
Chapter 24

Major Accidents and Disasters

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24. MAJOR ACCIDENTS AND DISASTERS

24.1 Introduction

This chapter assesses the potential risk of ‘major accidents and disasters’ arising from construction and operational phase activities for the proposed DART+ West project. The assessment is 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”). Close co-ordination and discussion between the EIA team has informed the preparation of this chapter to ensure that the major accidents and disasters identified are adequately assessed.

This chapter contains the applicable legislation and guidance used to prepare this chapter (Section 24.2), sets out the methodology adopted to assess the risk of major accidents and disasters (Section 24.3) and finally details the potential of the proposed DART+ West to cause major accidents and disasters (‘MADs’ hereafter), and its vulnerability to MADs during the construction and operational phase (Section 24.4).

This chapter should be read in conjunction with:

- Chapter 4 Description of the Proposed Development.
- 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.

24.2 Legislation, policy and guidance

24.2.1 Legislation

As stated earlier, the assessment of the risk of MADs has been undertaken in accordance inter alia with the EIA Directive, the Transport (Railway Infrastructure) Act 2001 (as amended and substituted), the European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations 2021 (S.I. No. 743/2021) which give further effect to transposition of the EIA Directive by amending the Transport (Railway Infrastructure) Act 2001.

The EIA Directive as amended by Directive 2014/52/EU requires that the EIAR shall contain:

Article 3 (1) *‘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’*

Annex III (1)(f) *‘the risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge’*

Annex IV (8) *“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. [...] 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.”

24.2.2 Policy

The assessment of impacts in relation to MADs is a relatively new requirement in the context of EIA, and specific national guidelines have not yet been published in Ireland. The development of the risk assessment methodology has been informed by the following legislation:

- S.I. No. 291 of 2013 – Safety, Health and Welfare at Work (Construction) Regulations 2013; (hereafter referred to as the Safety, Health and Welfare (Construction) Regulations).
- S.I. No. 209 of 2015 - A Guide to the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015.
- Seveso III Directive.
- EU Regulation 402/2013 on the Common Safety Method on Risk Evaluation and Assessment (CSM-RA) (as amended by Regulation EU 2015/1136).

24.2.3 Guidance

The development of the risk assessment methodology has been informed by the following guidelines:

- Institute of Environmental Management and Assessment's (IEMA) Major Accidents and Disasters in EIA: A Primer (IEMA 2020).
- Draft Advice Notes for Preparing Environmental Impact Statements Draft (EPA 2015b).
- Draft Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2015a).
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports; (EPA 2022).
- National Risk Assessment 2017: Overview of Strategic Risks (Department of the Taoiseach 2017).
- A National Risk Assessment for Ireland 2017 (Department of Defence 2017).
- A National Risk Assessment for Ireland 2020 (Government of Ireland 2020).
- 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).
- Health and Safety Authority Guidance on Technical Land-use Planning Advice for Planning Authorities and Operators of Establishments under the COMAH establishments.
- Safe Evacuation for All: A Planning and Management Guide (National Disability Authority 2011).
- Major Emergency Plan 2015 (Dublin City Council 2015).
- Major Emergency Plan of Fingal County Council (Fingal County Council 2011).

Transport Infrastructure Ireland's (TII's), Commission for Railway Regulation's (CRR), and Iarnród Éireann's (IÉ) strategies, procedures and reports:

- TII's Business Continuity Management – Process, Plans and Teams.
- TII's Business Continuity Plans.
- TII's Incident Management Plans.
- Railway Safety Performance in Ireland 2018 (CRR 2019).
- CRR Annual Report 2020 (CRR 2021).
- Iarnród Éireann Safety Report 2016 (Iarnród Éireann 2017).
- IÉ Business Continuity Plan.
- IÉ Rule Book.
- IÉ Emergency Management Plan.
- Department of Transport Multi-Agency Protocol for Rail Emergencies.

24.3 Methodology

24.3.1 Scope

The scope of this chapter is to complete an assessment of the significant adverse effects of the proposed development in terms of its potential to cause major accidents and disasters ('MADs' hereafter), and its vulnerability to the negative impacts of potential MADs. In accordance with the Institute of Environmental Management and Assessment (IEMA) guidelines (IEMA, 2020), it considers whether the associated risks are mitigated to a level that is 'as low as reasonably practicable'.

This chapter differs from the other specialist chapters of this EIAR in that it does not deal with *likely* effects. Rather, its scope is limited to sudden events of *low likelihood*, which *may conceivably occur*, and which would result in *major negative impacts* on infrastructure, human health, cultural heritage and / or the environment (or events of "*low likelihood but potentially high consequence*" as described by IEMA (2020; p. 13; Plate 18.1). Additionally, the understanding of what constitutes a 'significant' effect or impact in this context must differ from that of other chapters of the EIAR, which typically apply the standard definitions provided by the EPA guidelines (EPA, 2022). As stated in those guidelines, "*Significance* is a concept that can have different meanings for different topics" (ibid.; p. 50). In relation to MADs, the IEMA guidelines define 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*" (ibid. p. 6). This definition has been adopted herein.

As recommended by IEMA (2018), minor accident risks of relatively low consequence, e.g., crime/civil unrest, cyber-attacks, and terrorism have been scoped out of the assessment. Such events are addressed, where appropriate, in the relevant specialist chapters of this EIAR.

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.

The geographic scope of the assessment shall take in all external features which may present a hazard to the development, even if these are beyond the development boundary, see Table 24-3 for further detail.

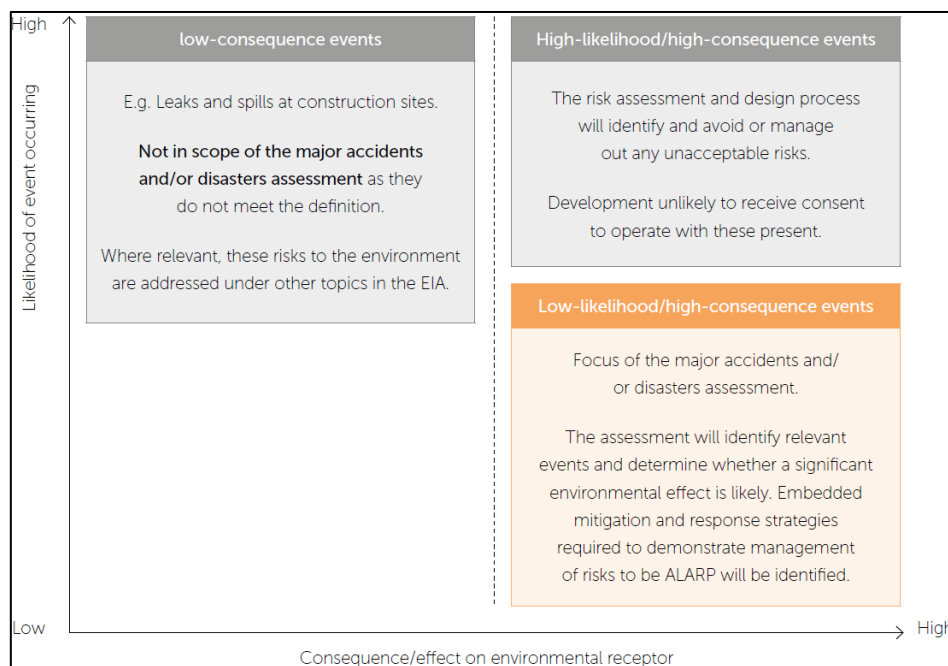


Figure 24-1 Summary of risk events considered in the scope of the impact assessment in relation to MADs (IEMA, 2020)

24.3.2 Definitions

This assessment is based on the following definitions of key concepts, which have been informed by the IEMA (2020), IPCC (2012) and UN/ISDR (2004) definitions, as well as the relevant sections of the EIA Directive.

