SECTION 18: Major Accidents and Natural Disasters

18.1 Introduction

This Section describes likely significant negative effects on the environment arising from the vulnerability of the Proposed Development to risks of major accidents and/or natural disasters. The assessment of the vulnerability of the Proposed Development to major accidents and natural disasters is carried out in compliance with the EIA Directive which states the need to assess:

"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 natural disasters which are relevant to the project concerned."

The underlying objective of this assessment is to ensure that appropriate precautionary actions are taken for those projects which *"because of their vulnerability to major accidents and/or natural disasters, are likely to have significant adverse effects on the environment"*. Based on the requirements of the EIA Directive, this Section seeks to determine:

- The relevant major accidents and/or natural disasters, if any, that the Proposed Development could be vulnerable to;
- The potential for these major accidents and/or natural disasters to result in likely significant adverse environmental effect(s); and
- The measures that are in place, or need to be in place, to prevent or mitigate the likely significant adverse effects of such events on the environment.

18.2 Assessment Methodology

The scope and methodology of this assessment is centred on the understanding that the Proposed Development will be designed, built and operated in line with best international current practice. As such, major accidents resulting from the Proposed Development will be very unlikely. The scope and methodology presented in the following sections is based on the provisions of the EIA Directive, the draft EPA Guidelines[15], EU Commission guidance[16] and other published risk assessment methodologies as described in Section 18.2.3 and professional judgement.

A risk analysis based methodology that covers the identification, likelihood and consequence of major accidents and/or natural disasters has been used for this assessment (Refer to **Section 18.2.3** for further detail on this approach).

Major accidents or natural disasters are hazards that have the potential to affect the Proposed Development. These include accidents during construction and operation caused by operational failure and/or natural hazards. The assessment of the risk of major accidents and/or disaster considers all factors defined in the EIA Directive that have been considered in this EIAR, i.e. population and human health, biodiversity, land, soil, water, air and climate and material assets, cultural heritage and the landscape.

18.2.1 Guidance and Legislation

[15] EPA (2017) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports: Draft, August 2017.

[16] European Commission (2017) Environmental Impact Assessment of Projects- Guidance on the preparation of the Environmental Impact Assessment Report

Legislative Requirements

The following paragraphs set out the requirements of the EIA Directive in relation to major accidents and/or natural disasters. Recital 15 of the EIA Directive states that:

"*In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or natural disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment. In order to avoid duplications, it should be possible to use any relevant information available and obtained through risk assessments carried out pursuant to Union legislation, such as Directive 2012/18/EU of the European Parliament and the Council*[17] *and Council Directive 2009/71/Euratom*[18]*, or through relevant assessments carried out pursuant to national legislation provided that the requirements of this Directive are met.*"

It is clear from the EIA Directive that a major accident and/or natural disaster assessment should be mainly applied to 'Control of Major Accident Hazards involving Dangerous Substances' (COMAH)[19] sites or major industrial/energy installations. Notwithstanding, the assessment of major accidents and natural disasters for the Proposed Development has been carried out for completeness given the strategic nature and importance of the Proposed Development.

Article 3 of the EIA Directive requires that the EIAR shall identify, describe and assess in the appropriate manner, the direct and indirect significant effects on population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape deriving from (amongst other things) the "*vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned*". The information relevant to major accidents and/or disasters to be included in the EIAR is set out in Section 8 of Annex IV of the EIA Directive as follows:

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

Guidance Documents

A number of guidance documents and published plans have been reviewed and considered in order to inform this assessment, as described in the following sections.

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[17] Directive 2012/18/EU of the European Parliament and the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (OJ L 197, 24.7.2012, p. 1).

[18] Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations (OJ L 172, 2.7.2009, p. 18

[19] Control of Major Accident Hazards Involving Dangerous Substances Regulations 2006, as amended (S.I. No. 209 of 2015), implementing the Seveso II Directive (96/82/EC)

Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report

The European Commission Guidance[2] outlines the legislative requirements and key considerations which should be taken into account in the preparation of EIARs with respect to accident and disaster risks. The Guidance lists the following issues which EIARs should address:

- What can go wrong with a Project?
- What adverse consequences might occur to human health and to the environment?
- How likely are these consequences?
- What is the Project's state of preparedness in case of an accident/disaster?
- Is there a plan for an emergency situation?

