N/A	No
Bridge Failure	Yes	The proposed Project consists of the replacement/upgrade of six existing bridges on the section between	<ul style="list-style-type: none"> Human Health 	Yes

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
		Park West and Cherry Orchard Station and Heuston Station (Zone B) and one existing bridge on the Phoenix Park Tunnel Branch Line (Zone D). Works are also required to parapets to achieve the necessary level of safety protection to prevent accidental contact with the OHLE. There is a risk of bridge failure during operational phase.	<ul style="list-style-type: none"> Population 	
Tunnel Failure / Fire	Yes	The proposed Project involves an increase in passenger train frequency from 2 trains per direction per hour to 7 trains per direction per hour through the Phoenix Park Tunnel Branch Line. The tunnel will continue to be used for freight services. There is a risk of fire within the tunnel from combustible/ flammable freight during the operational phase.	<ul style="list-style-type: none"> Human Health Population 	Yes
Dam Failure	No	There is no dam proposed as part of the proposed Project. There are no dams that would affect or be affected by the proposed Project.	N/A	No
Flood Defence Failure	No	There are no existing flood defences that would affect or be affected by the proposed Project.	N/A	No
Mast and Tower Collapse	No	There is no mast or tower proposed as part of the proposed Project. There are no masts or towers that would affect or be affected by the proposed Project.	N/A	No
Building Failure / Fire	Yes	The proposed Project involves the provision of a new Heuston West Station. A total of 6 traction electrical substations buildings will also be provided. There is a risk of building failure/ fire to occur at these locations during operation phase.	<ul style="list-style-type: none"> Human Health Population Material Assets Non-Agricultural 	Yes
Power Failure	Yes	The proposed Project involves the electrification of c.20km of railway line and thus its operation is vulnerable to loss of electrical power to the network's new electric train fleet resulting in disruption to the service.	<ul style="list-style-type: none"> Population Material Assets Non-Agricultural 	Yes

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Fire within trains	Yes	The proposed Project will electrify the northern track with new electric trains used on the railway corridor. The electrification of the northern track will result in a modal shift of the diesel powered rail services. The future DART service will operate on the electrified lines (northern tracks), while the Intercity and fast regional services (diesel powered fleet) will operate on the fast non-electrified lines. The introduction of new electrified fleet reduces the transport usage of flammable substances. As such, the proposed Project will not exacerbate the risk of fire within trains during the operational phase.	<ul style="list-style-type: none"> Human Health 	No
Safety Protection for general public and users of structures (risk of falling)	Yes	The proposed Project will electrify an existing railway corridor. It involves the replacement / upgrade of existing bridge structures over the railway line. The existing bridges along the route must comply with necessary safety requirements by providing suitable protection for the general public to prevent climbing or walking across parapets, reducing the risk of falling from structures.	<ul style="list-style-type: none"> Population Human Health 	Yes
Geological Disasters				
Mass Wasting ¹	Yes	The proposed Project does not have the potential to cause such an event. There are no significant volumes of soil / rock / debris on slopes in vicinity of the proposed Project.	N/A	No
Earthquakes	No	The proposed Project does not have the potential to cause an earthquake event. According to the Irish National Seismic Network, Ireland is the quietest place for seismic activity in Europe, with seismic activity of low magnitude –Other than structural damage to houses, no account could be found of any damage to built	N/A	No

¹ Landslides, rockfalls, debris flows, mudflows, avalanches etc.