Table 24-1 Key terminology for the assessment of major accidents and disasters (adapted from IEMA, 2020)

Term	Definition	Source
Major Accident	'Something that happens by chance or without expectation'. 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.	Oxford English Dictionary; IEMA Primer (IEMA 2020)
Disaster	'A sudden accident or a natural catastrophe that causes great damage or loss of life'. May be a natural hazard (such as an earthquake) or a man-made/external hazard (such as an act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident.	Oxford English Dictionary; IEMA Primer (IEMA 2020)
Hazard	Something with the potential to cause harm 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.	IEMA Primer (IEMA 2020)
Receptors	The specific component of the environment that could be adversely affected if the source reaches it. 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.	
Vulnerability	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.	IEMA Primer (IEMA 2020)
Sensitivity	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: <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. Recoverability – the temporal scale over, and extent to, which a receptor will recover following an effect.	IEMA Primer (IEMA 2020)
Magnitude of impact	The magnitude of an impact is typically defined by the following factors: <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. • Severity – the degree of change relative to existing environmental conditions. 	Annex III(3) of the EIA Directive IEMA Primer (IEMA 2020)
Adaptive capacity	The capacity of receptors to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.	IEMA Primer (IEMA 2020)
Risk	The likelihood of an impact occurring, combined with the effect or consequence(s) of the impact on a receptor if it does occur.	IEMA Primer (IEMA 2020)
Source-pathway-receptor linkage	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).	IEMA Primer (IEMA 2020)

Term	Definition	Source
Likelihood	A probability (of the hazard occurring) or a frequency, whichever is appropriate for the analysis under consideration.	A National Risk Assessment for Ireland 2017 (Department of Defence 2017)
Significant environmental effect (in relation to MANDs assessment)	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.	IEMA Primer (IEMA 2020)
As Low As Reasonably Practicable (ALARP)	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.	IEMA Major Accidents & Disasters in EIA: A Primer (the IEMA Primer) (IEMA 2020)

24.3.2.1 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 Dublin to Maynooth and M3 Parkway railway lines and the proposed works 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).
 - landscape and visual sensitive receptors.
- The historic environment, including
 - archaeology.
 - built heritage.

24.3.3 General Methodology

In Accordance with the IEMA guidelines (IEMA, 2020), this assessment follows a three-stage methodology as follows:

- Stage 1 Screening.
- Stage 2 Scoping.
- Stage 3 Assessment.

24.3.3.1 Stage 1 – Screening

The IEMA (2020) guidelines state that “During screening 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” (p. 10). Questions to consider at this stage include the following (adapted from IEMA, 2020):

- Is the proposed development a source of hazard itself that could conceivably result in a major accident and / or disaster occurring?
- Does the proposed development interact with any sources of external hazards that may conceivably make it vulnerable to a major accident and / or disaster?

- If an external major accident and/or disaster occurred, would the existence of the proposed development conceivably increase the risk of a significant effect to an environmental receptor occurring?

Since the proposed development has screened in for mandatory EIA (i.e. it is not a sub-threshold development), an EIA Screening Report has not been prepared for same. Accordingly, the screening exercise in respect of MADs is presented herein.

24.3.3.2 Stage 2 – Scoping

If the proposed development is screened in for the assessment of impacts in relation to MADs at Stage 1, the scoping stage aims to determine *in more detail* whether there is potential for significant effects as a result of MADs in relation to the proposed development.

At this stage, various hazard classes are considered in relation to the proposed development. The UK National Risk Register of Civil Emergencies (2017 Edition) has been used as the primary source to identify hazard classes herein. The baseline (i.e. receiving) environment is described insofar as is relevant to the hazard class in question.

HEMA provide a useful infographic illustrating the scoping decision process to aid at this stage (Figure 24-2).

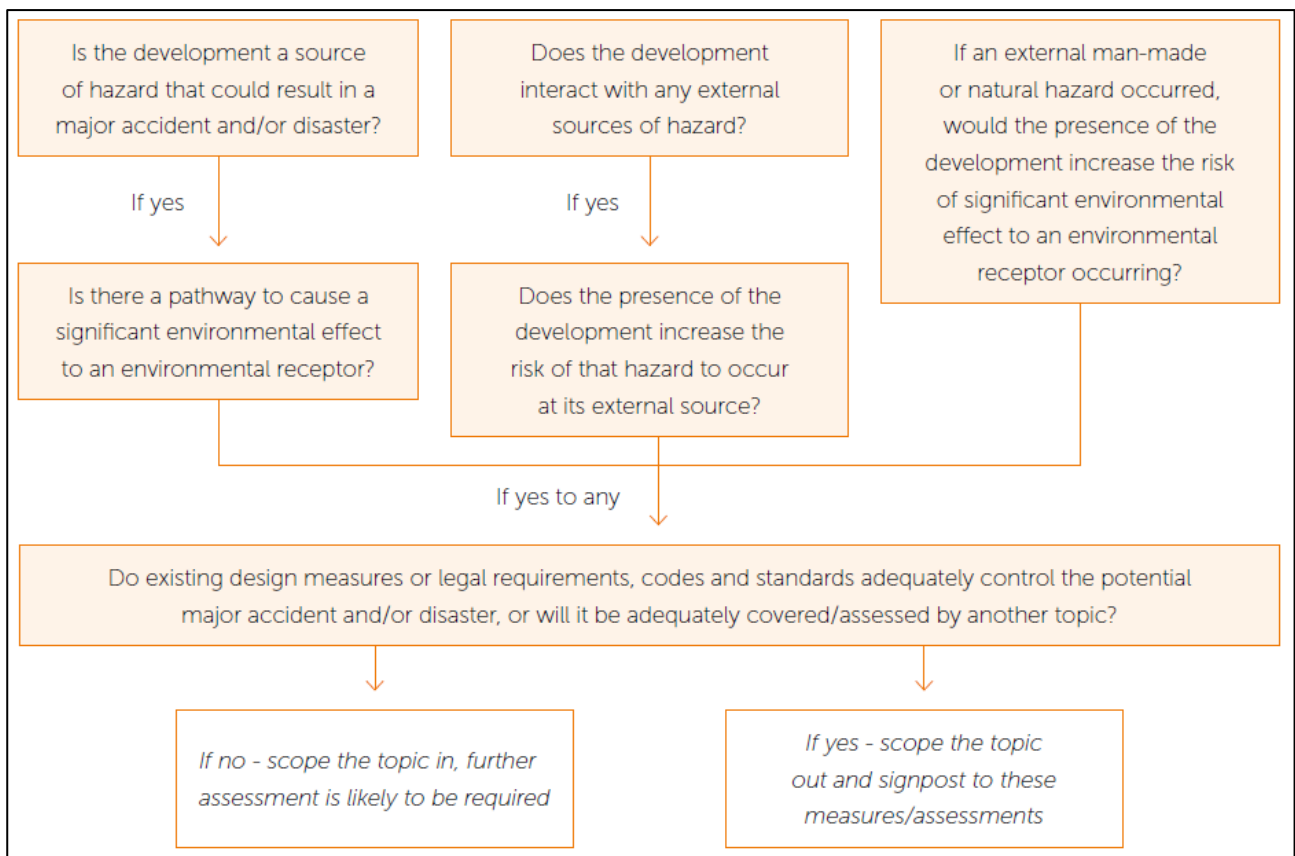


Figure 24-2 Scoping decision process flow (HEMA, 2020)

