Chapter 19
Major Accidents and Disasters

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19. MAJOR ACCIDENTS AND DISASTERS

19.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) assesses the potential risk of 'major accidents and disasters' arising from construction and operational phase activities for the West Clare Railway Greenway Section 1: Kilrush to Kilkee (hereafter referred to as the 'proposed development').

Close co-ordination and discussion between the EIA team has informed the preparation of this chapter to ensure that the major accidents and disasters identified are adequately assessed.

This chapter contains the applicable legislation and guidance used to prepare this chapter (Section 19.2), sets out the methodology adopted to assess the risk of major accidents and disasters (Section 19.3) and finally details the potential of the proposed development to cause major accidents and disasters ('MADs' hereafter), and its vulnerability to MADs during the construction and operational phase (Section 19.4).

This chapter should be read in conjunction with:

- Chapter 4 Description of the Proposed Development.
- Chapter 5 Traffic and Transportation.
- Chapter 6 Population
- Chapter 7 Human Health.
- Chapter 8 Biodiversity.
- Chapter 9 Land and Soils.
- Chapter 10 Hydrology.
- Chapter 11 Hydrogeology.
- Chapter 12 Air Quality.
- Chapter 13 Climate.
- Chapter 14 Noise and Vibration.

19.2 Legislation, Policy and Guidance

19.2.1 Legislation

Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/54/EU ('the EIA Directive' hereafter) mandates the consideration of MADs in EIA.

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."*

19.2.2 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 legalisation:

- 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).

19.2.3 Guidance

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

- Institute of Environmental Management and Assessment (IEMA) (2020) *Major Accidents and Disasters in EIA: A Primer*.
- EPA (2015b) *Draft Advice Notes for Preparing Environmental Impact Statements*.
- EPA (2022) *Guidelines on the Information to be contained in Environmental Impact Assessment Reports*.
- Department of the Taoiseach (2017) *National Risk Assessment 2017: Overview of Strategic Risks*.
- Department of Defence (2017) *A National Risk Assessment for Ireland 2017*.
- Government of Ireland (2020) *A National Risk Assessment for Ireland 2020*.
- EPA (2014) *Guidance on Assessing and Costing Environmental Liabilities*.
- Department of Environment, Heritage and Local Government (DoEHLG) (2010) *A Guide to Risk Assessment in Major Emergency Management*.
- Health and Safety Authority (HAS) (2022) *Guidance on Technical Land-use Planning Advice for Planning Authorities and Operators of Establishments under the COMAH establishments, Revision 2*.
- National Disability Authority (2011) *Safe Evacuation for All: A Planning and Management Guide*.
- Clare County Council (2018) *Major Emergency Plan*.

Transport Infrastructure Ireland's (TII's) strategies, procedures and reports:

- TII's Business Continuity Management – Process, Plans and Teams.
- TII's Business Continuity Plans.
- TII's Incident Management Plans.

19.3 Methodology

19.3.1 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 Sustainability and Environmental Professionals (ISEP, formerly 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 (now ISEP) (2020), 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. As per Table 19-1 below, risks that have a High likelihood of occurring and of High consequence will be assessed, as well as those that have a Low likelihood of occurring, that would have a High consequence.