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
		infrastructure in Ireland as a result of a seismic event. The proposed Project is not located in a geologically active area and as such, earthquakes are not considered to be a risk.		
Sinkholes	No	The proposed Project does not have the potential to cause such an event. The geology of the study area is not prone to sinkholes.	N/A	No
Volcanic Eruption	No	The proposed Project does not have the potential to cause a volcanic event. There is no volcanic activity in Ireland.	N/A	No
Hydrological Disasters				
Extreme weather (flood) events	Yes	There is a risk of the proposed Project to be vulnerable and to intensify flooding in the area due to increase in hardstanding on currently greenfield land.	<ul style="list-style-type: none"> • Human Health • Material assets Agriculture • Hydrology • Hydrogeology • Biodiversity 	Yes
Spillage or long-term seepage of pollutants into a watercourse.	Yes	<p>The proposed Project will electrify the northern track with new electric trains used on the railway corridor. The electrification of the northern track will result in a modal shift of the diesel powered rail services. Diesel powered fleet will still operate along the railway line, however the service enhancements to Intercity and fast regional services (diesel powered fleet) will not exacerbate the risk of such an event.</p> <p>New track drainage works between Park West & Cherry Orchard Station and Heuston Station including construction of 2 no. underground stormwater attenuation tanks), new drainage system works at proposed Heuston West Station (including construction of 1 no. underground attenuation tank), upgrades to the existing drainage</p>	<ul style="list-style-type: none"> • Human Health • Hydrology • Hydrogeology • Biodiversity 	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
		system along the Phoenix Park Tunnel Branch Line are proposed. The works will collect and attenuate runoff waters generated in the upgraded track infrastructure prior to discharge.		
Tsunami / Storm surge	No	The proposed Project does not have the potential to cause a tsunami / storm surge event. <i>'Historical records and geological evidence indicate that, while tsunamis are unlikely to occur around Ireland, the Irish coast is vulnerable to tsunamis from submarine landslides and distant earthquakes'</i> (Government of Ireland, 2021). Further, <i>'The risk of tsunami in Ireland is included as a Low Probability High Impact (LPHI) risk...'</i> (Government of Ireland, 2021).	N/A	No
Extreme Weather Events				
Extreme weather (Severe snowfall / blizzards / hailstorm) event	No	The proposed Project does not have the potential to cause such an event. There is considered to be no risk to the proposed Project from extreme weather events (snowfall, blizzard and hailstorm events or prolonged cold weather). The proposed Project has the potential to impact the operation of the proposed Project and its users, however the risk is no different from other transport infrastructure projects in Ireland. With regard to extreme weather events such as severe snowfall, blizzard and hailstorm events or prolonged cold weather events, the proposed Project will be designed to operate under a range of environmental conditions, in accordance with all relevant standards.	<ul style="list-style-type: none"> • Population • Human Health 	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Extreme weather (Gale force winds / storms / tornado / cyclone / hurricane / typhoon) event	Yes	The proposed Project does not have the potential to cause such an event. Flooding along the extents of the proposed Project which may occur in extreme wind events, is reviewed separately. Although there are gale force winds in Ireland, their destructive force tends to be much less than in other parts of the world. There is a risk of structural damage to various elements of the proposed development from extreme wind events, particularly to the OHLE equipment.	<ul style="list-style-type: none"> Population Human Health 	Yes
Droughts	No	The proposed Project is not especially vulnerable to negative impacts as a result of water supply shortages / restrictions, nor is it likely to exacerbate such an event.	N/A	No
Lightning Strikes	Yes	The proposed Project does not have the potential to cause such an event. The OHLE equipment along the extents of the proposed Project has the potential to be vulnerable to lightning strikes.	<ul style="list-style-type: none"> Human Health 	Yes
Heat waves	No	The design of the proposed Project will consider the effect of high temperatures. The design will be in accordance with the relevant codes and standards, including EN 1991-1-5 Eurocode 1 – Actions on structures - General actions – Thermal actions. However the proposed Project will be no more vulnerable than any other development or is it likely to exacerbate such an event.	N/A	No
Wildfires	No	The proposed Project does not have the potential to cause such an event. There is no vegetation in vicinity of the proposed Project development boundary which could support wildfire.	N/A	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Air Quality Events	Yes	The proposed Project consists of electrification of c.20km of railway line contributing to the reduction of rail infrastructure related air pollution. Where bridge reconstructions are necessary as part of the Project, associated roadworks will be necessary (including footpaths or cycle track reinstatement or enhancements). The Project will replace or enhance (where practicable) pedestrian and cycle facilities in the immediate vicinity of bridge reconstruction works. It is not considered necessary to undertake any more assessment than is already proposed for the air quality assessment in Chapter 12 of this EIAR.	<ul style="list-style-type: none"> • Population • Human Health • Biodiversity • Hydrology 	No
Extreme cold weather	Yes	The proposed Project does not have the potential to cause such an event. The design of the proposed Project is in accordance with the relevant codes and standards, including EN 1991-1-5 Eurocode 1 – Actions on structures: General actions - Thermal actions.	N/A	No
Space Disasters				
Impact events and airburst	No	The proposed Project is considered to be no more vulnerable to impact events and airburst than any other development.	N/A	No
Solar flare	No	The proposed Project is considered to be no more vulnerable to solar flare than any other development.	N/A	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Industrial accidents				
Accidents at Seveso Sites	Yes	The proposed Project is in vicinity of three Seveso sites in proximity to the existing railway line (Refer to Section 24.3.7). An explosion / fire from a Seveso site can present a risk to the operation of the proposed Project and its users. There is considered to be low risk to the Proposed Project from accidents/disasters caused by nearby COMAH Establishments (Seveso Sites) due to the safety, health and management systems and procedures in place as required under the COMAH Regulations. In the event of an accident, the Seveso site will have an emergency response plan registered with the HAS.	<ul style="list-style-type: none"> Population Human Health Material Assets Non-Agriculture 	Yes
Crime / Civil Unrest				
Crime or Civil Unrest	No	No more vulnerable than any other developments.	N/A	No
Cyber attacks	Yes	No more vulnerable than any other developments.	N/A	No
Terrorism	Yes	No more vulnerable than any other developments.	N/A	No
Security Incidents on Trains	Yes	Incidents of anti-social behaviour can occur on public transport, including the rail network. With the frequency of trains increasing as part of the proposed Project, there is an increased risk of security incidents. This does not constitute a major accident or a disaster.	N/A	Yes
Disease				
Human disease	Yes	Public transport services can present a risk of spread of disease between passengers and or members of staff due to the close proximity of people to each other, namely of Covid-19. The proposed Project will enhance the existing rail network and will not exacerbate the risk of human disease.	<ul style="list-style-type: none"> Population Human Health 	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Progress to Stage 3?
Animal and Plant disease	Yes	<p>There will be no risk of spread of invasive species during the operation phase of proposed Project.</p> <p>If a staff member identifies an invasive alien species along the railway line, measures outlined in existing Iarnród Éireann guidelines and procedures will be adhered to.</p>	<ul style="list-style-type: none"> • Human Health • Biodiversity • Material Assets Non-Agricultural • Material Assets Agricultural 	No

24.4.3. Stage 3 - Assessment

The screened in hazard classes from Stage 2 are brought forward to Stage 3 for further detailed assessment as shown in Table 24.7 (construction phase) and Table 24.8 (operation phase). The assessment is focused on risk events that have a low likelihood to occur but that have high consequence on environment, human health, infrastructure and/or cultural heritage.

The hazards are assessed based on their likelihood and impact and resulting level of significance, and scored and ranked as Low, Medium or High (based on the process outlined in Section 24.3.5). The outcome of this assessment will highlight if hazards have been managed to an acceptable level, to as low as reasonably practicable (ALARP). Where hazards do not provide sufficient mitigation by embedded mitigation (mitigation by design), these hazards are taken forward and assessed in more detail, with additional “secondary measures”.

Table 24.7: Assessment of Remaining Risks Associated with Proposed Project in the Construction Phase