It is stated that the assessment of impacts in relation to MADs can be scoped out if it can be demonstrated that:

1. *“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.*
2. *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.”* (HEMA, 2020; p. 12)

It is pointed out in the IEMA (2020) guidelines 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” (p. 11).

The EIA Scoping Report for the proposed development did not consider MADs, so this exercise is presented herein.

24.3.3.3 Stage 3 – Assessment

If hazard class(es) are screened in at Stage 2, they are brought forward to Stage 3 for a detailed consideration of the potential for significant impacts to arise. At this stage, the following exercises are carried out (as per IEMA, 2020):

- The potentially affected receptors are identified with as much specificity as is practicable. If no receptors can be identified, the hazard class in question is excluded from further consideration, since there is no valid source-pathway-receptor linkage.
- The reasonable worst-case impacts on the receptors are identified insofar as possible. This exercise is based on a qualitative, professional judgement. Uncertainty at this stage is to be acknowledged. Hazard classes which are not predicted to result in significant impacts under this reasonable worst-case scenario are excluded from further consideration.
- Mitigation by design (where appropriate) are identified and it is determined whether these are sufficient to mitigate the associated risk level(s) to be ALARP.

If, after all of the above-stated exercises have been carried out, there remain hazard classes which may potentially give rise to significant effects as a result of the proposed development or interaction with the proposed development, it is considered whether secondary mitigation measures can be incorporated into the design of the proposed development which would mitigate the associated risk level(s) to be ALARP.

Risk Classification

Following the completion of Stages 1 and 2, the potential risk of remaining MADs have been evaluated using criteria outlined in Table 24-2 and Table 24-3 below, adapted from ‘A National Risk Assessment for Ireland 2020’ prepared by the Department of Defence (2020), IEMA Primer (IEMA 2020) and guidelines provided in the EPA Guidelines (EPA 2022).

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 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.

Potential impacts resulting from MADs have been classified under the criteria described in Department of Defence’s ‘A National Risk Assessment for Ireland 2020’. The EPA Guidelines (EPA 2022) for describing the significance of effects on environment have also been applied, see Table 24-3. Significant impacts resulting from MADs are adverse impacts that are described as ‘Significant’, ‘Very Significant’ or ‘Profound’ under the EPA Guidelines (EPA 2022).

Table 24-3 Classification of Potential Impact (adapted from DoEHLG, 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. Environment: simple, localised effect only. Economic: up to 1% of Annual Budget. 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 contamination, effects of short duration. Economic: greater than 1% of Annual Budget. Socio-economic: community is functioning but 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. 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 effects of extended duration. Economic: greater than 4% of Annual Budget. 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 effects of extended duration. Economic: greater than 8% of Annual Budget. Socio-economic: affected community is unable to function without significant support.

Risk Evaluation

Using the guidelines prepared by the Department of Defence (Department of Defence, 2020) and amended by the provisions set out in the IEMA Primer (IEMA 2020), and EPA Guidelines (EPA, 2022), the MADs that were scoped in at Stage 2 (see Table 24-5) were evaluated against a risk matrix to determine the level of significance of each risk for each scenario. These have been grouped according to three categories listed 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.
- Green Zone: Low Risk Scenarios that have an evaluation score 1 to 6.

Table 24-4 Evaluation of 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
Consequence of Impact						

Categorisation of MADs based on the three aforementioned categories is shown in Table 24-6. As per Figure 24-1, the IEMA Primer (IEMA 2020) recommends that the focus of the MADs assessment is to identify, and focus on hazard types which are of low likelihood but potentially high consequence events which are generally represented by the Orange Zone. The Red Zone consists of hazard types / events which are high likelihood and high consequence events. Hazard types within the Green Zone achieved ALARP and did not need to be considered further.

MADs that fall within the Orange and Red Zones have been brought forward for further consideration as shown in Table 24-7, and re-evaluated to take into consideration the secondary mitigation measures proposed.

24.3.4 Study Area

For the purposes of identifying risk of major accidents and disasters the study area includes the extent of the proposed development, as well as any haul routes to and from the proposed development 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).

24.3.5 Survey methodology

Information was obtained from the desktop studies and surveys completed for the environmental factors contained within this other chapters of this EIAR (e.g., Hydrology, Air Quality, etc.) and inform this assessment as appropriate.

24.3.6 Consultation

Consultation, and the consideration of feedback from the public and statutory consultees is a key part of the EIA process and integral to informing the design development and this environmental assessment.

The key consultation phases and the feedback received that has informed this chapter include:

- Non-statutory EIA Scoping Report.
- Options Selection process.
 - Non-statutory public consultation no.1 emerging preferred option
 - Non-statutory public consultation no.2 preferred option & Local Ashtown public consultation on the revised preferred option.

Chapter 3 of this EIAR includes detail relating to the consultation undertaken during the project. The feedback received is summarised in the public consultation findings reports which has informed this chapter as appropriate. Close collaboration with the project team and other EIA specialists has also helped inform the assessment.

24.3.7 Difficulties encountered/ Limitations

There were no difficulties encountered when completing this chapter.

24.4 Description of potential impacts

24.4.1 Stage 1 – Screening

It is considered that the proposed development, due to its nature, scale and construction duration should screen in for the impact assessment in relation to MADs since, on the basis of a preliminary consideration of the proposed development and receiving environment, it is *conceivable* (although highly unlikely) that:

- the proposed development could result in a MAD.
- the proposed development could interact with external sources of hazards that could conceivably make it vulnerable to a MAD.
- if an external MAD occurred, the proposed development could conceivably exacerbate the associated risk of significant impacts.

24.4.2 Stage 2 – Scoping

In general, major accident and disaster events, as they relate to the proposed development, will fall into three categories:

1. Events that could not realistically occur, due to the type of development or its location.
2. Events that could realistically occur, but for which the proposed development, and associated receptors, are no more vulnerable than any other development.
3. 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 was undertaken primarily to identify this third group of major events, which would then form the shortlist of events to be taken forward for further consideration. The screening exercise undertaken for the long list of events are documented in Table 24-5.