Draft EPA Guidelines

The draft EPA guidelines[1] refer to major accidents and/or disasters in a number of sections including:

- Characteristics of the Project – The draft EPA guidelines[1] state under Section 3.5.2 that the project characteristics should include "a description of the Risk of Accidents – having regard to substances or technologies used."
- Impact assessment - The draft EPA guidelines[1] state under Section 3.7.1 that the impact assessment should, in accordance with Annex IV (5) of the EIA Directive, include "the risks to human health, cultural heritage or the environment (for example due to accidents or disasters)."
- Likelihood of Impacts - The draft EPA guidelines[1] state the following under Section 3.7.3:

"*To address unforeseen or unplanned effects the Directive further requires that the EIAR takes account of the vulnerability of the project to risk of major accidents and /or disasters relevant to the project concerned and that the EIAR therefore explicitly addresses this issue. The extent to which the effects of major accidents and / or disasters are examined in the EIAR should be guided by an assessment of the likelihood of their occurrence (risk). This may be supported by general risk assessment methods or by systematic risk assessments required under other regulations e.g. a COMAH (Control of Major Accident Hazards involving Dangerous Substances) assessment.*"

Guidance on Assessing and Costing Environmental Liabilities

The EPA guidance document[20] above presents a systematic approach for assessing and costing environmental liabilities associated with closure, restoration/aftercare and incidents. This guidance is targeted at activities falling under the various EPA authorisation regimes including the Industrial Emissions Directive (IED), Integrated Pollution Prevention and Control (IPPC), wastewater discharge authorisations (WWDA) and dumping at sea (DaS).

This document[20] provides guidance on the identification and quantification of risks, focusing on unplanned, but possible and plausible events that may occur during the construction and operational phases of licensed facilities and/or activities. Specifically, guidance is also provided on a range of risk assessment and evaluation techniques in Section 3.3 of the draft EPA guidance[20].

A Framework for Major Emergency Management Guidance Document 1-A Guide to Risk Assessment in Major Emergency Management

[20] EPA (2014) Guidance on Assessing and Costing Environmental Liabilities

The Department of the Environment, Heritage and Local Government, as it then was, published a guidance note[21] in July 2010 on best practice in the area of risk assessment for major emergency management. The document[7] provides guidance on the various stages of the risk assessment process and how it should be employed to inform mitigation and detailed planning during major emergency situations. Part 1 of the guidance[21] defines criteria for classifying impact and likelihood scenarios in order to support the risk assessment process, as well as a process for recording the risk assessment.

A National Risk Assessment for Ireland 2017

The most recent National Risk Assessment[22] forms a critical subset of the strategic process ('National Risk Assessment: Overview of Strategic Risks') undertaken by the Government on an annual basis to assess national risks. The purpose of the assessment is to identify national hazards across a broad range of emergencies, to assess the likelihood and impact of these risks and to inform actions at national level aimed at mitigating such risks, including the allocation of resources.

Major Emergency Plan for Limerick City & County Council

This plan[23] for Limerick City and County Council has been prepared in accordance with the guidance issued by the Department of the Environment, Community and Local Government in relation to Major Emergency Management and is consistent with 'A Framework for Major Emergency Management' (2016).

The objectives of this Plan[23] are to protect life and property, to minimise disruption to the community and to provide immediate support for those affected. To achieve this objective the Plan[23] sets out the basis for a co-ordinated response to a major emergency and the different roles and functions to be performed by the Limerick City and County Council, Health Services Executive, An Garda Síochána in the area and by the Principal Response Agencies (agencies designated by Government to respond to Major Emergencies).

18.2.2 Categorisation of the Baseline Environment

A desk-based study has been undertaken in order to establish the baseline environment on which the risk assessment is being carried out, as this will influence both the likelihood and the impact of a major accident and/or natural disaster. As outlined in the guidance[7], establishing the local and regional context prior to completion of the risk assessment enables a better understanding of the vulnerability and resilience of the area to emergency situations. **Section 18.3** provides an overview of the baseline environment that has been considered for this assessment.

18.2.3 Impact Assessment Methodology

Current Practice

As discussed above, the scope and methodology of this assessment is centred on the understanding that the Proposed Development will be designed, built and operated in line with best international current practice and, as such, the vulnerability of the Proposed Development to risks of major accidents and/or natural disasters is considered low.

[21] DoEHLG (2010) A Guide to Risk Assessment in Major Emergency Management

[22] Department of Defence (2017) A National Risk Assessment for Ireland 2017

[23] Limerick City & County Council Major Emergency Plan 2014

Current EIA practice already includes an assessment of some potential accidents and disaster scenarios such as pollution incidents to ground and watercourses as well as assessment of flooding events. These are described in detail in the relevant EIAR assessment Sections.