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
Transport Accidents								
C1	Major Road Traffic Accidents	<ul style="list-style-type: none"> Increased number of Heavy Goods Vehicles (HGVs) along haulage routes and construction site access points. Works on or near existing road network. Traffic diversions effected routes (where required). Materials such as structures, unsecure large objects and debris falling from HGVs onto the roads. 	<p>Major road traffic accident which can result in:</p> <ul style="list-style-type: none"> Death / injury to workforce and/or the public. Delays and congestion along the road network. Multiple vehicle collisions (from unexpected fallen construction objects from HGVs or general increase of HGVs along the network). Property damage. 	<ul style="list-style-type: none"> HGVs will transport materials and waste along designated haulage routes suitable for such vehicles as outlined in Chapter 5 Construction Strategy of this EIAR. Speed restrictions for construction vehicles will be required along the haul routes. Materials delivery times will be scheduled to be predominantly outside peak traffic hours, particularly for construction HGV's known to restrict natural flow of traffic. 	4 – Likely	3 – Significant	12 – Medium	Yes – to achieve ALARP
C2	Train accident / derailment	<ul style="list-style-type: none"> Working on and/ or adjacent to an existing live railway line 	<p>Train accident / derailment which can result in:</p> <ul style="list-style-type: none"> Death / injury to a member of the 	<ul style="list-style-type: none"> There are strict safety restrictions related to working on or adjacent to a live railway line. The works will be 	2 – V. Unlikely	3 – Significant	6 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
		<p>causes a train derailment / accident.</p> <ul style="list-style-type: none"> Falling objects onto the train / rail track from construction works. 	<p>public.</p> <ul style="list-style-type: none"> Delays and congestion along the rail network. Property damage. 	<p>carried out through a combination of restricted working zones (including sites completely segregated from live railway) and night-time/ weekend possessions as identified in Chapter 5 Construction Strategy.</p>				
C3	Accidents when working with electrical equipment and / or in vicinity of rail line	<ul style="list-style-type: none"> Working at or near live railway line (diesel powered or electrical). Installation of OHLE equipment. Installation of electrical equipment for buildings. 	<ul style="list-style-type: none"> Accidents leading to injury and in severe cases, death when handling electrical equipment. 	<ul style="list-style-type: none"> Installation of OHLE equipment will be carried out by appropriately trained contractors. Implementation of measures set out in IÉ standards and guidelines for working on or in vicinity of railway line which include, but not limited to, the following: <ul style="list-style-type: none"> IÉ I-DEP-0120 Guidance on Third Party Works. IÉ I-DEP-0121 Third Party Works: Additional Details of Railway Safety Requirements. IÉ Rule Book Section Z 	3 – Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
				<p>Electrified Lines.</p> <ul style="list-style-type: none"> Implementation of measures set out in codes and standards for installation of electrical equipment: <ul style="list-style-type: none"> EN 61140 Protection against electric shock - Common aspects for installation and equipment. I.S. 10101:2020 National Rules for Electrical Installations. EN 60364 Electrical installations for buildings. BS 7671 Requirements for electrical installations. IET Wiring Regulations. 				
Critical Infrastructure								
C4	Impact on Critical Infrastructure	<ul style="list-style-type: none"> Impact on overground and underground utilities. 	<ul style="list-style-type: none"> Damage to electrical utilities (overground and underground) resulting in power outage, risk of 	<ul style="list-style-type: none"> All utility services near the proposed Project have been identified and locations where the proposed alignment crosses existing infrastructure 	3 – Unlikely	2 – Moderate	6 - Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
			<p>electrification which can lead to serious injury or death.</p> <ul style="list-style-type: none"> • Damage to gas mains which can result in supply outage, risk of explosion or gas inhalation which can lead to serious injury or death. • Damage to water piping can lead to supply outage, flooding of construction sites and property damage to nearby buildings. • Damage to foul piping can lead to contamination of construction site, risk of water and soil pollution and other associated environmental impacts. 	<p>have been identified.</p> <ul style="list-style-type: none"> • Consultations have been undertaken with all known service providers and their requirements have been identified and incorporated into the design. • Where there is interaction between the proposed Project and existing infrastructure, the locations of the interactions have been identified and planned for, and therefore the potential for any service disruption is limited. • Any utilities to be diverted will comply with relevant service provider guidelines including but not limited to the below: <ul style="list-style-type: none"> ○ Irish Water Code of Practice for Water Infrastructure. ○ Irish Water Code of Practice for Wastewater. 				

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
				<p>Infrastructure .</p> <ul style="list-style-type: none"> Gas Network Ireland Code of Practice . ESB Code of Practice. 				
C5	Collapse / Damage to structures	<ul style="list-style-type: none"> Works to existing structures such as the railway bridges will be required. Vibratory works in vicinity of sensitive structures, such as buildings of architectural significance. Demolitions of existing buildings, structures and bridges is an activity with structural collapse risk. 	<ul style="list-style-type: none"> Risk of proposed building or structure, infrastructure collapsing, resulting in injury or death to workers and the general public. Collapse/ Damage to protected structures. Damage to adjacent occupied buildings resulting in injury or death to the general public. 	<p>Compliance with design standards that include, but are not limited to, the following:</p> <ul style="list-style-type: none"> EN 1990 Eurocode - Basis of structural design. EN 1993 Eurocode 3. Design of steel structures. EN 1993-1 Design of steel structures. General rules and rules for buildings. Degree of impact protection. <p>Compliance with material standards to include, but are not limited to, the following:</p> <ul style="list-style-type: none"> I.S. EN 1992-1-1:2005 (Eurocode 2, Part 1-1) – Design of concrete structures – General rules and rules for buildings. 	2 – V. Unlikely	4 – V. Significant	8 – Medium	Yes - to achieve ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
				<ul style="list-style-type: none"> I.S. EN 1993-1-1:2005 (Eurocode 3, Part 1-1) – Design of steel structures General Rules and rules for buildings. I.S. EN 1996-1-1:2005 (Eurocode 6, Part 1-1) – Design of masonry structures. General Rules for reinforced and unreinforced masonry structures. 				

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
C6	Collapse / Tunnel Failure	<ul style="list-style-type: none"> Works to the Phoenix Park Tunnel will be required. Potential issues with structural stability as a result of the proposed works. 	<ul style="list-style-type: none"> Collapse/ Damage to the tunnel structure resulting in injury or death to workers. 	<ul style="list-style-type: none"> The proposed construction sequence to lower the track bed involves removal of invert section of the tunnel lining. To ensure stability, this work will be carried out by installing temporary supports along points near the sidewall footing. A preliminary assessment has been carried out to check the capacity of the masonry lined tunnel in its temporary state when the invert is removed for lowering the track bed (the first 35m of the Phoenix Park tunnel from the Southern Portal Connyngham Road). To assess the stability of the tunnel lining during works and to determine the number of support points required, a Finite Element Model was developed wherein 	3 – Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
				<p>these construction stages were simulated. Results obtained from FE model were used to carry out capacity checks on the lining.</p> <p>The following standards and guidance were used in assessing the masonry lining's capacity:</p> <ul style="list-style-type: none"> • Design Guide to Eurocode 6 - Vertical Resistance. • Design Guide to Eurocode 6 - Lateral Resistance. • Design Guide to Eurocode 6 - Introduction to Eurocode 6. • BS EN 1996-1-1: 2005 Eurocode 6 - Design of Masonry Structures and NA. <p>This preliminary analysis of the tunnel in the temporary condition during construction indicated no significant heave in exposed ground under the invert.</p>				