Table 24-5 Stage 2 Scoping assessment of potential sources of major accidents and disasters (adapted from IEMA, 2020)

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Already covered in relevant EIAR Chapter?	Progress to Stage 3?
CONSTRUCTION PHASE					
Transport Accidents					
Major Road Traffic Accidents	Yes	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, urban and rural roads.	<ul style="list-style-type: none"> Human Health. Biodiversity. Hydrology. Population. Material Assets Non-Agricultural. 	Yes – Chapter 9 Hydrogeology and Chapter 10 Water (including Hydrology & Flood Risk)	Yes
Train derailment	Yes	The proposed development 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 development from objects accidentally falling onto the train / rail track during construction.	<ul style="list-style-type: none"> Human Health. Population. Material Assets Non-Agricultural. 	No	Yes
Accidents when working with electrical equipment and / or in vicinity of rail line	Yes	The electrification of the rail line involves the construction of OHLE equipment along the c.40km 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 – Chapter 4 Description of the Proposed Development, Chapter 23 Human Health	Yes
Infrastructure					
Impact on Critical Infrastructure	Yes	Construction activities of proposed development may impact on existing overground and underground utilities.	<ul style="list-style-type: none"> Population. Human Health. Hydrology. Hydrogeology. Material Assets Utilities. 	Yes – Chapter 18 Material Assets: Utilities	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 – Chapter 17 Material Assets: Non-agricultural Property, Chapter 21 Architectural Heritage	Yes
Closure of railway line due construction accidents	Yes	There is potential for unplanned closures of railway services / level crossings in an event of an accident when working on or in close proximity to an active rail 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. 	Yes – Chapter 4 Description of the Proposed Development & Chapter 5 Construction Strategy	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Already covered in relevant EIAR Chapter?	Progress to Stage 3?
Construction accidents					
Ground Collapse	Yes	The proposed development consists of works mainly within the existing railway line or within an urban environment. Extensive earthworks will be required for the construction of a new underground station at Spencer Dock and of the underpass at Ashtown where there may be a risk of ground collapse.	<ul style="list-style-type: none"> Human Health. Material Assets Non-Agricultural. 	N/A	Yes
Release of asbestos	Yes	The proposed development will require the demolition of buildings which may be contaminated with asbestos.	<ul style="list-style-type: none"> Human Health. 	No	Yes
Fire / explosion	Yes	The proposed development will require the use of flammable substances such as fuel storage areas at construction compounds and also working with electricity.	<ul style="list-style-type: none"> Human Health. Population. Material Assets Non-Agricultural. Architectural Heritage. 	No	Yes
Works near surface and groundwater bodies	Yes	The proposed development will require works at, within and over watercourses, namely the Royal Canal, Lyreen Stream, Barberstown area and other surface water bodies. Dewatering of surface and groundwater will also be required, namely for the construction of the proposed Spencer Dock Station and Ashtown underpass. Works near water pose a potential health and safety risk to construction workers and the general public.	<ul style="list-style-type: none"> Human Health. Population. Hydrology. Biodiversity. 	Yes	Yes
Industrial accidents					
Industrial Accidents (works near Seveso site)	Yes	The proposed development is in vicinity of Intel, a Seveso site in Collinstown Industrial Park. Works at this location will be confined to the existing railway line 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.	<ul style="list-style-type: none"> Human Health. Population. 	No	Yes
Hydrological Disasters					
Extreme Weather (Flooding) Events	Yes	Extreme flood events (heavy rainfall events, storms, prolonged flooding of the Royal Canal, Lyreen Stream, Barberstown area and other surface water bodies) have the potential to flood the construction sites which store construction material and equipment which are potential sources of contaminants. 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.	<ul style="list-style-type: none"> Biodiversity. Material Assets Agricultural. Material Assets Non-Agricultural. Population. Human Health. Hydrology. Hydrogeology. 	Yes – Chapter 10 Water (including Hydrology & Flood Risk) & Chapter 9 Hydrogeology	Yes
Groundwater Contamination	Yes	The proposed development will require ground disturbance activities which has the potential to accidentally damage / contaminate water abstraction points such as boreholes, wells and aquifers along the extents of the proposed development.	<ul style="list-style-type: none"> Human Health. Population. Hydrology. Hydrogeology. Biodiversity. 	Yes – Chapter 10 Water (including Hydrology & Flood Risk) & Chapter 9 Hydrogeology	Yes

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Already covered in relevant EIA Chapter?	Progress to Stage 3?
Spillage or long-term seepage of pollutants into a watercourse	Yes	The proposed development consists of works near and over watercourses, specifically the Royal Canal, Lyreen Stream, Rye Water River, River Liffey and the River Tolka. There is potential for accidental pollution / long-term seepage of pollutants into the watercourses during construction.	<ul style="list-style-type: none"> Population. Human Health. Hydrology. Hydrogeology. Biodiversity. 	Yes – Chapter 10 Water (including Hydrology & Flood Risk), Chapter 9 Hydrogeology, Chapter 8 Biodiversity	Yes
Disease					
Animal and Plant disease	Yes	Invasive species have been identified within the construction work areas. 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.	<ul style="list-style-type: none"> Biodiversity. Human Health. Material Assets Agricultural. Material Assets Non-Agricultural. 	Yes – Chapter 8 Biodiversity	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. 	No	Yes
OPERATION PHASE					
Transport					
Major Road Traffic Accidents	Yes	There is a risk of major traffic accidents to occur during the operation phase of the proposed development due to the proposed modifications to road network.	<ul style="list-style-type: none"> Human Health. Population. Hydrology. Biodiversity. 	Yes – Chapter 9 Hydrogeology and Chapter 10 Water (including Hydrology & Flood Risk) Chapter 23 Human Health	Yes
Rail accidents / Train derailment	Yes	The proposed development involves works within an existing rail corridor. There is a risk of rail accidents to occur during operation phase of the proposed development.	<ul style="list-style-type: none"> Human Health. Population. Architectural Heritage. Material Assets Non-Agricultural. 	Yes – Chapter 5 Traffic and Transportation	Yes
Electrical Accidents	Yes	The electrification of the rail line involves the construction of OHLE equipment and substations along the c.40km section of the rail line. There is potential for the public to come in contact with the electrical equipment.	<ul style="list-style-type: none"> Human Health. 	Yes – Chapter 4 Description of the Proposed Development, Chapter 23 Human Health	Yes
Aircraft Disasters	No	The proposed development does not have the potential to cause such an event. It would not be affected negatively by a major disruption of air travel, nor is it likely to exacerbate such an event.	N/A	N/A	No
Maritime Disasters	Yes	This proposed development 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	N/A	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Already covered in relevant EIAR Chapter?	Progress to Stage 3?
Bridge Failure	Yes	The proposed development consists of modification works to existing bridge structures and the construction of new bridge structures over the railway line and the canal. There is a risk of bridge failure during operational phase.	<ul style="list-style-type: none"> Human Health. Population. 	Yes – Chapter 4 Description of the Proposed Development & Chapter 5 Construction Strategy	Yes
Tunnel Failure / Fire	Yes	The proposed development will construct an underpass at Ashtown as a road replacement infrastructure. There is a risk of underpass collapse / failure during the operation phase.	<ul style="list-style-type: none"> Human Health. Population. 	Yes – Chapter 4 Description of the Proposed Development & Chapter 5 Construction Strategy	Yes
Dam Failure	No	There is no dam proposed as part of the proposed development. There are no dams that would affect or be affected by the proposed development.	N/A	N/A	No
Flood Defence Failure	No	There are no flood defences proposed as part of the proposed development. There are no existing flood defences that would affect or be affected by the proposed development.	N/A	N/A	No
Mast and Tower Collapse	No	There is no mast or tower proposed as part of the proposed development. There are no masts or towers that would affect or be affected by the proposed development.	N/A	N/A	No
Building Failure / Fire	Yes	The proposed development involves the construction of a depot, an underground train station at Spencer Dock and modifications to existing Connolly Station. 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 – Chapter Description of the Proposed Development & Chapter 5 Construction Strategy	Yes
Power Failure	Yes	The proposed development involves the electrification of c.40km of railway line and thus its operation is vulnerable to loss of power which can affect the commuter services.	<ul style="list-style-type: none"> Population. Material Assets Non-Agricultural. 	No	Yes
Fire within trains	Yes	The proposed development will electrify the currently diesel-powered rail services. Although diesel powered fleets will operate along the rail line, the fraction of these will be replaced by the electrified fleet, reducing the transport usage of flammable substances. As such, the proposed development will not exacerbate the risk of fire within trains during operation phase.	<ul style="list-style-type: none"> Human Health. 	No	No
Members of the public falling or jumping from overbridges	Yes	The proposed development will electrify an existing railway corridor. It involves the construction of new structures over the railway line and the Royal Canal. There is a risk of members of the public falling or jumping from these structures.	<ul style="list-style-type: none"> Population. Human Health. 	Yes – Chapter 23 Human Health	Yes
Geological Disasters					
Mass Wasting ¹	Yes	The proposed development 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 development.	N/A	N/A	No