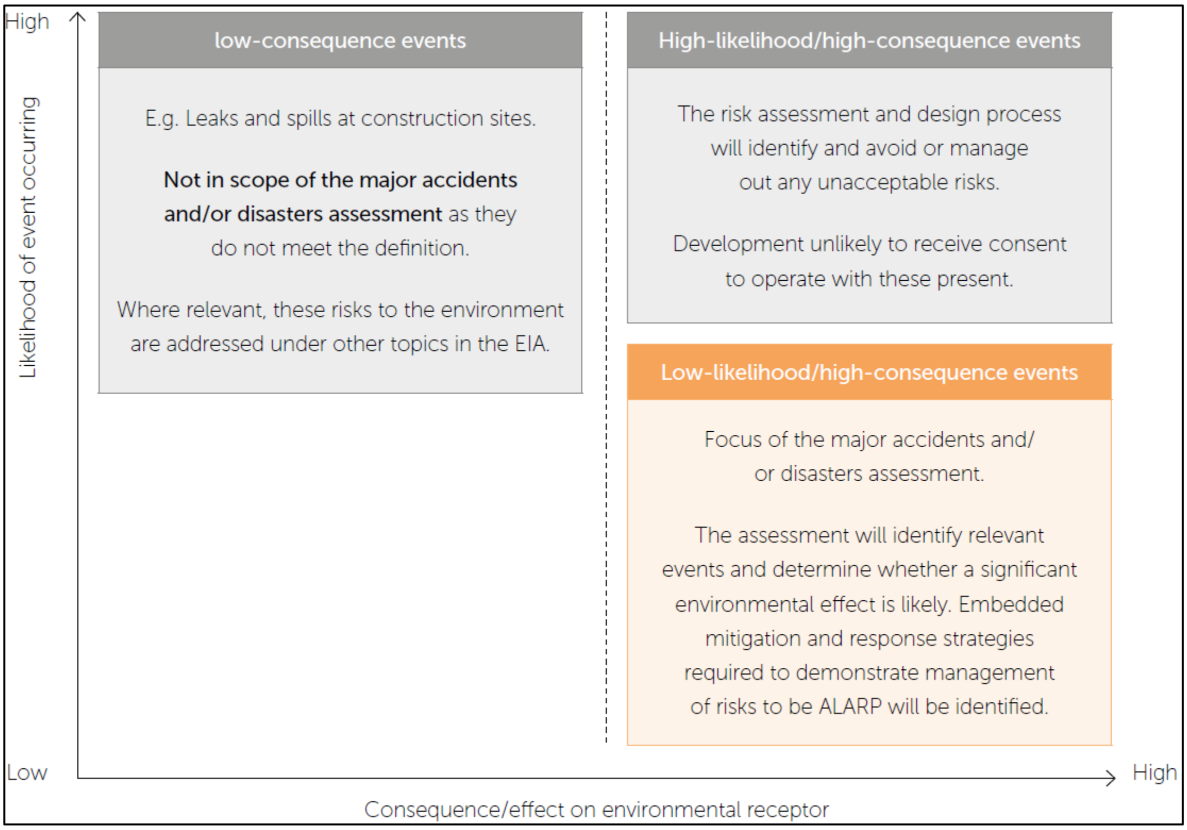

Plate 19-1 Summary of risk events considered in the scope of the impact assessment in relation to MADs (IEMA, 2020)

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 19-3 for further detail.

19.3.2 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 19-1 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)

Term	Definition	Source
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: • 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: • 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)

19.3.2.1 Receptors

The assessment of significant adverse effects considers all environmental factors defined in Article 3 of Directive 2011/92/EU, as amended. For the purpose of this assessment, an environmental receptor is therefore considered to be any of the following relevant receptors:

- Infrastructure and the built environment;
- Public health;
- 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.

19.3.3 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.

19.3.3.1 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?

19.3.3.2 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.

IEMA provide a useful infographic illustrating the scoping decision process to aid at this stage (Plate 19-2).