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
Construction Accidents								
C7	Ground Collapse	<ul style="list-style-type: none"> Deep excavations for construction may lead to fluctuations to the groundwater water table resulting in settlement collapse of soil in the construction site. 	<ul style="list-style-type: none"> Collapse of the proposed structure during construction resulting in property damage and injury or death to workers. 	<ul style="list-style-type: none"> Geophysical surveys will be carried out at detailed design stage and prior to construction works. Construction methods carried out in accordance with appropriate regulations. Slopes cutting back the excavation/ trench at an angle inclined away from the excavation or shoring protections, excavations, and trenches daily inspection, keep excavation material and equipment away from trench edges. 	3 – Unlikely	4 – V. Significant	12 – Medium	Yes - to achieve ALARP.
C8	Release of asbestos	<ul style="list-style-type: none"> Demolition of buildings and/or structures which may be contaminated with asbestos. 	<ul style="list-style-type: none"> Exposure of workers to asbestos containing materials. In extreme cases, an uncontrolled release of asbestos 	<ul style="list-style-type: none"> Prior to any works, demolition surveys will be carried out for the purposes of identifying asbestos containing materials (ACM) prior to planned demolition. In buildings where traces of asbestos have been found, a 	3 –Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
			containing materials and the subsequent exposure of the material to the general public.	remedial strategy will be developed prior to any construction and demolition works.				
C9	Fire / explosion	<ul style="list-style-type: none"> The proposed Project will require the use of flammable substances such as fuel stored at construction compounds. Presence of gas pipelines within the works (as discussed under C7). Electrical accidents (as discussed under C6). Construction works requiring hot work e.g., cutting, welding, soldering. 	<ul style="list-style-type: none"> Death or injury to workers when handling flammable materials, carrying out hot work. Fire/ explosion at construction site leading to damage or collapse to proposed structures and/ or nearby property affecting members of the public. Theft of explosive/ flammable material. 	<ul style="list-style-type: none"> All construction compounds and construction sites will have appropriate fencing. In addition, to security fencing, gated access to the sites and compounds to check vehicles and personnel arriving on site will be required as outlined in Chapter 5 Construction Strategy. 	2 – V. Unlikely	5 – Profound	10 - Medium	Yes - to achieve ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
C10	Works near surface and groundwater bodies	<ul style="list-style-type: none"> Unknown groundwater level or regime. An uncontrolled release of silty sediment during construction. Excavations and below ground utilities during construction could be vulnerable to groundwater inundation and flooding. 	<ul style="list-style-type: none"> Death or injury to workers and/ or the general public. Release of large quantities of water within construction site. 	<ul style="list-style-type: none"> Site water management is required at all earthworks sites to prevent waterlogging of freshly excavated soil, to prevent silty runoff from entering watercourses and drainage systems, and to alleviate rutting of haul routes. 	3 – Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP
Industrial Accidents								
C11	Industrial Accidents (works near Seveso site)	<ul style="list-style-type: none"> Risk of occurrence of fire / explosion or pollution event in a nearby Seveso site. 	<ul style="list-style-type: none"> Injury or death of construction workers. Infrastructural damage to the Seveso site and the proposed development. Environmental contamination. 	<ul style="list-style-type: none"> There is no mitigation by design measures that can reduce the risk of an accident at a Seveso site. 	2 – V. Unlikely	4 – V. Significant	8 – Medium	Yes - to achieve ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
Hydrological Disasters								
C12	Extreme Weather (Flooding) Events	<ul style="list-style-type: none"> Weather events leading to flooding such as heavy/prolonged rainfall/ tidal event. Prolonged heavy rain / flooding directly over construction sites. Prolonged heavy rain resulting in breach of embankments in nearby waterbodies. Extreme/prolonged rainfall events causing sediment runoff during construction. Extreme/prolonged rainfall events over open or deep 	<p>Extreme flood events can lead to:</p> <ul style="list-style-type: none"> Hazardous working conditions for workers. Flooding on construction sites, specifically within high flood risk areas. Breach of embankments on nearby waterbodies, particularly Hazelhatch and Shinkeen Streams, Coneyburrow Stream, Lucan Stream, River Griffeen, River Camac, River Liffey and the Royal Canal. Damage of construction materials, collapse of temporary and 	<ul style="list-style-type: none"> A Flood Risk Assessment (Stage 3) has been completed for the Project. Refer to the Flood Risk Assessment Report. Continuous weather monitoring will be undertaken in areas where works are in areas at risk of flooding to identify specific weather windows to work in if required, where feasible, and also to predict when river flood events might occur. An emergency response plan may be drawn up including appropriate response measures for such Extreme Weather (Flooding) situations. 	4 - Likely	3 – Significant	12 – Medium	Yes- to achieve ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
		excavations.	permanent structures. • Sediment runoff/ release of contaminants into watercourses from construction sites, specifically those within high flood risk areas.					
C13	Groundwater Contamination	<ul style="list-style-type: none"> Ground disturbance activities which have the potential to accidentally damage/ contaminate unknown water abstraction points such as boreholes, wells and aquifers. Contamination of surface water. 	<ul style="list-style-type: none"> Contamination of public drinking water supply. 	<ul style="list-style-type: none"> Groundwater levels have been determined from recent ground investigation works carried out along the extents of the proposed Project. Further ground investigation surveys will be undertaken during detailed design stage prior to construction. 	2 – V. Unlikely	3 - Significant	6 - Low	No – mitigation by design is sufficient