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

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Already covered in relevant EIAR Chapter?	Progress to Stage 3?
Earthquakes	No	The proposed development does not have the potential to cause an earthquake event. Seismic activity in and around Ireland is typically of low magnitude – although moderately damaging events of higher magnitude do occasionally occur (Blake, 2006). Besides houses, no account could be found of any damage to built infrastructure in Ireland as a result of a seismic event. The site is not in a geologically active area and as such, earthquakes are not considered to be a risk or serious possibility.	N/A	N/A	No
Sinkholes	No	The proposed development does not have the potential to cause such an event. The geology of the study area is not prone to sinkholes.	N/A	N/A	No
Volcanic Eruption	No	The proposed development does not have the potential to cause a volcanic event. There is no volcanic activity in Ireland. Indirect impacts (i.e. tsunamis and disruption to air travel) are considered separately in this chapter.	N/A	N/A	No
Hydrological Disasters					
Extreme weather (flood) events	Yes	There is a risk of the proposed development to be vulnerable and to intensify flooding in the area due to increase in hardstanding on currently greenfield land e.g., for the proposed depot.	<ul style="list-style-type: none"> Human Health. Material assets Agriculture. Hydrology. Hydrogeology. Biodiversity. 	Yes – Chapter 10 Water (including Hydrology & Flood Risk) & Chapter 11 Hydrogeology	Yes
Spillage or long-term seepage of pollutants into a watercourse.	Yes	The proposed development will reduce the number of fuel powered trains operating on the railway line and will therefore not exacerbate the risk of such an event. New surface water drainage networks will be provided throughout the project which collect surface water run-off from the railway area shall pass through hydrocarbon interceptors separator prior to discharge to receiving waterbodies. In addition, vegetated Sustainable Drainage Systems (SuDS) are to be incorporated in the design at the proposed depot. The aforementioned measure are likely to have a positive effect on nearby watercourses.	<ul style="list-style-type: none"> Human Health. Hydrology. Hydrogeology. Biodiversity. 	Yes – Chapter 10 Water (including Hydrology & Flood Risk) & Chapter 11 Hydrogeology	No
Tsunami / Storm surge	No	The proposed development does not have the potential to cause a tsunami / storm surge event. Extreme waves events do occur in Ireland's marine and coastal waters, although seldom resulting in major impacts (O'Brien et al., 2013). Future extreme wave events affecting the British Isles are conceivable (Giles, 2020; Ward & Day, 2001). However, as pointed out by O'Brien and co-authors (2013; p. 643), "... these types of events occur very rarely, approximately of the order of thousands of years" and tsunami risk in Ireland is, on the whole, "very low" (ibid; p. 645).	N/A	N/A	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Already covered in relevant EIAR Chapter?	Progress to Stage 3?
Extreme Weather Events					
Extreme weather (Severe snowfall / blizzards / hailstorm) event	No	The proposed development does not have the potential to cause such an event. Severe snowfall / blizzard and hailstorm events could affect the operation of the proposed DART+ West and its users. However, the risk is no different from other transport electrification developments in Ireland. The proposed development will be designed to operate under a range of environmental conditions, in accordance with the relevant standards, including <i>EN 1991-1-4 Eurocode 1: Actions on structures: general actions - Wind actions</i> and <i>EN 1991-1-5:2003 Eurocode 1 – Actions on structures: General actions – Thermal actions</i> .	<ul style="list-style-type: none"> Population. Human Health. 	N/A	No
Extreme weather (Gale force winds / storms / tornado / cyclone / hurricane / typhoon) event	Yes	The proposed development does not have the potential to cause such an event. Flooding along the extents of the proposed development 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, and the replacement works associated with the level crossings including overbridges and underbridges.	<ul style="list-style-type: none"> Population. Human Health. 	Yes – Chapter 13 Climate	Yes
Droughts	No	The proposed development 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	N/A	No
Lightning Strikes	Yes	The proposed development does not have the potential to cause such an event. The OHLE equipment along the extents of the proposed development has the potential to be vulnerable to lightning strikes.	<ul style="list-style-type: none"> Human Health. 	No	Yes
Heat waves	No	The detailed design of the proposed development will be in accordance with the relevant codes and standards, including <i>EN 1991-1-5:2003 Eurocode 1 – Actions on structures - General actions – Thermal actions</i> . The proposed development design will consider the effect of high temperatures; however the proposed development will be no more vulnerable than any other development or is it likely to exacerbate such an event.	N/A	N/A	No
Wildfires	No	The proposed development does not have the potential to cause such an event. There is no vegetation in vicinity of the proposed development which could support wildfire.	N/A	N/A	No
Air Quality Events	Yes	The proposed development consists of electrification of c.40km of rail line contributing to the reduction of rail infrastructure related air pollution. Road infrastructure is also proposed as part of the DART+ West development and although vehicle emissions can contribute to poor air quality, it is not considered necessary to undertake any more assessment than is already proposed for the air quality assessment in Chapter 14 of this EIAR.	<ul style="list-style-type: none"> Population. Human Health. Biodiversity. Hydrology. 	Yes - Chapter 12: Air Quality	No
Extreme cold weather	Yes	The proposed development does not have the potential to cause such an event. The detailed design of the proposed development will be in accordance with the relevant codes and standards, including <i>EN 1991-1-5:2003 Eurocode 1 – Actions on structures: General actions - Thermal actions</i> .	N/A	N/A	No