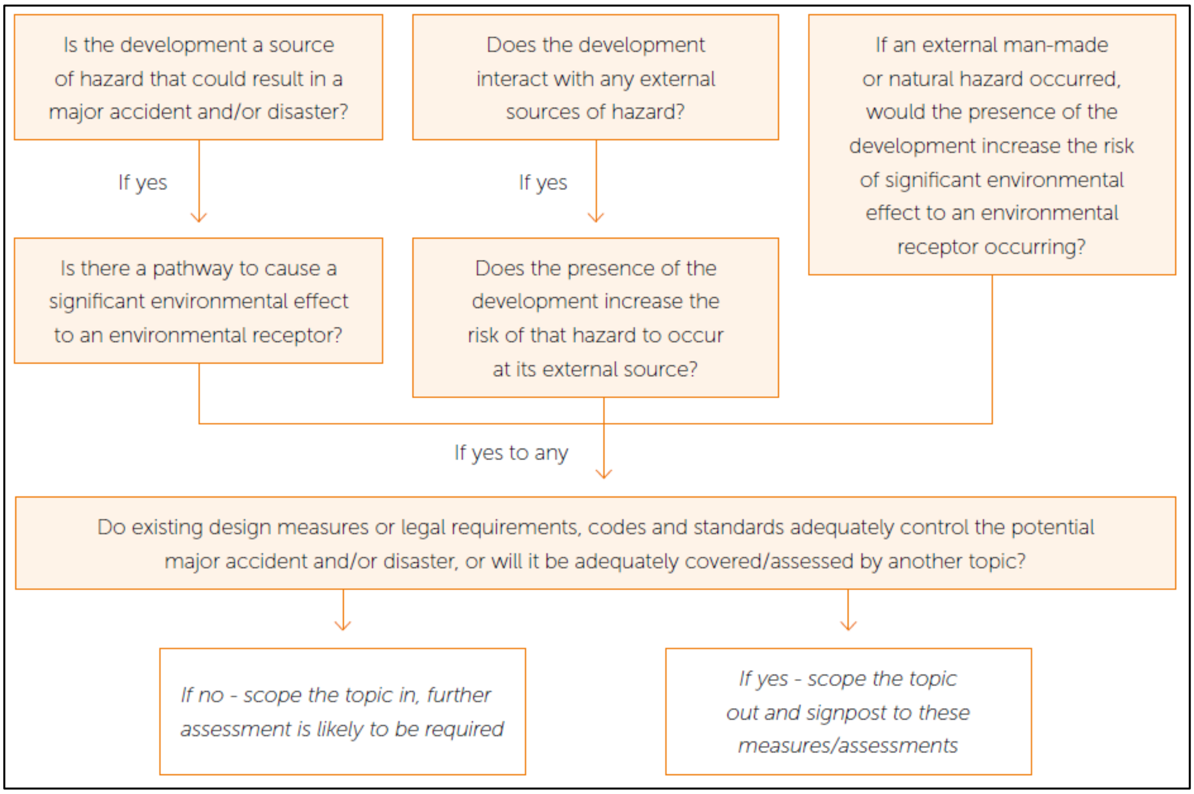

Plate 19-2 Scoping decision process flow (IEMA, 2020)

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."* (IEMA, 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).

19.3.3.3 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) is identified and it is determined whether it is sufficient to mitigate the associated risk level(s) to be ALARP.

If, after all of the above-stated exercises have been carried out, there remains 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 19-2 and Table 19-3 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 19-2 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 19-3. Significant impacts resulting from MADs are adverse impacts that are described as 'Significant', 'Very Significant' or 'Profound' under the EPA Guidelines (EPA 2022).

Table 19-3 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	• 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	• 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	• 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	• 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	• 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 19-5) 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 19-4:

- 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 19-4 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 19-6. As per Plate 19-1, 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 19-7, and re-evaluated to take into consideration the secondary mitigation measures proposed.

19.3.4 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).

19.3.5 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 they have informed this assessment as appropriate.

19.3.6 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 include:

- Public Consultation 1 (September 2021).
- Public Consultation 2 (September 2022).
- Public Consultation 3 (March 2024).
- Non-statutory EIA Scoping Report (January 2026).

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

19.3.7 Difficulties Encountered/ Limitations

There were no difficulties encountered when completing this chapter.

19.4 Description of Potential Impacts

19.4.1 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.

19.4.2 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 from long list of events to sift down to short-list is documented in Table 19-5.

Table 19-5 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 road traffic accidents occurring during construction stage along haulage routes due to increased levels of light Vehicles (LV), Cranes, and Heavy Goods Vehicles (HGVs) on motorways and urban roads. Without appropriate mitigation measures, the proposed works have the potential to lead to a negative impact on the road network including: • Delay and disruption to road users, especially on the N67; • Road safety issues should the construction works not be carried out in line with good traffic management practices; • Inappropriate parking of construction related vehicles along the route of the works; • Soiling of public roads leads to general lack of cleanliness and poor skid resistance on roads.	• Biodiversity. • Hydrology. • Population and Human Health. • Material Assets and Land.	Yes – Chapter 5 Traffic and Transportation Chapter 6 Population.	**No**
Accidents when working with electrical equipment	No	There is a potential risk of accidents involving electrical equipment as construction stage will involve electrically powered tools and potential interaction with existing underground or overhead services. However, the project is not at greater risk than any typical development of this nature. It is very unlikely that the public will encounter the electrical equipment as they will be stored appropriately within the construction areas and compounds.	• Population and Human Health	No	**No**
Infrastructure					
Impact on Critical Infrastructure	Yes	The construction activities may result in the disturbance or interruption of services such as water, power and other utilities. The magnitude of impact will be influenced by the type of disturbance and the duration involved. These impacts are generally of a temporary to short term duration being limited to the extent of construction works. There are a number of utilities within and surrounding the proposed development including water supply mains, telephone connections and existing ESB overhead lines. There are no known public utilities along the route of the proposed development that will need to be diverted.	• Population and Human Health • Material Assets and Land	Yes – Chapters 16 & 17 Material Assets and Land	**Yes**