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
C14	Spillage or long-term seepage of pollutants into a watercourse	<ul style="list-style-type: none"> Works near and over watercourses. Accidental pollution/ long-term seepage of pollutants from construction materials into watercourses during construction. 	<ul style="list-style-type: none"> Impacting the water quality status of watercourses from accidental pollution event/ sediment runoff from construction sites into the waterbody. Pollution event on downstream European sites. Pollution to surface water which connects with groundwater, potentially affecting drinking water supply. 	<ul style="list-style-type: none"> There are no mitigation by design measures that can completely prevent the risk of accidental spillage or long-term seepage of pollutants into a watercourse during construction. However, it is not considered likely that significant volumes to cause significant effects would be on construction sites close to water bodies. Surface water control measures will be implemented to ensure that silt laden or contaminated surface water run-off from construction compounds does not discharge directly to surface waters. 	3 – Unlikely	3 – Significant	9 – Medium	Yes – to reach ALARP
Disease								
C15	Animal and Plant Disease	<ul style="list-style-type: none"> Presence of invasive species at construction compounds. 	<ul style="list-style-type: none"> Spread of invasive species during construction works. 	<ul style="list-style-type: none"> Invasive species have been identified within and adjacent to the rail corridor – refer to Chapter 8 of this EIAR. Prior to commencing 	3 – Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
				<p>construction, a further invasive species survey will be undertaken within the lands made available and all stands will be tapped off to prevent accidental spread.</p> <ul style="list-style-type: none"> A treatment plan which will include in-situ chemical treatment and / or excavation and disposal at a suitably licensed facility will be undertaken. Good machinery hygiene will be practiced to ensure invasive species are not spread between sites or along the corridor. 				
C16	Human Disease	<ul style="list-style-type: none"> Construction workers working on construction sites for the project. 	<ul style="list-style-type: none"> Spread of disease (Covid - 19) amongst workers on site and in worst case, to members of the community. Weils disease may be 	There are no mitigation measures by design to alleviate / eliminate the risk of human disease.	3- Unlikely	3 – Significant	9 – Medium	Yes - to achieve ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
			<p>contracted at any location.</p> <ul style="list-style-type: none"> Shortage of workers on construction sites due to illness can impact the construction programme. 					

Table 24.8: Assessment of Remaining Risks Associated with Proposed Development in the Operational Phase

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
					Likelihood	Potential Impact		
Transport								
O1	Major Road Traffic Accidents	<ul style="list-style-type: none"> Proposed modifications to road network bridge reconstructions. 	<ul style="list-style-type: none"> Severe congestion and delays caused by changes to the road network. Major traffic accidents resulting in injury or death. Spillage of contaminants such as fuels in an event of a traffic accident. 	<ul style="list-style-type: none"> The Project will replace or enhance (where practicable) pedestrian and cycle facilities in the immediate vicinity of bridge reconstruction works. The transport routes have been designed in accordance with a range of codes and standards applicable to road design published by TII and the NTA. These include the Design Manual for Urban Roads and Streets (DMURS) along with standards relating to cycleways and technical standards relating to roads, lighting, drainage and safety. 	2 – Likely	2 – Moderate	4 - Low	No – mitigation by design achieves ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
O2	Rail accidents / Train derailment	<ul style="list-style-type: none"> Power outage affecting the electrical rail fleet. Electromagnetic interference. Failure of electrical infrastructure (e.g., failure of signalling, track crossovers, communication). Collapse of new structures onto the rail track. Obstruction along the railway line. Vehicles striking rail structures such as bridges. 	<p>Major rail derailment accident may lead to:</p> <ul style="list-style-type: none"> Injury or death of staff and rail passengers. Damage to nearby properties and / or injury to the general public. Impact to existing and proposed road network causing a major traffic accident. Disruption to rail transportation network. Spillage of contaminants such as fuels in an event of derailment causing a traffic accident. 	<ul style="list-style-type: none"> New rail tracks have been designed to the Iarnród Éireann and European standards providing for derailment protection and containment where required. For the proposed bridge reconstructions, a 0.5m approx. derailment protection wall shall be constructed to the rail side of the abutment walls to protect the abutment from impact loading associated with derailment (refer to Chapter 4 Project Description). The proposed Project will be designed to withstand extreme weather events such as wind, rainfall, flooding, temperature etc.) 	2 – V. Unlikely	5 - Profound	10 – Medium	Yes - to achieve ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				including climate change allowances. <ul style="list-style-type: none"> All equipment that has Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI) to be used will be in accordance with EU standards. 				
O3	Electrical Accidents	<ul style="list-style-type: none"> Members of public coming into contact with OHLE equipment. Members of staff working with electrical equipment. 	<ul style="list-style-type: none"> General public coming into contact with OHLE equipment resulting in injury. 	<ul style="list-style-type: none"> Electrical safety of the OHLE and protection against electric shock will be achieved by complying with: <ul style="list-style-type: none"> EN 50122-1 as set out in ENE-TSI chapter 4.2.18 'Protective provisions against electric shock'. I-ETR-4004 'Electrification clearances'. Operation of Electrical Installations. IEC 62236 Railway applications - Electromagnetic 	3 – Unlikely	2 – Moderate	6 - Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				<p>compatibility.</p> <ul style="list-style-type: none"> ○ S.I. 299/2007 Statutory Instrument Safety, Health and Welfare at Work (General Application) Regulations 2007. <p>The required safety standards will be achieved through installation of safety screens and extending / modifying the existing fencing where applicable along the rail corridor to eliminate the risk of OHLE coming into contact with members of the public.</p>				
O4	Bridge Failure	<ul style="list-style-type: none"> • Bridge strike by train or road traffic. • Inadequate/ poor design of bridge structure(s). • Poor quality of materials used for construction. • New bridge 	<ul style="list-style-type: none"> • Death or injury to staff and / or members of the public. 	<ul style="list-style-type: none"> • All structures have been designed to be fully compliant with: <ul style="list-style-type: none"> ○ IÉ's CCE-TMS-410 Civil Engineering Structures Design Standard. ○ Eurocode I.S. EN 1990 Basis of structural design. 	2 – V. Unlikely	3 – Significant	6 – Low	<p>No – mitigation by design achieves ALARP</p>

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
		structures proposed as part of the development.		<ul style="list-style-type: none"> ○ Eurocode I.S. EN 1991-2 <i>Actions on structures – Part 2: Traffic loads on bridges (Including Irish National Annex).</i> ○ Eurocode I.S. EN 1991-1-7 <i>Actions on structures – Part 1-7: General actions Accidental actions (Including Irish National Annex).</i> ○ I.S. EN 1992-2 <i>Design of concrete structures – Concrete bridges – Design and detailing rules (Including Irish National Annex).</i> ○ EN 1990 <i>Eurocode - Basis of structural design.</i> ○ EN 1993 <i>Eurocode 3. Design of steel structures.</i> ○ EN 1993-1 				

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				<p>Design of steel structures. General rules and rules for buildings.</p> <ul style="list-style-type: none"> ○ Degree of impact protection. <p>Compliance with material standards to include, but are not limited to, the following:</p> <ul style="list-style-type: none"> • I.S. EN 1992-1-1:2005 (Eurocode 2, Part 1-1) – Design of concrete structures – General rules and rules for buildings. • I.S. EN 1993-1-1:2005 (Eurocode 3, Part 1-1) – Design of steel structures General Rules and rules for buildings. • I.S. EN 1996-1-1:2005 (Eurocode 6, Part 1-1) – Design of masonry structures. General Rules for reinforced and unreinforced masonry structures. 				