Hazard Type	Relevant for Long list?	Why? (note if risk to the project, or project exacerbates risk)	Potential Receptors	Already covered in relevant EIAR Chapter?	Progress to Stage 3?
Space Disasters					
Impact events and airburst	No	The proposed development is considered to be no more vulnerable to impact events and airburst than any other development.	N/A	N/A	No
Solar flare	No	The proposed development is considered to be no more vulnerable to solar flare than any other development.	N/A	N/A	No
Industrial accidents					
Accidents at Seveso Sites	Yes	There is a risk of fire / explosion and equipment / infrastructure failure at nearby Seveso sites, namely Intel at Collinstown Industrial Park, adjacent to the proposed development.	<ul style="list-style-type: none"> Population. Human Health. Material Assets Non-Agriculture . 	Yes – Chapter 23 Human Health	Yes
Crime / Civil Unrest					
Crime or Civil Unrest	No	No more vulnerable than any other developments.	N/A	No	No
Cyber attacks	Yes	No more vulnerable than any other developments.	N/A	No	No
Terrorism	Yes	No more vulnerable than any other developments.	N/A	No	No
Security Incidents on Trains	Yes	Incidents of anti-social behaviour can occur on public transport, including the rail network. With frequency of trains increasing as part of the proposed development, there is an increased risk of security incidents.	N/A	Yes – Chapter 23 Human Health	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 development 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	No
Animal and Plant disease	Yes	There will be no risk of spread of invasive species during the operation phase of proposed development. If a staff member identifies an invasive alien species along the railway line, measures outlined in following Iarnród Éireann guidelines will be adhered to: <ul style="list-style-type: none"> Iarnród Éireann CCE -TEB –2012–008 Identification and Control of Giant Hogweed Iarnród Éireann CCE-TEB-2013–3 Guidance on the Identification and Control of Japanese Knotweed 	<ul style="list-style-type: none"> Human Health. Biodiversity. Material Assets Non-Agricultural. Material Assets Agricultural. 	Yes – Chapter 8 Biodiversity	No

24.4.3 Stage 3 – Assessment

Stage 3 of the assessment requires more detailed consideration of the short list of major events developed during Stage 2, though this may only mean that the risk needs to remain on the design risk register until it is closed out through design. Major events that were included on the short list and which have subsequently been considered in more detail are presented in Table 24-6.

Table 24-6 Assessment of Remaining Risks Associated with Proposed Development

No.	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 PHASE								
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. 	4 – Likely	3 – Significant	12 – Medium	Yes – to achieve ALARP
C2	Train accident / derailment	<ul style="list-style-type: none"> Works on and adjacent to a live rail line. Falling objects onto the train / rail track from construction works. 	<p>Train accident / derailment which can result in:</p> <ul style="list-style-type: none"> Death / injury to a member of the public. Delays and congestion along the rail network. Property damage. 	<ul style="list-style-type: none"> Scheduling of works outside of operational times of rail services and freights i.e., night time works as identified in Chapter 5 Construction Strategy. Complete possession of rail line when works at, or near the rail line need to be carried out at daytime Chapter 5 Construction Strategy. 	2 – V. Unlikely	3 – Significant	6 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.
C3	Accidents when working with electrical equipment and / or in vicinity of rail line	<ul style="list-style-type: none"> Installation of OHLE equipment. Working at or near live railway line (diesel powered or electrical). 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 can lead to injury or death. 	<ul style="list-style-type: none"> Appropriate training will be provided for installing OHLE equipment. Implementation of measures set out in IÉ standards and guidelines for working on or in vicinity of rail 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 Electrified Lines. Implementation of measures set out in codes and standards for installation of electrical equipment: 	3 – Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.

No.	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"> 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 				
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 electrification which can lead to serious injury or death. 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. 	<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 have been identified. 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. In bridge deck reconstructions, where interactions are located, these utilities will undergo decommissioning, followed by replacement of pipes, and later diverted appropriately. Any utilities to be diverted will comply to guidelines below: <ul style="list-style-type: none"> Irish Water Code of Practice for Water Infrastructure. Irish Water Code of Practice for Wastewater Infrastructure. Gas Network Ireland Code of Practice. ESB Code of Practice. 	3 – Unlikely	2 – Moderate	6 - Low	No – mitigation by design achieves ALARP and will not lead to MADs.
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 	<ul style="list-style-type: none"> Risk of proposed building e.g., Spencer Dock station / depot or structure e.g., level crossing replacement infrastructure collapsing, resulting in injury or 	<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 	2 – V. Unlikely	4 – V. Significant	8 – Medium	Yes - to achieve ALARP.

No.	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"> buildings of architectural significance. Works within the Connolly Station vaults. Demolitions of existing buildings and bridges is an activity with structural collapse risk. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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. 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. 				
C6	Ground Collapse	<ul style="list-style-type: none"> Deep excavations to construct a new station at Spencer Dock 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.
C7	Release of asbestos	<ul style="list-style-type: none"> Demolition of buildings 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 containing materials and the subsequent exposure of the material to the general public. 	<p>Prior to any works, demolition surveys will be carried out.</p> <p>In buildings where traces of asbestos have been found, a remedial strategy will be developed prior to any construction and demolition works.</p>	3 – Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.
C8	Fire / explosion	<ul style="list-style-type: none"> The proposed development 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). 	<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. 	<ul style="list-style-type: none"> All construction compounds and construction sites will have appropriate fencing. 	2 – V. Unlikely	5 – Profound	10 - Medium	Yes - to achieve ALARP.

No.	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"> Electrical accidents (as discussed under C6). Construction works requiring hot work e.g., cutting, welding, soldering. 	<ul style="list-style-type: none"> Theft of explosive / flammable material. 					
C9	Works near surface and groundwater bodies	<ul style="list-style-type: none"> Unknown groundwater level or regime. An uncontrolled breach of the canal during construction. Failure of temporary cofferdams or similar could release very large quantities of water. The excavations for the underpass, associated drainage, 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"> Preliminary assessments of the geotechnical risks associated with the proposed development will be developed further as the project evolves, aiding the identification of items for investigations and design mitigation. The various investigations conducted to date to characterise the site including the advance geophysical survey and ground investigation contract prior to construction works. 	3 –Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.
C10	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 (Intel at Collinstown Industrial Park) 	<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 are 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.
C11	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. 	<ul style="list-style-type: none"> Extreme flood events can lead to: Hazardous working conditions for workers. Flooding on construction sites, specifically within high flood risk areas such as the depot lands and Docklands. Breach of embankments on nearby waterbodies, particularly the Royal Canal and Lyreen Stream. Damage of construction materials, collapse of temporary and permanent structures. 	<ul style="list-style-type: none"> Works for the Spencer Dock station will occur in an area which is effectively defended to the 1 in 1000 year Coastal / fluvial event. 	4 - Likely	3 – Significant	12 – Medium	Yes- to achieve ALARP.