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?
Collapse / Damage to structures	Yes	There are buildings and bridge structures in the vicinity of the proposed construction works. Works on existing structures will likely be required. There is a risk of structures to be damaged during the adjacent works or when works are to be carried out on structures.	• Population and Human Health • Material Assets and Land	Yes – Chapter 6 Population and Human Health Chapters 16 & 17 Material Assets and Land	**Yes**
Construction Accidents					
Ground Collapse	Yes	The proposed development consists predominantly of earthworks, structures and greenway pavement construction. The construction works could increase the risk of ground collapse and thus increase the potential for related impacts on population and human health. Since the Greenway will predominantly follow the route of the old railway and associated embankments, minimal earthworks are required.	• Population and Human Health • Material Assets	No	**No**
Release of asbestos	Yes	The proposed development will not require the demolition of buildings and will therefore not involve the potential disturbance of asbestos. There may be illegal dumping of asbestos waste encountered along the route during construction, however this would be managed in accordance with the Resource and Waste Management Plan for the project, The proposed development is considered no more vulnerable than any other development.	• Human Health	No	**No**
Fire / explosion	Yes	The proposed development will require the use of flammable substances such as fuel storage areas at construction compounds. However, the proposed development is no more vulnerable than any other development.	• Population and Human Health. • Material Assets and Land.	No	**No**
Works near surface and groundwater bodies	Yes	The proposed development consists of works near and over waterbodies including Dough, Lisluinaghan, Garraun, Lismuse, Mouth of Shannon (coastal waterbody), and Kilrush (ground waterbody). Poulnasherry Bay is located directly adjacent to much of the proposed development and is hydrologically connected to the proposed development. Works near water pose a potential health and safety risk to construction workers and the general public.	• Population and Human Health. • Hydrology. • Biodiversity.	Yes – Chapter 6 Population and Human Health Yes – Chapter 9 Hydrology	**Yes**

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?
Industrial Accidents					
Industrial Accidents (works near Seveso site)	Yes	There is 1 Seveso Site located within 10km of the proposed development, Money Point power station, which is an upper tier establishment The Seveso site is located approximately 6.4km from the proposed development. Works are not likely to cause damage to the Seveso site in an event of an accident. Due to the distance from the site to the proposed development works, an explosion / fire from the Seveso site is very unlikely to present a risk to the development and construction workers.	• N/A	N/A	**No**
Hydrological Disasters					
Extreme Weather (Flooding) Events	Yes	Both the vulnerability of the project to flooding, and its potential to exacerbate flooding have been assessed in the EIAR, both in terms of the risk to the proposed development and increased risk due to the proposed development. The proposed development traverses areas which may be liable to flooding. The greatest risk to the proposed development comes from coastal flooding. 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.	• Biodiversity. • Material Assets and Land. • Population and Human Health. • Hydrology. • Hydrogeology	Yes – Chapter 9 Hydrology	**Yes**
Groundwater Contamination	Yes	The proposed development will require ground disturbance activities which have the potential to accidentally damage / contaminate water abstraction points such as boreholes, wells and aquifers in the vicinity of the proposed development.	• Human Health. • Population. • Hydrology. • Hydrogeology. • Biodiversity	Yes – Chapter 10 Hydrogeology Chapter 8 Land and Soils	**Yes**

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?
Spillage or long-term seepage of pollutants into a watercourse	Yes	The proposed development consists of works near and over waterbodies including Dough, Lisluinaghan, Garraun, Lismuse, Mouth of Shannon (coastal waterbody), and Kilrush (ground waterbody). Poulnasherry Bay is located directly adjacent to much of the proposed development and is hydrologically connected to the proposed development. There is a risk of pollution to the watercourses crossed by the proposed development and to waterbodies downstream of the proposed development including Poulnasherry Bay. During the construction phase, surface water runoff, or flood events could mobilize sediment or pollutants and carry them to downstream waterbodies. While standard measures to prevent pollution to watercourses will be utilized throughout the construction period, the use of concrete and machinery may result in accidental pollution events via cementitious materials and fuel entering the watercourses. Additionally, dust arising from construction works could lead to sedimentation in the watercourses. Such events could result in sediment and pollutants entering the watercourses or Poulnasherry Bay.	• Population and Human Health. • Hydrology. • Hydrogeology. • Biodiversity. • Soils and Geology.	Yes - Chapter 7 Biodiversity and Chapter 9 Hydrology	**Yes**
Disease					
Animal and Plant disease	Yes	Invasive plants, including species listed on the Third Schedule to the Habitats Regulations, but also other species which can negatively impact biodiversity were recorded during the habitat surveys. The construction of the proposed development could cause invasive species to be spread within and outside the site. Construction activities could aid the spread of invasive species within the site, into the surrounding area and to further afield. In the absence of control measures, these species may be inadvertently spread during construction, through the movement of equipment and contaminated soil to and from the site. Machinery or materials contaminated with invasive species from other locations could lead to the introduction of other invasive species to the location of the proposed development	• Biodiversity	Yes - Chapter 7 Biodiversity	**Yes**
Human disease	Yes	People with health conditions living in proximity to the construction site are considered to be vulnerable to changes in the environment as they may require specific support or facilities. They have greater sensitivity to air pollution and potential effects on the respiratory system and cardiovascular system. Some subtle changes in the environment have the potential to have an adverse effect that would not be experienced by a younger, more resilient person. Other vulnerable groups also include the mobility impaired or mentally ill. The proposed development is no more vulnerable than any other development.	• Human Health	Yes - Chapter 6 Human Health	**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?
OPERATION PHASE					
Transport					
Major Road Traffic Accidents	Yes	During the operational phase, the completed Greenway is expected to generate car-based trips. Operational traffic volumes are estimated to be low. The greenway is not expected to generate any significant heavy vehicle (HGV) traffic. Vehicle movements will primarily consist of light vehicles associated with visitors accessing the trailhead car parks. It is conceivable that a road traffic accident could occur on the adjoining roads with the Greenway, or as a result of vehicular use along the Greenway during maintenance or emergency access. However, overall, it is considered that the design and operational phase procedures of the proposed development are such that the level of risk associated with such an event is mitigated to a tolerable level.	• Population and Human Health. • Hydrology. • Biodiversity.	Yes - Chapter 5 Traffic and Transportation	**No**
Electrical Accidents	Yes	It is very unlikely that the public will come in contact with the electrical equipment as electrical equipment along the greenway will not be required beyond the construction phase.	• Population and Human Health	No	**No**
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	The development site is generally located outside of the High-Water Mark, except for works across Moyasta bridge. However, the bridge is not located in navigable waters so there is no potential for maritime disasters involving vessels or ships.	• Population and Human Health	No	**No**
Bridge Failure	Yes	The proposed development consists of works to two existing bridge structures and the construction of new bridge structures. There is a risk of bridge failure during operational phase.	• Population and Human Health	No	**Yes**
Tunnel Failure / Fire	No	There is no tunnel as part of the proposed development. There are no tunnels that would affect or be affected by the proposed development.	• N/A	N/A	**No**
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**

