CORY

DECARBONISATION

ENVIRONMENTAL STATEMENT: 6.1 CHAPTER 20: MAJOR ACCIDENTS AND DISASTERS

Cory Decarbonisation Project

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Revision A

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations (2009) - Regulation 5(2)(a)

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20. MAJOR ACCIDENTS AND DISASTERS

20.1. INTRODUCTION

20.1.1. This chapter reports the assessment of the vulnerability of the Proposed Scheme to major accidents and disasters (MA&D) during construction and operation and describes:

- relevant policy, legislation and guidance;
- consultation undertaken to date;
- the methodology for assessment;
- potential effects of the construction phase; and
- potential effects of the operational phase.

20.1.2. Where appropriate, this chapter includes the further mitigation measures required to prevent, reduce or offset any significant adverse effects, the preparedness for and proposed response to emergencies, and the expected residual effects after these measures have been adopted.

20.1.3. This chapter (and its associated figures and appendices) is intended to be read as part of the wider ES, with particular reference to:

- **Chapter 5: Air Quality (Volume 1)**;
- **Chapter 7: Terrestrial Biodiversity (Volume 1)**;
- **Chapter 8: Marine Biodiversity (Volume 1)**;
- **Chapter 11: Water Environment and Flood Risk (Volume 1)**;
- **Chapter 12: Climate Resilience (Volume 1)**;
- **Chapter 14: Population, Health and Land Use (Volume 1)**;
- **Chapter 17: Ground Conditions and Soils (Volume 1)**;
- **Chapter 18: Landside Transport (Volume 1)**; and
- **Chapter 19: Marine Navigation (Volume 1)**.

20.1.4. The above chapters also outline the proposed measures to prevent or mitigate significant effects and where they have identified emergency scenarios, provide details of the preparedness for, and the proposed response.

20.2. POLICY, LEGISLATION AND GUIDANCE

20.2.1. The policy, legislation and guidance relevant to the assessment of MA&D for the Proposed Scheme is detailed in **Table 20-1**.

Table 20-1: MA&D Summary of Key Policy, Legislation and Guidance

Policy, Legislation or Guidance	Description
Policy	
Overarching National Policy Statement (NPS) for Energy EN-1 2024[1]	This Overarching National Policy Statement for Energy (EN-1) is part of a suite of NPS designated by the Secretary of State of DESNZ in January 2024. Paragraph 4.13.7 includes reference to the need to *"prevent, control and mitigate major accidents".*
National Planning Policy Framework (NPPF) 2023[2]	The NPPF sets out the Government's planning policies for England and how these should be applied, with the following paragraphs relating to MA&D: • Paragraph 45 states *"Local planning authorities should consult the appropriate bodies when considering applications for the siting of, or changes to, major hazard sites, installations or pipelines, or for development around them".* • Paragraph 101 states: *"Planning policies and decisions should promote public safety and take into account wider security and defence requirements by:* *a) anticipating and addressing possible malicious threats and natural hazards, especially in locations where large numbers of people are expected to congregate. … This includes appropriate and proportionate steps that can be taken to reduce vulnerability, increase resilience and ensure public safety and security; and* *b) recognising and supporting development required for operational defence and security purposes and ensuring that operational sites are not affected adversely by the impact of other development proposed in the area".*
The London Plan 2021[3]	The Spatial Development Strategy for Greater London setting out a framework for how London will develop over the next 20-25 years and the Mayor's vision for Good Growth. Policy D11 of the London Plan is the key policy specific to MA&D within Greater London, which states that the: "*Mayor will use his convening power to work with relevant partners and stakeholders to ensure and maintain a safe and secure environment in London that is resilient against emergencies including fire, flood, weather, terrorism and related hazards as set out in the London Risk Register*".
The Bexley Local Plan 2023[4]	The Local Plan, adopted on 26 April 2023, positively plans for sustainable development across the Borough. It is essential to the delivery of the Council's other key plans and strategies,