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
O5	Tunnel Failure / Fire	<ul style="list-style-type: none"> There is a risk of fire within the tunnel from combustible/ flammable freight during the operational phase. 	<ul style="list-style-type: none"> Death or injury to staff and / or members of the public. Contaminated firewater run-off. 	<ul style="list-style-type: none"> Prevention of accidents through speed restriction (20mph) within the enclosed tunnel and not permitting other trains in the tunnel whilst freight trains are using the tunnel. Iarnród Éireann to implement a routine inspection and maintenance regime for the tunnel lining. Iarnród Éireann to collaborate with Dublin Fire Brigade and provide updates on the nature or type of combustible / flammable freight that is to be transported through the tunnel. Iarnród Éireann to provide a 150mm dry main within the enclosed tunnel, pipe diameter subject to discussions with Dublin Fire Brigade. Iarnród Éireann and 	1 -Ext. Unlikely	5 – Profound	5 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				<p>Dublin Fire Brigade to test their respective emergency plans before the newly electrified tunnel commences with the provision of public transportation.</p> <ul style="list-style-type: none"> Iarnród Éireann and Dublin Fire Brigade to routinely test their respective emergency plans after the newly electrified tunnel commences with the provision of public transportation. 				
O6	Building Failure / Fire	<ul style="list-style-type: none"> Operation of the proposed Heuston West Station. 	<ul style="list-style-type: none"> In event of building collapse or fire, there is a risk of death or injury to staff and / or members of the public. 	<p>The design of the Heuston West Station adheres to project standards related to permanent way and civil engineering. In addition, standards relating to building regulations, and national Technical Guidance Documents including those applicable to footpaths and cycleways published by TII and the</p>	2 – V. Unlikely	4 – V. Significant	8 – Medium	Yes - to achieve ALARP.

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				NTA, and also other international guidelines concerning accessibility and fire safety.				
O7	Power Failure	<ul style="list-style-type: none"> • Extreme weather events. • Mishandling of electrical equipment. • Electromagnetic interference. 	<p>Power failure may lead to:</p> <ul style="list-style-type: none"> • Failure of electrical infrastructure (e.g., failure of signalling, track crossovers, communication). • Disruption to rail transportation network. • Power outage to electrical substation buildings. 	<p>The installation of electrical components within structures complies with guidelines/ standards that include, but are not limited to the following:</p> <ul style="list-style-type: none"> • EN 60364 Electrical installations for buildings. • BS 7671 Requirements for electrical installations IET Wiring Regulations. 	3 – Unlikely	2 – Moderate	6 - Low	No – mitigation by design achieves ALARP
O8	Safety Protection for general public and users of structures	<ul style="list-style-type: none"> • Reconstruction of existing bridge structures over the railway line. • Presence of OHLE along the extents of the development. • Electric shock. 	<ul style="list-style-type: none"> • Risk of injury or death to the members of the public. 	<ul style="list-style-type: none"> • The existing bridges along the route must comply with necessary safety requirements. The requirement is that the parapets over the newly electrified rail lines should be minimum 1.8m in height and have 	1 -Ext. Unlikely	5 – Profound	5 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				<p>measures in place to prevent climbing or walking across the top of the parapets.</p> <ul style="list-style-type: none"> The bridge replacements will require new parapets which meet current containment standards (H4a containment) for bridges crossing railways, where applicable. (Refer to Chapter 4 Project Description). A number of existing bridges require parapet modification works to ensure that there is an adequate containment barrier to the OHLE from road level (refer to Chapter 4 Project Description). Fencing along the railway line will be developed in accordance with Iarnród Éireann <i>CCE-TRK-SPN-037 Fencing</i> 				

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Specification.				
Hydrological Disasters								
O9	Extreme weather (flood) events	<ul style="list-style-type: none"> Extreme flooding causing breach of embankments of watercourses. Extreme or prolonged rainfall events flooding the railway line. New structures such as the substations affecting the flood patterns in the area. 	<ul style="list-style-type: none"> Construction of associated infrastructure such as substations on greenfield lands may affect flood patterns in the area causing more intense flooding on surrounding lands. Flooding along the railway line which may temporarily suspend services. 	<ul style="list-style-type: none"> New infrastructure has been designed to include allowances for climate change. Drainage design includes allowances for climate change. A Flood Risk Assessment (Stage 3) has been completed for the Project. Refer to the Flood Risk Assessment Report. 	3 – Unlikely	3 – Significant	9 –Medium	Yes - to achieve ALARP.
Extreme Weather Events								
O10	Extreme weather (Gale force winds / storms/ hurricane) events	<ul style="list-style-type: none"> Extreme weather events such as storms / gale force winds within the area of proposed development. 	<ul style="list-style-type: none"> Damage to rail infrastructure e.g., OHLE equipment. Obstruction of rail line due to fallen objects e.g., trees. 	<ul style="list-style-type: none"> The detailed design of the proposed development will be in accordance with all relevant codes and standards, including <i>IS EN 1991-1-4:2005 Eurocode 1: Actions</i> 	3 – Unlikely	2 – Moderate	6 - Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				<p>on structures – general actions - Wind actions.</p> <ul style="list-style-type: none"> Iarnród Éireann have a management protocol for preparedness and response to extreme weather events such as CCE-TMS-311 Irish Rail Weather Management Procedures. This protocol includes assessing the operability of the network for services and co-operating and communicating with emergency services and national stakeholders, to ensure passengers are accommodated insofar as is practical and safe. In addition, Irish Rail have a management protocol to facilitate passenger services being brought back into operation as quickly and safely as possible after an 				