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?
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	No hazards of this type proposed in the operational phase.	• N/A	N/A	**No**
Power Failure	Yes	The proposed development involves the handling of electrical equipment/infrastructure, such as lighting of car parks, and traffic control systems including pedestrian crossing of N67, traffic signage, which are vulnerable to mishandling or damage risks.	• Population and Human Health	Yes	**No**
Members of the public falling or jumping from overbridges	Yes	The proposed development involves the construction of new bridge structures for the proposed greenway. There is a risk of members of the public falling or jumping from these bridges.	• Population and Human Health	No	**Yes**
Geological Disasters					
Mass Wasting	Yes	The study area includes several ground conditions that may contribute to mass waste. Blanket peat and cut over raised peat pose the greatest risk due to their low shear strength and sensitivity to saturation, making them prone to settlement and localized slippage. Till derived from Namurian sandstones and shales is generally stable but may undergo shallow failures where slopes are steep or waterlogged. Bedrock outcrops and sub crops can create abrupt changes in ground conditions, with potential for minor erosion or rockfall along exposed faces. Contaminated or previously disturbed soils may also contribute to instability, increasing their susceptibility to erosion or shallow ground movement. The development site is not prone to landslides.	• Population and Human Health	Yes – Chapter 8 Land and Soils	**Yes**
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). No account could be found of any damage to build 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**