No.	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"> Extreme / prolonged rainfall events over open or deep excavations. An uncontrolled breach of the Royal Canal during construction or failure of temporary cofferdams or similar could release very large quantities of water. 	<ul style="list-style-type: none"> Sediment runoff / release of contaminants into watercourses from construction sites, specifically those within high flood risk areas e.g., the depot. An uncontrolled breach of the Royal Canal during construction or failure of temporary cofferdams or similar could release very large quantities of water. 					
C12	Groundwater Contamination	<ul style="list-style-type: none"> Ground disturbance activities which has the potential to accidentally damage / contaminate unknown water abstraction points such as boreholes, wells and aquifers. Contamination of surface water. pumping and release of groundwater at Spencer Dock. 	<ul style="list-style-type: none"> Contamination of public drinking water supply. 	<ul style="list-style-type: none"> Geophysical and rotary coring surveys have been carried out to determine the groundwater table level along the extents of proposed development. Local Authorities have been consulted to identify any private boreholes / wells within 1km of the proposed development. Further geophysical surveys and ground investigation surveys will be undertaken during detailed design stage prior to construction. 	2- Ext. Unlikely	3 - Significant	6 - Low	No – mitigation by design is sufficient
C13	Spillage or long-term seepage of pollutants into a watercourse	<ul style="list-style-type: none"> Works near and over watercourses, specifically over the Royal Canal and rechanneling of Lyreen Stream. 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. 	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.	3 – Unlikely	3 – Significant	9 – Medium	Yes – to reach ALARP
C14	Animal and Plant Disease	<ul style="list-style-type: none"> Presence of invasive species at construction sites and compounds. 	<ul style="list-style-type: none"> Spread of invasive species during construction works. 	Ecological site surveys have been carried out along the extents of proposed development to identify any invasive species present. Invasive Species Management Plan has been prepared to avoid the spread of invasive species.	3 – Unlikely	2 – Moderate	6 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.

No.	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		
C15	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 contracted at any location. Shortage of workers on construction sites due to illness can impact the construction programme. 	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.
OPERATION PHASE								
O1	Major Road Traffic Accidents	<ul style="list-style-type: none"> Presence of new road infrastructure such as bridge structures, junction arrangements, closure of level crossings. 	<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 design of new / modification to existing road network is compliant with: <ul style="list-style-type: none"> TII's DMRB DN-REQ-03034 <i>The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges</i> IE's CCE-TMS-410 Civil Engineering Structures Design Standard Eurocode I.S. EN 1990 Basis of structural design. 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>. The design of the new road infrastructure has taken into consideration the existing and future traffic figures. Road safety features have been included in the design of the level crossing replacement infrastructure to include segregation between pedestrians / cyclists and the vehicular traffic. Closure of the six level crossings removes the interface between road and rail traffic and may improve road safety for all road users. 	2 – Likely	2 – Moderate	4 - Low	No – mitigation by design achieves ALARP and will not lead to MADs.

No.	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		
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, communications). Collapse of new structures onto the rail track. Obstruction along the railway line Vehicles striking rail structures such as bridges, level crossings etc. New track installation on approach to Spencer Dock station 	<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"> Limited stretches of new track installation will be required as the proposed development will reuse the existing operational railway line between Dublin to Maynooth / M3 Parkway. New rail tracks have been designed to the IÉ and European standards providing for derailment protection and containment where required. For instance, due to tight radii curves on the approach to the new Spencer Dock Station and to protect bridge piers, derailment containment will be provided on the approach to the station. All new structures, such as overbridges proposed at Coolmine, Porterstown, Clonsilla and Barberstown are located a minimum of 4.5m from the closest running edge of the railway which will mitigate the risk of a derailed train impacting the structure. The proposed development will be designed to withstand extreme weather events such as wind, rainfall, flooding, temperature etc.) including climate change allowances. All equipment that has Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI) to be used will be in accordance with EU standards. 	2 – V. Unlikely	5 - Profound	10 – Medium	Yes - to achieve ALARP.
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 within 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 Section 4.2.18 'Protective provisions against electric shock' I-ETR-4004 'Electrification clearances'. Operation of Electrical Installations IEC 62236 Railway applications - Electromagnetic compatibility 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</p>	3 – Unlikely	2 – Moderate	6 - Low	No – mitigation by design achieves ALARP and will not lead to MADs.

No.	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		
				along the rail corridor to eliminate the risk of OHLE coming into contact with members of the public.				
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 structures proposed as part of the development. 	<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"> IE's CCE-TMS-410 Civil Engineering Structures Design Standard. Eurocode I.S. EN 1990 Basis of structural design. 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 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. Compliance with material standards to include, but are not limited to, the following: <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. 	2 – V. Unlikely	3 – Significant	6 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.

No.	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		
O5	Building Failure / Fire	<ul style="list-style-type: none"> Operation of the proposed Spencer Dock Station and depot. 	<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. 	<ul style="list-style-type: none"> The design of the Spencer Dock Station, Connolly Station and the depot complies with guidelines / standards that include, but are not limited to the following: <ul style="list-style-type: none"> I.S. EN 1990:2002 (Eurocode 0) – Basis of the structural design. I.S. EN 1990:2002/A1:2005 (Eurocode 0) – Basis of the structural design. I.S. EN 1991-1-1:2002 (Eurocode 1, Part 1-1) – Actions on structures – General actions - Densities, self-weight, imposed loads. I.S. EN 1991-1-2:2002 (Eurocode 1, Part 1-2) – Actions on structures – General actions – Actions on structures exposed to fire. Iarnród Éireann Standards IE-STR-6310 – Civil Engineering Structures Design Standard. Irish Building Regulation Technical Guidance Document A. Structure 1997 (2005). Guidance for fire precautions on existing British rail surface stations. February 1993. Irish Building regulations. Technical Guidance Document. Part B. 2006 In relation to fire, the design of proposed buildings is compliant with the following guidelines and standards: <ul style="list-style-type: none"> CEN/TS 54:14 Fire detection and fire alarm systems. Part 14. Planning, design installation, commissioning, use and maintenance. IS 3218 Fire detection and alarm systems for buildings - System design, installation, commissioning, servicing and maintenance & Amendment 1:2019 S.I. 299/2007 Statutory Instrument Safety, Health and Welfare at Work (General Application) Regulations 2007. I.S. EN 1992-1-2:2005 (Eurocode 2, Part 1-2) – Design of concrete structures – General Rules. Structural Fire Design. 	2 – V. Unlikely	4 – V. Significant	8 – Medium	Yes - to achieve ALARP.

No.	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 1993-1-2:2005 (Eurocode 3, Part 1-2) – Design of steel structures. General Rules. Structural Fire Design I.S. EN 1996-1-2:2005 (Eurocode 6, Part 1-2) – Design of masonry structures. General Rules – Structural fire design. <p>The above list is non-exhaustive.</p>				
O6	Tunnel Failure / Fire	<ul style="list-style-type: none"> Operation of the underpass under the rail line at Ashtown. 	<ul style="list-style-type: none"> In event of an underpass collapse, there is a risk of death or injury to staff and / or members of the public. There is a risk of train derailment in the event of collapse of the underpass. 	<ul style="list-style-type: none"> The design of the underpass at Ashtown complies with the IÉ / TII DMRB codes of practice and guidance documents and other standards to include: <ul style="list-style-type: none"> Eurocode I.S. EN 1990 Basis of Structural Design. I.S. EN 1992-2 <i>Design of concrete structures – Concrete bridges – Design and detailing rules (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> IÉ's CCE-TMS-410 <i>Civil Engineering Structures Design Standard.</i> TII's DMRB DN-REQ-03034 <i>The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges.</i> <p>The above list is non-exhaustive.</p>	1 Ext. Unlikely	4 – V. Significant	4 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.
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, communications). Disruption to rail transportation network. Power outage within new structures such as the Spencer Dock Station and the depot. 	<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 and will not lead to MADs.