Site-Specific Risk Assessment Methodology

Overview

A site-specific risk assessment identifies and quantifies risks focusing on unplanned, but possible and plausible events occurring during the construction and operation of the Proposed Development. The approach to identifying and quantifying risks associated with the Proposed Development by means of a site specific risk assessment is derived from the EPA guidance[20].

The criteria for categorising impact is derived from the DoEHLG guidance[21] (Refer to Figure 18-1 and Figure 18-2).

The following steps were undertaken as part of the site-specific risk assessment:

- Risk identification;
- Risk classification, likelihood and consequence; and
- Risk evaluation.

Risk Identification

Risks have been reviewed through the identification of plausible risks in consultation with relevant specialists. The identification of risks has focused on non-standard but plausible incidents that could occur at the Proposed Development during construction and operation. In accordance with the European Commission Guidance[16], risks are identified in respect of the projects:

1) Potential vulnerability to disaster risks; and
2) Potential to cause accidents and/or disasters.

Risk Classification

Classification of Likelihood

Having identified the potential risks, the likelihood of occurrence of each risk has been assessed. An analysis of safety procedures and proposed environmental controls was considered when estimating likelihood of identified potential risks occurring. Figure 18-1 defines the likelihood ratings that have been applied. The approach adopted has assumed a 'risk likelihood' where one or more aspects of the likelihood description are met, i.e. any risk to the Proposed Development less than extremely unlikely to occur has been excluded from the assessment.

Ranking	Classification	Likelihood
1	Extremely Unlikely	May occur only in exceptional circumstances; Once every 500 or more years
2	Very Unlikely	Is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communicates; and / or little opportunity, reason or means to occur; May occur once every 100-500 years.
3	Unlikely	May occur at some time; and /or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or comparable organisations worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

Figure 18-1: Risk Classification Table - Likelihood (Source DoEHLG[7])

Classification of Consequence

The consequence rating assigned to each risk has assumed that all proposed mitigation measures and/or safety procedures have failed to prevent the major accident and/or disaster. Further the Limerick City & County Council Major Emergency Plan[23], if implemented as intended, will work to reduce the consequence of any major accident or disaster. The consequence of the impact if the event occurs has been assigned as described in Figure 18-2. The consequence of a risk to/from the Proposed Development has been determined where one or more aspects of the consequence description are met, i.e. risks that have no consequence have been excluded from the assessment.

Ranking	Classification	Impact	Description
1	Minor	Life, Health, Welfare	Small number of people affected; no fatalities and small number of minor injuries with first-aid treatment.
		Environment	No contamination, localised effects
		Infrastructure	<0.5M Euros
		Social	Minor localised disruption to community services or infrastructure (<6 hours).
2	Limited	Life, Health, Welfare	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements.
		Environment	Simple contamination, localised effects of short duration
		Infrastructure	0.5-3M Euros
		Social	Normal community functioning with some inconvenience.
3	Serious	Life, Health, Welfare	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support.
		Environment	Simple contamination, widespread effects or extended duration
		Infrastructure	3-10M Euros
		Social	Community only partially functioning, some services available.
4	Very serious	Life, Health, Welfare	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated
		Environment	Heavy contamination, localised effects or extended duration
		Infrastructure	10-25M Euros
		Social	Community functioning poorly, minimal services available
5	Catastrophic	Life, Health, Welfare	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated.
		Environment	Very heavy contamination, widespread effects of extended duration.
		Infrastructure	>25M Euros
		Social	Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support.

Figure 18-2: Risk Classification Table – Consequence (Source DoEHLG[7])

Risk Evaluation

Once classified, the likelihood and consequence ratings have been multiplied to establish a 'risk score' to support the evaluation of risks by means of a risk matrix. The risk matrix sourced from the DoEHLG[7] guidance and as outlined in

Table 18.1 indicates the critical nature of each risk. This risk matrix has therefore been applied to evaluate each of the risks associated with the Proposed Development. The risk matrix is colour coded to provide a broad indication of the critical nature of each risk:

- The red zone represents 'high risk scenarios';

- The amber zone represents 'medium risk scenarios'; and
- The green zone represents 'low risk scenarios'.