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?
Sinkholes	No	The proposed development does not have the potential to cause such an event. There are no sinkholes (karst features) noted in the development site. The closest sinkhole site is located in Foynes.	• N/A	N/A	**No**
Volcanic Eruption	No	The proposed development does not have the potential to cause a volcanic event. There are active or dormant volcanoes in Ireland. It is geologically stable. 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	The proposed development may be liable to flooding. The greatest risk to the proposed development comes from coastal flooding.	• Population and Human Health. • Material assets and Land. • Hydrology. • Hydrogeology. • Biodiversity.	Yes – Chapter 9 Hydrology and Chapter 12 Climate	**Yes**
Spillage or long-term seepage of pollutants into a watercourse.	Yes	There is a risk of spillage from hazardous loads as a result of a road traffic accident e.g. fuel tankers. However, as these types of vehicles already use the existing roads, the proposed development will not exacerbate the risk of such an event.	• Population and Human Health. • Hydrology. • Hydrogeology. • Biodiversity.	Yes- Chapter 7 Biodiversity and Chapter 10 Hydrology	**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 greenway. However, the risk is no different from other transport developments in Ireland. The proposed development is designed to operate under a range of environmental conditions, in accordance with the relevant standards, including EN 1991-1-4 Eurocode 1: Actions on structures: general actions - Wind actions and EN 1991-1-5:2003 Eurocode 1 – Actions on structures: General actions – Thermal actions.	• Population and Human Health • Material assets and Land. • Hydrology. • Hydrogeology. • Biodiversity.	Yes – Chapter 9 Hydrology and Chapter 12 Climate	**Yes**
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 storm 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.	• Population and Human Health	No	**No**
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 detailed design will be in accordance with all relevant codes and standards (IS / BS / EN / ISO), including IS EN 62305-1 :2011, Protection against Lightning, General Principles. Accordingly, it is considered that the design of the proposed development is such that the level of risk associated with such an event will be mitigated to a tolerable level.	• Population and Human Health	No	**No**
Heat waves	No	The detailed design of the proposed development will be in accordance with the relevant codes and standards, including EN 1991-1-5:2003 Eurocode 1 – Actions on structures - General actions – Thermal actions. The proposed development detailed design will consider the effect of high temperatures; however, the proposed development will be no more vulnerable than any other development, nor is it likely 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?
Wildfires	No	There may be some potential for grassland fires, though the risk is no greater than any other development.	• N/A	N/A	**No**
Air Quality Events	Yes	The proposed development does not have the potential to cause a major air pollution event in the order of a major accident or disaster.	• N/A	N/A	**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 EN 1991-1-5:2003 Eurocode 1 – Actions on structures: General actions - Thermal actions.	• N/A	N/A	**No**
Space Disasters No					
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	The closest upper tier Seveso site is located approximately 6.4 km from the proposed development. Due to the distance from the site to the proposed development, an explosion / fire from the Seveso site is very unlikely to present a risk to the development.	• Population and Human Health • Material Assets	No	**No**
Crime / Civil Unrest					
Crime or Civil Unrest	No	No more vulnerable than any other developments.	• N/A	N/A	**No**
Cyber attacks	No	No more vulnerable than any other developments.	• N/A	N/A	**No**
Terrorism	No	No more vulnerable than any other developments.	• N/A	N/A	**No**
Disease					
Human disease	No	The proposed development does not have the potential to cause such an event.	• Population and Human Health	No	**No**
Animal and Plant disease	Yes	If invasive species are not eradicated during construction and appropriately managed during operation, the proposed development could inadvertently cause invasive species to spread during operation.	• Human Health • Biodiversity	Yes- Chapter 7 Biodiversity	**No**

19.4.3 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 19-6.

Table 19-6 Assessment of Remaining Risks Associated with Proposed Development

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
CONSTRUCTION PHASE							
Impact on Critical Infrastructure	• Impact on overhead and underground utilities.	• Damage to electrical utilities (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.	• All utility services near the proposed development have been identified. • It is likely that there are various local private connections across the greenway, and these will be protected and retained in situ during construction. • Where water and wastewater mains are located within local roads, these will be protected where they are intersected by the proposed development. • All utility companies will be consulted as part of the detailed design to ensure that no services are unexpectedly encountered during construction. • There are no known public utilities along the route of the proposed development that will need to be diverted. • Any utilities to be diverted will comply to guidelines below: ○ 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	1- Slightly	3 - Slight	**No -** mitigation by design achieves ALARP and will not lead to MADs.

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
Collapse / Damage to structures	• Works to the structures such as the new bridges and under and overpasses will be required. • Impact on residential properties by the construction of the development.	• Collapse / Damage to existing and newly constructed, resulting in injury or death to workers and the public. • Damage to adjacent occupied buildings resulting in injury or death to the general public.	The design of the proposed development will comply with design standards that include, but are not limited to, the following: • 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. The design of the proposed development will comply with material standards to include, but are not limited to, the following: • 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. A Construction Environmental Management Plan (CEMP) and Incident Response Plan (IRP) will be prepared to manage the risk of collapse / damage to structures. A preliminary CEMP and IRP are included in the appendices in Volume 4 of this EIAR.	1 – Ext. Unlikely	4 – V. Significant	4 - Low	**No** – mitigation by design achieves ALARP and will not lead to MADs.

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
Works near surface and groundwater bodies	• Potential construction spillages • Flood prone areas have the potential to exacerbate pollution events if the works area is inundated. • The excavations for the underpass, associated drainage, and below ground utilities during construction could be vulnerable to groundwater inundation and flooding.	• Death or injury to workers. • Release of large quantities of water within construction site.	• 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 CEMP and IRP to be developed for the project will include measures to manage the risk of contamination and potential flooding of works sites. A preliminary CEMP and IRP are included in the appendices in Volume 4 of this EIAR.	3 - Unlikely	2 - Moderate	6 - Low	**No** – mitigation by design achieves ALARP and will not lead to MADs.
Extreme Weather (Flooding) Events	• Weather events leading to flooding such as heavy / prolonged rainfall / tidal event. • Prolonged heavy rain / flooding directly over construction sites. • Prolonged heavy rain resulting in breach of embankments in nearby waterbodies. • Extreme / prolonged rainfall events causing sediment runoff during construction. • Extreme / prolonged rainfall events over open or deep excavations.	Extreme flood events can lead to: • Hazardous working conditions for workers. • Flooding on construction sites. • Damage of construction materials, collapse of temporary and permanent structures. • Sediment runoff / release of contaminants into watercourses from construction sites, specifically those within high flood risk areas.	• As is normal practice with infrastructure projects, an Environmental Operating Plan (EOP) and CEMP will be prepared for the proposed development. An IRP 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. A preliminary CEMP, EOP and IRP are included in the appendices in Volume 4 of the EIAR.	3 Unlikely	3 – Significant	9 - Medium	**Yes**