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				extreme weather event.				
O11	Lightning Strikes	<ul style="list-style-type: none"> The proposed Project does not have the potential to cause such an event. OHLE equipment along the extents of the proposed Project has the potential to be vulnerable to lightning strikes. 	<p>In event of lightning strikes, there is a risk of:</p> <ul style="list-style-type: none"> Power outage which may cause signal failures along the line which are electrically powered. Suspension of rail services. Risk of injury to staff and rail passengers. 	<ul style="list-style-type: none"> To protect the DART+ South West OHLE equipment against atmospheric overvoltage protection, lightning and switching overvoltage, surge arresters will be installed. The design will be based on the methods contained in IEC 62305 'Protection Against Lightning, Part 2, Risk Management'. In addition, the low voltage elements within DART+ South West will comply with I.S. 10101 Part 443 'Protection against transient overvoltages of atmospheric origin or due to switching'. In relation to buildings, measures included in BS EN 	2 – V. Unlikely	2 – Moderate	4 - Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				62305 Protection against lightning and BS 7430 Code of practice for protective earthing of electrical installations will be complied with.				
Industrial Accidents								
O12	Industrial Accidents – Accidents at Seveso Sites	<ul style="list-style-type: none"> Fire/ explosion and/ or equipment failure nearby, Seveso industrial sites. 	<ul style="list-style-type: none"> Damage to the railway line. Risk of injury or death and environmental impact. 	There is no mitigation by design measures that can reduce the risk of an accident at a Seveso site.	2 – V. Unlikely	4 – V. Significant	8 – Medium	Yes - to achieve ALARP.
Crime/ Civil Unrest								
O13	Security Incidents on Trains	<ul style="list-style-type: none"> Anti-social behaviour on trains. 	<ul style="list-style-type: none"> Verbal or physical conflicts from passenger(s) directed at other passengers or members of staff. 	<ul style="list-style-type: none"> Existing measures devised by Iarnród Éireann will be implemented such as a security strategy which incorporates the proactive support of Iarnród Éireann’s security contractor and An Garda Síochána. The Iarnród 	4 - Likely	1 - Slight	4 – Low	No – mitigation by design achieves ALARP

Id	Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Éireann's Text SMS Service ² which is currently operational on the DART network will be maintained to allow all customers to discreetly report incidents of anti-social behaviour at any time including while on board a train while the incident is occurring.				

² Irish Rail ONLINE Available At <https://www.irishrail.ie/en-ie/faqs/how-do-i-use-the-anti-social-behaviour-text-servic>

The hazards have been assessed based on their likelihood and impact and resulting level of significance, and scored and ranked as Low, Medium or High (based on the process outlined in Section 24.3.5). The outcome of this assessment has highlighted specific hazards require additional “secondary measures” to reduce and manage the risk to an acceptable level, to as low as reasonably practicable (ALARP).

These hazards have been brought forward for further assessment and are presented in Table 24.9 and Table 24.10 below.

Table 24.9: Assessment of Major Accidents and Disasters in the Construction Phase with Secondary Mitigation Measures in Place

No.	Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
Construction Phase						
C1	Major Road Traffic Accidents	<ul style="list-style-type: none"> Human Health Biodiversity Hydrology Population Material Assets Non-Agricultural 	<ul style="list-style-type: none"> A Construction Traffic Management Plan (CTMP) will be prepared and implemented during the construction phase to be agreed with Iarnród Éireann and the respective local authority prior to the commencement of the construction phase. A Mobility Management Plan will be developed as part of the CTMP and will address all modes of transport and travel required to deliver the project during the construction phase. This will include details regarding construction workers travelling to site, car-parking, haulage routes and construction compounds to reduce potential effects (incl. traffic accidents) caused due to construction traffic and residential neighbourhoods. All accesses to the worksite and the compounds will be signposted, and anyone outside the work will be prohibited, installing the necessary perimeter fences and the necessary warning signs. The necessary traffic signs will be placed outside the work to warn pedestrian and vehicle traffic of the risks involved in the work. Similarly, the necessary protections and notices will be placed, in specific cases in which the circulation through the annexed streets is affected. All HGV drivers will be provided with appropriate safety awareness training. 	2 – Unlikely	2– Moderate	4 - Low

No.	Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
C5	Collapse / Damage to structures	<ul style="list-style-type: none"> Human Health Material Assets Non-Agricultural Architectural Heritage 	<ul style="list-style-type: none"> Stakeholder consultations with owners of sensitive structures / buildings. Monitoring of existing historic / sensitive structures during construction to ensure their stability and durability. Where appropriate, sensitive structures at risk from construction works will be protected. A CEMP and an Incident Response Plan (IRP) will be prepared to manage the risk of collapse / damage to structures. Mitigation measures in relation to vibration identified in EIA Chapter 14 Noise and Vibration will be adhered to. 	2 – V. Unlikely	3 – Significant	6 - Low
C7	Ground Collapse	<ul style="list-style-type: none"> Human Health Material Assets Non-Agricultural 	<ul style="list-style-type: none"> A CEMP and an Incident Response Plan (IRP) will be prepared to manage the risk of collapse/ damage to structures. 	1 – Ext. Unlikely	4 – V. Significant	4 - Low
C9	Fire / explosion	<ul style="list-style-type: none"> Human Health Population Material Assets Non-Agricultural Architectural Heritage 	<ul style="list-style-type: none"> The risk is managed through the CEMP and IRP. Hot Work Permit procedure will be followed. All construction compounds and construction sites will have 24/7 security. Explosive materials will not be stored on construction site /compounds overnight. Transportation of explosives will be subject to prior agreement. When transportation of these materials is required, appropriate security measures will be implemented such as escort by An Garda Síochána. 	2 - V. Unlikely	3 - Significant	6 - Low