No.	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		
O8	Members of the public falling or jumping from overbridges	<ul style="list-style-type: none"> Construction of new overbridge structures over the railway line and the Royal Canal. 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 design of new overbridges complies with the regulatory requirement for safety of pedestrians as detailed in TII's DMRB DN-REQ-03034 <i>The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges</i>. New overbridge structures will include parapets over the railway that are a minimum of 1.8m high and of solid construction to prevent the public gaining access to the railway and the OHLE. Fencing along the railway line will be developed in accordance with Iarnród Éireann CCE-TRK-SPN-037 <i>Fencing Specification</i>. 	1 -Ext. Unlikely	5 – Profound	5 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.
O9	Extreme weather (flood) events	<ul style="list-style-type: none"> Extreme flooding causing breach of embankments of watercourses, specifically the Royal Canal flooding the railway line. Extreme or prolonged rainfall events flooding the railway line. New structures such as the depot affecting the flood patterns in the area. 	<ul style="list-style-type: none"> Construction of depot and associated infrastructure 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. Flooding of new structures such as Spencer Dock station and the depot. 	<ul style="list-style-type: none"> Construction of compensatory storage areas on lands adjacent to the depot. These areas will store excess water during extreme or prolonged flood events to reduce impact on surrounding agricultural land / property. New infrastructure has been designed to include allowances for climate change. Drainage design includes allowances for climate change. Stormwater attenuation tank has been included in the design at Spencer Dock Station. Track lowering has been avoided at locations prone to flooding. 	3 – Unlikely	3 – Significant	9 –Medium	Yes - to achieve ALARP.
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 on structures – general actions - Wind actions</i>. Iarnród Éireann have a management protocol for preparedness and response to extreme weather events such as CCE-TMS-311 Iarnród Éireann 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, Iarnród Éireann have a management protocol to facilitate passenger services being brought back into 	3 – Unlikely	2 – Moderate	6 - Low	No – mitigation by design achieves ALARP and will not lead to MADs.

No.	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		
				operation as quickly and safely as possible after an extreme weather event.				
O11	Lightning Strikes	<ul style="list-style-type: none"> The proposed development does not have the potential to cause such an event. OHLE equipment along the extents of the proposed development 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+ West OHLE equipment against atmospheric overvoltage protection, lightning and switching overvoltages, 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+ 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 62305 Protection against lightning and BS 7430 Code of practice for protective earthing of electrical installations will be complied with. 	2 – V. Unlikely	2 – Moderate	4 - Low	No – mitigation by design achieves ALARP and will not lead to MADs.
O12	Industrial Accidents – Accidents at Seveso Sites	<ul style="list-style-type: none"> Fire / explosion and / or equipment failure at the Intel, Seveso industrial site in Collinstown Industrial Park 	<ul style="list-style-type: none"> Damage to the railway line Risk of injury or death and environmental impact. 	There are 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.
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 IE's security contractor and An Garda Síochána. The Iarnród Éireann's Text SMS Service² 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. 	4 - Likely	1 - Slight	4 – Low	No – mitigation by design achieves ALARP and will not lead to MADs.

² Iarnród Éireann ONLINE Available At <https://www.irishrail.ie/en-ie/faqs/how-do-i-use-the-anti-social-behaviour-text-servic> [Accessed 18.05.2022]

Table 24-7 Assessment of Major Accidents and Disasters 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
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"> Groundwater extraction will be required prior to construction works, specifically to enable the construction of the underground station at Spencer Dock. Continuous monitoring of groundwater levels, earthworks. Pump tests will be carried out prior to pumping of the groundwater. 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 EIAR Chapter 14 Noise and Vibration will be adhered to. 	3 – V. Unlikely	3 – Significant	6 - Low
C6	Ground Collapse	<ul style="list-style-type: none"> Human Health. Material Assets Non-Agricultural. 	<ul style="list-style-type: none"> Groundwater extraction will be required prior to construction works, specifically to enable the construction of the underground station at Spencer Dock and the underpass at Ashtown. Continuous monitoring of groundwater levels and earthworks will be carried out. 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
C8	Fire / explosion	<ul style="list-style-type: none"> Human Health. Population. Material Assets Non-Agricultural. 	<ul style="list-style-type: none"> The risk is managed through the CEMP, Environmental Operating Plan (EOP) 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. 	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)
		<ul style="list-style-type: none"> Architectural Heritage. 	<ul style="list-style-type: none"> 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. 			
C10	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 development 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. 	2 – V. Unlikely	3 - Significant	6 - Low
C11	Extreme Weather (Flooding) 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"> As is normal practice with infrastructure projects, an Environmental Operating Plan (EOP) and Construction Environmental Management Plan (CEMP) will be prepared for the proposed development. An Incident Response Plan (see Appendix F of Appendix A5.1 in Volume 4 of this EIAR) will be prepared as part of the CEMP detailing the procedures to be undertaken in the event of flood risks that can lead to pollution events. Monitoring of weather forecasts to ensure that necessary actions will be implemented in time at construction sites prior to prolonged / extreme weather events. Continuous monitoring of water levels in the Liffey Estuary and Lyreen Stream. 	3 – V. Unlikely	2– Significant	6 - Low
C13	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, an EOP and CEMP will be prepared for the proposed development. An Incident Response Plan (see Appendix F of Appendix A5.1 in Volume 4 of this EIAR) 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 EOP to be undertaken on, over or near water in consultation with Inland Fisheries Ireland (IFI) and other relevant authorities. Implementation of mitigation measures identified in Chapter 8 Biodiversity, Chapter 10 Water (including Hydrology & Flood Risk), 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"> <i>Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites</i> (Eastern Regional Fisheries Board) <i>Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers.</i> <i>CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors.</i> <i>CIRIA C648 Control of Water Pollution from Constructional Sites.</i> <i>Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (TII, 2006).</i> 	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)
C14	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 work places to reduce the spread of the virus amongst the construction workers. 	2 – V. Unlikely	3 - Significant	6 - Low
OPERATION PHASE						
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. All relevant staff members shall familiarise themselves with Section Z Electrified Lines of the IÉ Rule Book prior to operating the 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+ 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 rail 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 Design measures for the DART+ 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
O5	Building Failure / Fire	<ul style="list-style-type: none"> Human Health. Population. 	<ul style="list-style-type: none"> A Fire Strategy has been prepared for the Spencer Dock Station and Connolly Station. The Fire Strategies for both buildings have been approved by the Dublin Fire Brigade the measures in which will be implemented in event of a fire. A Fire and Evaluation Performance Based Design was prepared for the proposed depot. The design was approved by the Kildare Chief Fire Officer, the measures in which will be implemented in event of a fire. 	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. 	<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 compensatory storage areas. A dedicated Major Incident Response Plan has been developed by Iarnród Éireann for the DART+ West project to identify the appropriate emergency response plans in event of flooding. 	3 – V. Unlikely	3 - 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"> Hydrology. Hydrogeology. 				
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 development 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. 	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 DART+ West 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

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