Table 18.1: Risk Matrix (Source DoEHLG[7])

Likelihood Rating							
	Very Likely	5					
	Likely	4					
	Unlikely	3					
	Very Unlikely	2					
	Extremely Unlikely	1					
			Minor	Limited	Serious	Very Serious	Catastrophic
			1	2	3	4	5
			Consequence Rating				

18.3 Baseline Conditions

18.3.1 Natural Disasters

Ireland's geographic position means it is less vulnerable to natural disasters such as earthquakes or tsunamis, which might pose risk to projects of this nature and scale in other locations. However, in recent times there has been an increase in the number of severe weather events in the country, particularly those leading to flooding and flash flood incidents. The site was flooded severely in November 2009 due to the Lower River Shannon bursting its banks following unprecedented torrential rainfall. With regards natural disasters, severe weather conditions pose one of the most common risks to Ireland and to the Proposed Development.

18.3.2 Major Disasters

The nearest SEVESO site encountered (Grassland Agro., Dock Road, Limerick City) was nearly 6 kms away from the Proposed Development. This site was deemed to have no impact on the Proposed Development, and therefore, no further assessment was carried out.

18.4 Likely Significant Effects

18.4.1 Do Nothing Scenario

In the do-nothing scenario, the potential risk of the Proposed Development causing, or being affected by a disaster and/or accident would be eliminated as the proposed Castletroy Wastewater Treatment Project would not be implemented.

18.4.2 Assessment of Effects during Construction

The risks specific to the construction of the Proposed Development have been identified. These are outlined in the Construction Risk Register in Table 18.2Table 18.2

Table 18.2: Risk Register- Construction

Risk ID	Potential Risk	Possible Cause
A	Flooding of WwTP site during the construction	Extreme weather- periods of heavy rainfall, taking into account climate change, strong winds and tidal events
B	Accidents due to site access from University of Limerick	Construction traffic passing through the University of Limerick campus
C	Leakages and spillage incidents of wastewater into watercourse or groundwater	Failure of, or damage to WwTP infrastructure or inlet works; Fuel spillage during tanker unloading/ delivery operation; and Surface run-off during construction, accidental spillage of fuel, discharge from road run-off drainage
D	Discharge, spillage of untreated wastewater into watercourse or groundwater table	Failure of, or damage to WwTP infrastructure or inlet works;

18.4.3 Assessment of Effects during Operation

The risks specific to the operation of the Proposed Development have been identified. These are outlined in the Operation Risk Register in Table 18.3.

Table 18.3: Risk Register- Operation

Risk ID	Potential Risk	Possible Cause
E	Discharge, spillage of untreated wastewater into watercourse or groundwater table	Loss from above-ground tanks/ pipelines, discharge to surface water; Overflow/failure in storage of chemicals used in WwTP; and Flooding of site resulting in uncontrolled discharge.
F	Longer-term seepage of fuel, chemicals solvents etc. into watercourse or groundwater table	Equipment of power failure; and Employee negligence;
G	Fire/Explosion	Equipment or infrastructure failure; Electrical problems; and Employee negligence.
H	Flooding of WwTP	Extreme weather- periods of heavy rainfall, taking into account climate change, strong winds and tidal events
I	Vehicle collisions on site	Employee negligence; and Failure of vehicular operations.
J	Collapse/ damage to structures	Earthquakes; and Vehicular collisions.

The risk register is based upon possible risks associated with the Proposed Development. As outlined in Section 18.2.3, the consequence (Conseq.) rating assigned to each potential risk assumes that all proposed mitigation measures and safety procedures have failed to prevent the major accident and/or disaster.

18.4.4 Risk Assessment

Risks have been assessed in accordance with the relevant classification (Refer to Figure 18.1 and Figure 18.2) and the resulting risk analysis is given in 18.4.

Table 18.4: Risk Assessment

Risk ID	Potential Risk	Possible cause	Environmental effect	Likelihood Rating	Basis of Likelihood	Conseq. Rating	Basis of Consequence	Risk Score (Conseq. x Likelihood)
Construction								
A	Flooding of WwTP site during the construction	Extreme weather-periods of heavy rainfall, taking into account climate change, strong winds and tidal events	Sedimentation of the Lower Shannon River, Damage to, or depletion of aquatic habitats and species; Potential flooding of properties	3	The risk of flooding during the construction is considered unlikely as the site is characterised to have the depth of water on site during the 1% and 0.1% AEP flood. As outlined in CEMP, all chemicals will be stored appropriately in the Control of Substances Hazardous to Health (COSHH) stores. Oil, including diesel, will be stored in properly bunded tanks / bunded mobile bowsers/ drip trays. No fuels, chemicals or solvents will be stored outside of the confines of the WwTP buildings.	2	The risk of flooding during the construction will result in a limited consequence in that there would be 'a limited number of people affected' with 'Simple contamination, localised effects of short duration.' Further, there will be 'normal community functioning' in Castletroy site and University of Limerick campus with 'some inconvenience'. The potential effects due to a part of the development site being located primarily within Flood Zone A, have been reduced by mitigation as specified in **Section 14**. Earthworks operations will be designed with adequate drainage to promote safe runoff and prevent ponding and flooding. The 'generic command, control & co-ordination systems' as well as the 'common elements of	6