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
Groundwater Contamination	• Ground disturbance activities which have the potential to accidentally damage / contaminate unknown water abstraction points such as boreholes, wells and aquifers. • Contamination of surface water.	• Contamination of public drinking water supply.	• CCC and landowners have been consulted to identify any private boreholes / wells within 2km of the proposed development. • Further geophysical surveys and ground investigation surveys will be undertaken during detailed design stage prior to construction.	1 - Ext. Unlikely	3 - Significant	3 - Low	**No** – mitigation by design is sufficient
Spillage or long-term seepage of pollutants into a watercourse	• Works near and over waterbodies including Dough, Lisluinaghan, Garraun, Lismuse, Mouth of Shannon (coastal waterbody), and Kilrush (ground waterbody). • Risk of pollution to the watercourses crossed by the proposed development and to waterbodies downstream of the proposed development including Poulnasherry Bay. • Surface water runoff, or flood events could mobilize sediment or pollutants and carry them to downstream waterbodies. • Use of concrete and machinery may result in	• 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 is 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. Design mitigations include single clear span structures over river channels to avoid instream works and silt mitigation measures, reducing the risk of accidental spillage or long-term seepage or long-term spillage of pollutants into a watercourse during construction. • As is normal practice with infrastructure projects, an EOP and CEMP will be prepared for the proposed development which will detail measures to be taken on site, such as secondary containment for storage of fuel. An IRP 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,	4 - Likely	2 - Moderate	8 - Moderate	**Yes**

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
	accidental pollution events via cementitious materials and fuel entering the watercourses. • Dust arising from construction works could lead to sedimentation in the watercourses.		or other such risks that could lead to a pollution incident, including flood risks. • A preliminary CEMP, EOP and IRP are included in the appendices in Volume 4 of the EIAR.				
Animal and Plant disease	• Presence of invasive species at construction sites and compounds.	• 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. No species subject to restrictions as listed on the Third Schedule of the Birds and Natural Habitats Regulations were recorded within the study area. • A Biosecurity Protocol will be prepared to avoid the spread of aquatic invasive species. • An Invasive Species Management Plan has been developed and is included in Volume 4 of this EIAR.	3 – Unlikely	2 – Moderate	6 – Low	**No** – mitigation by design achieves ALARP and will not lead to MADs.
OPERATION PHASE							
Bridge Failure	• Bridge strike by road traffic. • Inadequate / poor design of bridge structure(s). • Poor quality of materials used for construction.	• Death or injury to staff and / or members of the public.	• All structures have been designed to be fully compliant with: ○ Eurocode I.S. EN 1990 Basis of structural design. ○ Eurocode I.S. EN 1991-2 *Actions on structures – Part 2: Traffic loads on bridges (Including Irish National Annex)*. ○ Eurocode I.S. EN 1991-1-7 Actions on structures – Part 1-7: General	2 – V. Unlikely	3 – Significant	6 – Low	**No** – mitigation by design achieves ALARP and will not lead to MADs.

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
	• New bridge structures proposed as part of the development.		actions Accidental actions (Including Irish National Annex). ○ I.S. EN 1992-2 *Design of concrete structures – Concrete bridges – Design and detailing rules (Including Irish National Annex)*. ○ 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: • 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.				
Members of the public falling or jumping from overbridges	• Construction of new bridge structures. • Changes and modifications to existing bridges including	• Risk of injury or death to the members of the public.	• The design of new bridges complies with the regulatory requirement for safety of pedestrians as detailed in TII's DMRB DN-REQ-03034 *The Design of Road Restraint Systems*	1 -Ext. Unlikely	5 – Profound	5 – Low	**No** – mitigation by design achieves ALARP and