No.	Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
C11	Industrial Accidents (works near Seveso site)	<ul style="list-style-type: none"> Human Health Population Material Assets Non-Agricultural 	<ul style="list-style-type: none"> The proposed Project cannot provide offsite mitigation measures however, TII's protocols for the management of major accidents will be followed in an event there is an incident at a nearby Seveso sites. In the event of an accident, the Seveso site will have an emergency response plan registered with the HAS which will be activated and implemented. 	2 – V. Unlikely	3 - Significant	6 - Low
C12	Extreme Weather (Flooding) Events	<ul style="list-style-type: none"> Biodiversity, agricultural assets Material Assets Non-Agricultural Population Human Health Hydrology Hydrogeology 	<ul style="list-style-type: none"> As is normal practice with infrastructure projects a Construction Environmental Management Plan (CEMP) will be prepared for the proposed Project. Monitoring of weather forecasts to ensure that necessary actions will be implemented in time at construction sites prior to prolonged / extreme weather events. <p>An emergency response plan may be drawn up including appropriate response measures for such Extreme Weather (Flooding) situations.</p>	3 – V. Unlikely	2– Significant	6 - Low
C14	Spillage or long-term seepage of pollutants into a watercourse	<ul style="list-style-type: none"> Population Human Health Hydrology Hydrogeology Biodiversity 	<ul style="list-style-type: none"> As is normal practice with infrastructure projects, a CEMP will be prepared for the proposed Project. An Incident Response Plan will be prepared as part of the CEMP detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance with any permit or license, or other such risks that could lead to a pollution incident, including flood risks. The Environmental Manager will prepare Method Statements for construction works as detailed in the CEMP to be undertaken on, over or near water in consultation with Inland Fisheries Ireland (IFI) and other relevant authorities. 	3 – V. Unlikely	2– Significant	6 - Low

No.	Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
			<ul style="list-style-type: none"> Implementation of mitigation measures identified in Chapter 8 Biodiversity, 10 Hydrology, and Chapter 11 Hydrogeology in EIAR Volume 2. During construction, cognisance will have to be taken of the following guidance documents for construction work on, over or near water: <ul style="list-style-type: none"> Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board). Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers. CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors. CIRIA C648 Control of Water Pollution from Constructional Sites. <i>Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (TII, 2006).</i> 			
C16	Human Disease	<ul style="list-style-type: none"> Human Health Population 	<ul style="list-style-type: none"> The contractor will provide site operatives with appropriate first aid material. All site operatives will be advised to wear steel toe cap boots with trousers to be tucked inside along with appropriate PPE such as gloves and headwear. All site operatives should be advised of the importance of washing hands before eating to avoid the risk of contracting weils disease and other water borne diseases. Government and HSE health and safety guidelines will be adhered to in relation to Covid-19 in workplaces to 	2 – V. Unlikely	3 - Significant	6 - Low

No.	Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
			reduce the spread of the virus amongst the construction workers.			

Table 24.10: Assessment of Major Accidents and Disasters in the Operation Phase with Secondary Mitigation Measures in Place

No.	Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
O2	Train Derailment	<ul style="list-style-type: none"> Human Health Population Architectural Heritage Material Assets Non-Agricultural 	<ul style="list-style-type: none"> Appropriate training will be provided to all relevant staff members for operation of the electrified train fleet. Operation and maintenance manuals will be made available to staff as early as possible. A dedicated Major Incident Response Plan has been developed by Iarnród Éireann for the DART+ South West Project to identify the appropriate emergency response plans in event of an incident. Appropriate back up procedures will be prepared and implemented in an event of an incident. Periodic inspections and maintenance (as required) of the railway line in accordance with Iarnród Éireann (IÉ) Standards which include, but not limited to, the following: <ul style="list-style-type: none"> IÉ CCE-TMS-363 Requirements for the Rail Testing Vehicle. IÉ CCE-TMS-360 Track and Structures Inspection Requirements. IÉ CCE-TMS-320 Track Quality Standard. International Union of Railways (UIC) Code 712 R Rail Defects. As the design of the project has progressed Applications for Safety Approvals (ASA), Acceptance of Safety Cases and Authorisation for Placing in Service (APIS) are being developed. Design measures for the DART+ South West project have been accepted by the Commission for Railway Regulation (CRR) in order for licence to be granted. 	1 – Ext. Unlikely	5 - Profound	5 - Low

No.	Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
O6	Building Failure / Fire	<ul style="list-style-type: none"> Human Health Population 	<ul style="list-style-type: none"> A Fire Safety Certificate will be submitted in advance of operation of the station (post approval of the railway order). It will be agreed and approved the Dublin Fire Brigade. 	2 – V. Unlikely	3 – Significant	6 - Low
O9	Extreme weather (flood) events	<ul style="list-style-type: none"> Biodiversity Material assets agricultural Material Assets Non-Agricultural Population Human Health Hydrology Hydrogeology 	<ul style="list-style-type: none"> Ongoing consultation and cooperation with local authorities and the Office of Public Works (OPW). Inspections and maintenance (as applicable) of the drainage system and the proposed attenuation tanks. A dedicated Major Incident Response Plan has been developed by Iarnród Éireann for the DART+ South West project to identify the appropriate emergency response plans in event of flooding. 	2 – V. Unlikely	3 - Significant	6 - Low
O12	Industrial Accidents – Seveso sites	<ul style="list-style-type: none"> Human Health Population Material Assets Non-Agriculture 	<ul style="list-style-type: none"> The proposed Project cannot provide offsite mitigation measures however, TII's protocols for the management of major accidents will be followed in an event there is an incident at a nearby Seveso sites. In the event of an accident, the Seveso site will have an emergency response plan registered with the HAS which will be activated and implemented. 	2 – V. Unlikely	3 – Significant	6 - Low



24.5. Residual Effects

Significant residual effects are not likely to occur during construction or operational phases of the proposed Project as there are no identified risk events that would present a sufficient in-combination likelihood of risk and consequence that would lead to a major accident or a disaster.

24.6. References

Commission for Railway Regulation (2020). *Railway Safety Performance in Ireland 2020*

Department of Environment, Heritage and Local Government (2010). *A Guide to Risk Assessment in Major Emergency Management*

Department of Environment, Heritage and Local Government (2010). *A Framework for Major Emergency Management, Guidance Document 1, A Guide to Risk Assessment in Major Emergency Management*

Environmental Protection Agency (2022). *Guidelines on the Information to be contained in Environmental Impact Assessment Report*

Environmental Protection Agency (2014). *Guidance on Assessing and Costing Environmental Liabilities*

Government of Ireland (2021). *A National Risk Assessment for Ireland 2020*.

Government of Ireland (2021). *National Risk Assessment 2021/2022 Overview of Strategic Risks*.

Health and Safety Authority (2022). *Guidance on Technical Land-use Planning Advice for Planning Authorities and COMAH Establishment Operators*.

Iarnród Éireann (2017). *Iarnród Éireann Safety Report 2017*.

Institute of Environmental Management and Assessment (2020). *Major Accidents and Disasters in EIA: A Primer*.