							response' detailed in the Limerick City and County Council Major Emergency Plan will work to reduce the consequence of potential flood events during construction.	
B	Accidents due to site access from University of Limerick	Construction traffic passing through the University of Limerick campus	Damage to, or depletion of habitats and species; and Injury or loss of life	1	Standard best practice construction measures will be implemented by the contractor during construction. The risk of accidents causing damage to environment due to traffic is considered extremely unlikely in that it 'may occur only in exceptional circumstances'	2	In the event of an accident, a limited consequence is envisaged in that a 'limited number of people' will be affected, with 'a few serious injuries.' As outlined in the **Section 5**, traffic management plan will be outlined to ensure safe passage of traffic through the campus of University of Limerick.	2
C	Leakages and spillage incidents into watercourse or groundwater	Fuel spillage during tanker unloading/ delivery operation; and Surface run-off during construction, accidental spillage of fuel, discharge from road run-off drainage	Damage to, or depletion of aquatic habitats and species; and Illness or loss of life.	1	The risk of discharge of leakages and spillages into the Lower Shannon River or groundwater table is considered to be extremely unlikely in that the instance 'may occur only in exceptional circumstances'. The Shannon reach is considered an area of particularly high conservation value as	2	Limited consequence Mobilisation of nutrients and suspended solids during the construction phase will have limited impact on aquatic habitats and species as any discharge to either sewer or watercourse would be subject to a discharge licence; Deterioration of the water quality of surface waters due to contaminated runoff from the site or accidental spillages will have limited consequence as discharge from the dewatering	2

					it is influenced by the tide and the catchment is dominated by Carboniferous limestone geology; The construction of the Proposed Development involves a possibility of silt/sediment and hydrocarbons run-off to adjacent drains and watercourses, as well as run-off of other pollutant materials such as cement;		process will be passed to a suitably sized settlement pond or a proprietary silt removal system located within the working area, before discharge to the Lower River Shannon or the local sewer network; Accidental spillages that have the potential migrate downwards into the underlying groundwater but the low vulnerability will restrict the infiltration of such contaminants.	
D	Discharge, spillage of untreated wastewater into watercourse or groundwater table	Failure of, or damage to WwTP infrastructure or inlet works; WwTP operability affected due to construction activity	Damage to, or depletion of aquatic habitats and species; and Illness or loss of life.	1	The risk of discharge of untreated wastewater into the Lower Shannon River or groundwater table is considered to be 'extremely unlikely' in that instance 'may occur only in exceptional circumstances'	1	Minor Consequence There will be 'small number of people affected' with 'localised effects' and 'minor localised disruption to community services or infrastructure'. The plant will be operational during the construction process. An offline methodology will be used to integrate new infrastructure including other measures specified in **Section 5.6**.	1
Operation								
E	Discharge, spillage of untreated	Loss from above-ground tanks/	Damage to, or depletion of aquatic habitats	3	The risk of discharge of untreated wastewater into the	2	Limited consequence The volume of treated discharge will increase but the plant will be	6

	wastewater into watercourse or groundwater table	pipelines, discharge to surface water; Overflow/failure in storage of chemicals used in WwTP; and Flooding of site resulting in uncontrolled discharge.	and species; and Illness or loss of life.		Lower Shannon River or groundwater table is considered to be, 'Unlikely' in that the instance 'may occur at some time' or it has 'some opportunity, reason or means to occur'		operating within its PE capacity limitations and therefore the final quality of the final effluent will be improved; There will be less untreated stormwater pumped into the river as the stormwater storage tank will retain stormwater until such a time it can be pumped into the treatment process; The consequence will be limited as, The impacts of the operational phase of the upgrade will have a neutral effect on water quality; Quality of the final treated effluent will remain compliant with environmental standards; and It is expected that given the scale of the upgrade works at Castletroy WwTP, a review will be carried out and there is a possibility ELVs will be reduced to account for the additional loading to the plant. The final effluent will continue to be monitored in accordance with the terms of the Wastewater Discharge Authorisation Licence.	