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
	○ Moyasta rail bridge. ○ L6090 Carrowncalla river bridge.		*(Vehicle and Pedestrian) for Roads and Bridges*. • The design includes provision of safety fencing/structures have been incorporated into the preliminary design of the greenway at existing and proposed bridges.				will not lead to MADs.
Mass Wasting	• Presence of Blanket peat and cut over raised peat pose the greatest risk due to their low shear strength and sensitivity to saturation, making them prone to settlement and localized slippage • Till derived from Namurian sandstones and shales may undergo shallow failures where slopes are steep or waterlogged. • Bedrock outcrops and sub crops can create abrupt changes in ground conditions, with potential for minor erosion or rockfall along exposed faces. • Contaminated or previously disturbed soils along the old railway line may also contribute to instability, increasing their susceptibility to erosion	• Risk of injury or death to members of the public. • Risk of damage to infrastructure including the greenway, nearby local and national roads and housing / community facilities	• Minimization of earthworks • Use of floating pavement on soft ground • Use of cut materials for embankments, avoiding soil material import/export • Peat depths and stability conditions will be investigated by a qualified Geotechnical Engineer prior to construction and as part of the detail design ground investigation.	3- Unlikely	2- Moderate	6-Low	**No –** mitigation by design achieves ALARP and will not lead to MADs.

Hazard Type	Source and / or pathway receptor linkage	Reasonable worst consequence if event did occur	Mitigation by design & best practice	Risk Evaluation		Level of Significance	Secondary mitigation required?
				Likelihood	Potential Impact		
	or shallow ground movement.						
Extreme weather (flood) events	• Extreme flooding causing breach of embankments of watercourses. • Extreme or prolonged rainfall events flooding the Greenway.	• Construction of associated infrastructure on greenfield lands may affect flood patterns in the area causing more intense flooding on surrounding lands. • Flooding of the roads and surrounding areas may temporarily prevent access at this location.	• New infrastructure has been designed to include allowances for climate change, including flood risk. • Drainage includes allowances for climate change. • A Maintenance and Management Plan (MMP) will be developed which will include extreme weather management and response procedures prior to and following extreme weather events. An outline MMP is included in the appendices in Volume 4 of this EIAR.	3 – Unlikely	3 – Significant	9 - Medium	**Yes**

Table 19-7 Assessment of Major Accidents and Disasters with secondary mitigation measures in place

Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
CONSTRUCTION PHASE					
Extreme Weather (Flooding) Events	• Biodiversity. • Material Assets and Land. • Population and Human Health. • Hydrology. • Hydrogeology.	• Monitoring of weather forecasts and tidal forecasts to ensure that necessary actions will be implemented in time at construction sites prior to prolonged / extreme weather events. • Monitoring of water levels in watercourses. • Siting of construction compounds, earthworks and materials will be planned to minimise the potential for surface water runoff or contaminants entering watercourses, particularly during extreme weather events. A CEMP will be prepared detailing the procedures to be undertaken in the event of extreme weather (flooding) events.	3 – V. Unlikely	2– Significant	6 - Low
Spillage or long-term seepage of pollutants into a watercourse	• Population and Human Health. • Hydrology. • Hydrogeology. • Biodiversity. • Soils and Geology	• As is normal practice with infrastructure projects, an EOP and CEMP will be prepared for the proposed development which will detail measures to be taken on site, such as secondary containment for storage of fuel. An Incident Response Plan will be prepared as part of the CEMP detailing the procedures to be undertaken in the event of spillage of chemical, fuel or other hazardous wastes, non-compliance with any permit or license, or other such risks that could lead to a pollution incident, including flood risks. • The Environmental Manager will prepare Method Statements for construction works as detailed in the 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 7 Biodiversity, Chapter 8 Soils and Geology, Chapter 9 Hydrology, and Chapter 10 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: ○ Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board) ○ CD 529 Standards for Highways Design Manual for Roads and Bridges ○ Standard for Highways: Design of Outfall and Culvert Details ○ Central Fisheries Board Channels and Challenges – The enhancement of Salmonid Rivers. ○ CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors. ○ CIRIA C648 Control of Water Pollution from Constructional Sites.	3 – V. Unlikely	2 - Moderate	6 - Low

Hazard Type	Receptors	Secondary mitigation	Post Mitigation Likelihood	Post Mitigation Potential Impact	Level of Significance (Residual Effect)
		○ CIRIA C753 The SuDS Manual ○ CIRIA C698 Site Handbook for the Construction of SuDS ○ Construction, Replacement or Alteration of Bridges and Culverts: A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945 ○ Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes ○ Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters			
OPERATION PHASE					
Extreme weather (flood) events	• Material Assets and Land. • Population and Human Health.	• Monitoring of weather forecasts by CCC to ensure that necessary actions such as flood warnings, will be implemented in time, prior to prolonged / extreme weather events. • A Maintenance and Management Plan (MMP) will be developed which will include extreme weather management and response procedures prior to and following extreme weather events.	3 – V. Unlikely	2– Significant	6 - Low

19.5 Residual Effects

Significant residual effects are not likely to occur during construction or operational phases of the proposed development as following mitigation, 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.

19.6 References

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