F	Longer-term seepage of fuel, chemicals solvents etc. into watercourse or groundwater table	Equipment of power failure; and Employee negligence;	Illness or loss of life; and Damage to, or depletion of habitats and species	1	The possibility of long-term seepage occurring that will result in a significant negative impact on the Proposed Development, resulting in a major impact on watercourse and/or groundwater is considered 'extremely unlikely' in that it 'may occur only in exceptional circumstances; once every 500 or more years'	2	All chemicals will be stored appropriately in the COSHH stores; All oil, including diesel, will be stored in properly bunded tanks / bunded mobile bowsers/ drip trays; and Metal jerry cans will be stored in a bund or drip tray when not in use.	2
G	Fire/Explosion	Equipment or infrastructure failure; Electrical problems; and Employee negligence.	Illness or loss of life; Damage to, or depletion of habitats and species; and Impacts on ambient air quality.	1	The WwTP is extremely unlikely to give rise to fire or explosion. As outlined in CEMP, all chemicals will be stored appropriately in the COSHH stores. All oil, including diesel, will be stored in properly bunded tanks / bunded mobile bowsers/ drip trays and metal jerry cans will be stored in a bund or drip tray when not in use. However, is not	4	Should a fire/explosion occur at the WwTP site, a very serious impact would occur in that a number of people in the affected area could be impacted with multiple fatalities (5 to 50)'. Further, 'external resources would be required for personal support' and 'there would be simple contamination with widespread effects for an extended duration.' The 'generic command, control & co-ordination systems' as well as the 'common elements of response' detailed in the Limerick City & County Council	4

					considered to be a significant fire risk. In accordance with Section 19 of the Safety, Health and Welfare at Work Act 2005 (the 2005 Act), the development shall be subject to a fire safety risk assessment which would assist in the identification of any major risks of fire on site, and mitigation of the same during operation.		Major Emergency Plan will work to reduce the consequence of potential fire/explosions at the site.	
H	Flooding of WwTP	Extreme weather-periods of heavy rainfall, taking into account climate change, strong winds and tidal events	Damage to, or depletion of aquatic life; and Illness or loss of life.	3	As described in **Section 14**, there is a significant flood risk at Castletroy WWTP as a portion of the site lies within Flood Zone A; and The CFRAM map indicates that the 1% Annual Exceedance Probability (AEP) fluvial flood level (Flood Zone A) is +6.37mOD and the 0.1% AEP fluvial flood level is +6.93mOD.	2	All highly essential infrastructure will be constructed at an elevation higher than the 1% AEP flood level with a suitable freeboard; The proposed storm water tank will be constructed on the open green area of the site which is largely classified Flood Zone C; The new Salsnes filters and sludge holding tank will be encroaching on Flood Zones A/B but are expected to cause minimal loss of flood plain storage; and can easily be	6

							compensated for elsewhere on the site; and Appropriate drainage measures will ensure that all runoff from the site will be limited to the greenfield runoff rate.	
I	Vehicle collisions on site	Employee negligence; and Failure of vehicular operations.	Injury or loss of life.	1	A limited number of vehicles will be permitted on the site of the WWTP to facilitate servicing/maintenance of equipment /infrastructure, the removal of de-watered sludge, and staff/visitor parking. As such, it can be determined that it 'may occur only in exceptional circumstances'.	2	A limited consequence is predicted. Having regard to on-site speed limits and vehicular movements, a 'limited number of people affected' should a vehicular collision occur, with 'a few serious injuries with hospitalisation and medical treatment required.'	2
J	Collapse/ damage to structures	Earthquakes; and Vehicular collisions.	Injury or loss of life.	1	According to the Irish National Seismic Network (INSN), earthquakes measuring ~2 on the Richter Scale are "normal" in terms of seismicity in Ireland. These are known as microearthquakes; they are not commonly	3	In the event of a building collapse, a serious impact would occur in that 'a significant number of people in affected area would be impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation.'	3

					felt by people and are generally recorded only on local seismographs. As such, buildings in Ireland are extremely unlikely to be damaged or collapse due to seismic activity. Having regard to on-site speed restrictions and vehicular movements, it is not predicted that any collision of vehicles and the WWTP buildings/infrastructure would result in significant damage/collapse.			

18.4.5 Risk Scores

The risk assessment in Table 18.5 categorises each of the potential risks by their 'risk score.' A corresponding risk matrix is provided in Table 18.6, which is colour coded in order to provide an indication of the critical nature of each risk. As outlined in Section 18.2.3, the red zone represents 'high risk' scenarios', the amber zone represents 'medium risk scenarios' and the green zone represents 'low risk scenarios.

Table 18.5: Risk Scores

Risk ID	Potential Risks	Likelihood Rating	Conseq. Rating	Risk Score
During Operation				
E	Discharge, spillage of untreated wastewater into watercourse or groundwater table	3	2	6
F	Longer-term seepage fuel, chemicals solvents etc. into watercourse or groundwater table	1	2	2
G	Fire/Explosion	1	4	4
H	Flooding of WwTP	3	2	6
I	Vehicle collisions on site	1	2	2
J	Collapse/ damage to structures	1	3	3
During Construction				
A	Flooding of WwTP site during the construction	3	2	6
B	Accidents due to site access from University of Limerick	1	2	2
C	Leakages and spillage incidents into wastewater of groundwater	1	2	2
D	Discharge, spillage of untreated wastewater into watercourse or groundwater table	1	1	1

Table 18.6: Risk Matrix

Likelihood Rating	**Very Likely**	**5**					
	Likely	**4**					
	Unlikely	**3**		A, E, H			
	Very Unlikely	**2**					
	Extremely Unlikely	**1**	D	B, C, F, I	J	G	
			Minor	**Limited**	**Serious**	**Very Serious**	**Catastrophic**
			1	**2**	**3**	**4**	**5**
			Consequence Rating				

As outlined in Table 18.6, the potential risks identified during the construction and operation of the Proposed Development can all be classified as 'low risk scenarios.' The scenario with the highest risk score in terms of a major accident and/or natural disaster during the operation phase of the Proposed Development was identified as being 'flooding of WwTP site during operation' and 'Discharge, spillage of untreated wastewater into watercourse or groundwater table.'

The scenarios with the highest risk score in terms of a major accident and/or natural disaster during the construction phase of the Proposed Development were identified as being 'Flooding of WwTP site during the construction.

18.4.6 Flooding of WwTP site during construction

There is a potential risk of the WwTP site flooding partially. However, all the earthworks operations will be designed with adequate drainage to promote safe runoff and prevent ponding and flooding. The potential effects due to a part of the development site being located primarily within Flood Zone A, have been reduced by Mitigation measures as specified in **Section 14**. Also as outlined in CEMP, all chemicals will be stored appropriately in the Control of Substances Hazardous to Health (COSHH) stores. Oil, including diesel, will be stored in properly bunded tanks / bunded mobile bowsers/ drip trays. No fuels, chemicals or solvents will be stored outside of the confines of the WwTP buildings.

Thus, the risk of flooding during the construction is considered unlikely and has been assigned a risk score of 6. This indicates a scenario that is 'unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low risk scenario.'

18.4.7 Discharge, spillage of untreated wastewater into watercourse or groundwater table during operation

There is a potential risk of untreated wastewater being released into the watercourse from a WwTP facility, following the occurrence of an incident or malfunction on-site. However, implementation of appropriate drainage and dewatering measures to control groundwater during construction to mitigate groundwater discharge will be carried out. Groundwater level monitoring will be undertaken and the aquifer vulnerability map classifies the site as having a low vulnerability rating which indicates a low water table and hence a low risk of groundwater related flooding as per **Section 13**. As outlined in **Section 5**, the site will be powered by mains supplies or diesel generators where an electrical supply is not available. Also, diesel will be stored on-site in a bunded area to ensure containment and prevent spillages of fuel. Any water used during the testing will be treated accordingly (to remove silt or other contaminants) and discharged (in accordance with an approved discharge licence) to a local water course or to the drainage network (as outlined in Section 05). Consultation should be undertaken with Waterways Ireland to discuss potential impact on River Shannon (as outlined in **Section 14**).

As such, the risk of discharge, spillage or longer-term seepage of untreated wastewater into the watercourse or groundwater table, resulting in a major accident and/or disaster, was given a risk score of 6. This indicates a scenario that is 'unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low risk scenario.'

18.4.8 Flooding of WwTP site during operation

There is a potential risk of the WwTP site flooding during the operation as a section of the site lies within the 1% AEP fluvial flood extent. However, all highly essential infrastructure will be constructed at an elevation higher than the 1% AEP flood level with a suitable freeboard. The proposed storm water tank will be constructed on the open green area of the site which is largely classified Flood Zone C. Appropriate drainage measures will ensure that all runoff from the site will be limited to the greenfield runoff rate.

As such, the risk of flooding to the WwTP site during the operation was given a risk score of 6. This indicates a scenario that is 'unlikely' to occur and will have 'limited' consequences should it do so, representing a 'low risk scenario.'

18.5 Mitigation Measures and Monitoring

18.5.1 Mitigation during construction

As outlined in Section 18.4, the scenario with the highest risk score in terms of the occurrence of major accident and/or disaster during construction was identified as 'flooding of WwTP site during construction.'

As outlined in Section 4 and Appendix 5A, a preliminary CEMP has been submitted and will be developed into a detailed CEMP on award of contract, prior to the commencement of any works and implemented during the works. The CEMP will be a live document maintained by the contractor that will work to ensure that potential risks of major accident and/or disaster are identified, avoided and mitigated, as necessary. Refer to Appendix 5A for an outline CEMP that sets out the minimum standards to be employed by the contractor.

18.5.2 Mitigation during operation

As outlined in **Section 18.2.1**, the Proposed Development will be designed and built in line with best international current practice and, as such, mitigation against the risk of major accidents and/or disasters will be embedded through the design.

In accordance with the provision of the European Commission Guidance[2] the Risk Management Plan on site will be updated and implemented to ensure an effective response to disasters or the risk of accidents. The plan should include sufficient preparedness and emergency planning measures.

Further, the maintenance programme at the site will be updated and implemented, in compliance with the conditions of the Wastewater Discharge Authorisation required under the Wastewater Discharge (Authorisation) Regulations 2007-2016. The purpose of the maintenance programme is to ensure that all critical equipment at the WwTP and elsewhere throughout the Proposed Development is operating correctly, therefore reducing the risk of major accidents and/or disasters on site.

As outlined in **Section 18.4**, the scenarios with the highest risk score in terms of a major accident and/or disaster during operation were identified as 'discharge, spillage or longer-term seepage of untreated wastewater into the watercourse or groundwater table,' and 'flooding of WwTP during operation.' The storage of diesel in a contained and bunded area on-site will mitigate 'by prevention' the risk of surface and/or ground pollution. A flood risk assessment has been carried out which recommends appropriate measures to mitigate the effects of flood risk.

18.5.3 Monitoring during construction

As outlined in **Section 4** and **Appendix 4A**, a detailed CEMP will be prepared prior to the commencement of any works and implemented and monitored during the works. The CEMP will be a live document maintained by the Contractor and will work to ensure that potential risks of major accident and/or disaster are monitored, as necessary.

Refer to **Appendix 4A** for an outline CEMP that sets out the minimum standards to be employed by the contractor.

18.5.4 Monitoring during operation

Uisce Éireann and the operator of the Proposed Development will continue to assess the risk of major accidents and/or disasters on site on an on-going basis during operation. The maintenance programme, record of reported incidents, as well as general site activities will be monitored on an on-going basis to ensure risk of major accidents does not increase over time.

18.6 Residual Effects

18.6.1 Residual Effects during construction

The risk of a major accident and/or disaster during the construction of the Proposed Development is considered 'low' in accordance with the risk evaluation methodology[21] . It is considered that there will not be significant residual effect(s) during the construction of the Proposed Development.

18.6.2 Residual effects during operation

The risk of a major accident and/or disaster during the operation of the Proposed Development is considered 'low' with regards the risk evaluation methodology[21]. It is therefore considered that there will not be significant residual effect(s) during the operation of the Proposed Development.

18.7 References

Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations (OJ L 172, 2.7.2009, p. 18

Control of Major Accident Hazards Involving Dangerous Substances Regulations 2006, as amended (S.I. No. 209 of 2015), implementing the Seveso II Directive (96/82/EC)

Department of Defence (2017) A National Risk Assessment for Ireland 2017

Directive 2012/18/EU of the European Parliament and the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (OJ L 197, 24.7.2012, p. 1).

DoEHLG (2010) A Guide to Risk Assessment in Major Emergency Management

EPA (2014) Guidance on Assessing and Costing Environmental Liabilities

EPA (2017) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports: Draft, August 2017.

European Commission (2017) Environmental Impact Assessment of Projects- Guidance on the preparation of the Environmental Impact Assessment Report

Limerick City & County Council Major Emergency Plan 2014