Policy, Legislation or Guidance	Description
	including the Bexley Plan, the Growth Strategy and the Connected Communities Strategy. Policy DP28: Contaminated Land and Development and Storage of Hazardous Substances identifies that "*Development proposals for hazardous installations and development proposals within the relevant consultation zones for existing hazardous installations must consult with the Health and Safety Executive*".
London Environment Strategy 2018[5]	The London Environment Strategy seeks to ensure that London will become a "*zero carbon city by 2050*" by setting out policies and proposals in seven policy areas to address environmental challenges, including the transition to a low carbon circular economy. The London Environment Strategy does not specifically consider MA&D. However, Policy 8.1.2 makes the commitment to: "*Develop, refine and monitor plans and indicators of London's resilience to severe weather and longer-term climate change impacts on flooding, heat risk and water pollution".*
South East Inshore Marine Plan 2021[6]	The South East Inshore Marine Plan area stretches from Felixstowe in Suffolk to west of Dover in Kent and incorporates the River Thames. It will help to enhance and protect the marine environment and achieve sustainable economic growth while respecting local communities both within and adjacent to the marine plan area. The South East Inshore Marine Plan does not specifically consider MA&D. However, the text of Policy SE-PS-1 states that: "*Proposals within statutory harbour authority areas or their approaches that detrimentally and materially affect safety of navigation, or the compliance by statutory harbour authorities with the Open Port Duty or the Port Marine Safety Code, will not be authorised unless there are exceptional circumstances."* The description of the policy aim goes on to state that: *"Also recognised is the need to ensure safe navigation both within and in the approaches to ports, at present and in the future. Harbour masters are recognised experts in navigational safety within their jurisdictional areas. Accordingly, the policy recognises that their views regarding how proposals affect safety of navigation, the Open Port Duty and compliance with the Port Marine Safety Code should be sought and given significant weight."*

Policy, Legislation or Guidance	Description
Legislation	
Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[7]	The Infrastructure Planning (Environmental Impact Assessment (EIA)) Regulations 2017 (the EIA Regulations) cover the process of EIA in the context of Nationally Significant Infrastructure Projects. They apply the amended EU Directive 2014/52/EU. Schedule 4 Paragraph 5(d) of the EIA Regulations requires: • "*A description of the likely significant effects of the development on the environment resulting from … the risks to human health, cultural heritage or the environment (for example due to accidents or disasters)*". Schedule 4, Paragraph 8 of the EIA Regulations requires: • A description of the expected significant adverse effects of the Proposed Scheme on the environment deriving from the vulnerability of the Proposed Scheme to risks of MA&D that are relevant to the project concerned. • If appropriate, a description of the measures envisaged to prevent or mitigate the significant adverse effects of major accidents and/or disasters on the environment and details of the preparedness for and proposed response to such emergencies.
Health and Safety at Work etc. Act 1974 (c. 37)[8]	The Act provides the framework for the regulation of workplace health and safety in the UK. It provides a legal framework for the provision of safe plant and equipment and prevention of harm to people from occupational hazards present in a workplace, including emergencies, which may affect those offsite or visiting the Proposed Scheme.
Construction (Design and Management) (CDM) Regulations 2015[9]	These Regulations place legal duties on almost all parties involved in construction work, with specific duties on clients, designer(s) and Contractor(s), so that health and safety is considered throughout the life of a construction project from inception to demolition and removal. The client, designer(s) and Contractor(s) must avoid foreseeable risks, so far as is reasonably practicable, by eliminating hazards associated with the design, construction, operation and maintenance of the Proposed Scheme. The Regulations ensure that mechanisms are in place to continually identify, evaluate and manage safety risks throughout the design, construction and operation phases of the Proposed Scheme. Many of the risks identified and managed at the detailed design phase also serve to eliminate or reduce the

Policy, Legislation or Guidance	Description
	risk of a major accident (and therefore environmental consequence) occurring during the construction and operation phases.
Control of Major Accident Hazards (COMAH) Regulations 2015[10]	The purpose of the COMAH Regulations is to prevent major accidents involving dangerous substances and limit the consequences to people and the environment of any accidents which do occur. There are at least four COMAH sites within a 5km radius of the Proposed Scheme.
The Planning (Hazardous Substances) Regulations 2015[11]	These Regulations transpose the land-use planning requirements of the European Seveso III Directive and relate to the way hazardous substances consents operate, and the way in which the planning system reduces the likelihood and impact of major accidents. Hazardous substance consents focus on ensuring the safety of the public around the consented site from potential major accident hazards. Many of the risks identified and managed at the detailed design phase also serve to eliminate or reduce the risk of a major accident (and therefore environmental consequence) occurring during the construction and operation phases.
The Supply of Machinery (Safety) Regulations 2008[12]	The Regulations aim to remove technical barriers to trade, in particular products, by harmonising national health and safety provisions applicable to such products when they are first placed on the market or put into service in the European Economic Area. Many of the risks identified and managed in the design of machinery used in and associated with the Proposed Scheme will serve to eliminate or reduce the risk of a major accident (and therefore environmental consequence) occurring during the construction and operation phases of the Proposed Scheme.
The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR)[13]	DSEAR implements the Chemical Agents Directive 98/24/EC and the Explosive Atmospheres Directive 99/92/EC. DSEAR sets minimum requirements for the protection of staff from fire and explosion risks arising from dangerous substances and potentially explosive atmospheres. Under the regulations, the Proposed Scheme will require that mechanisms are in place to identify, evaluate and manage the risk of a major accident due to loss of containment to As Low As Reasonably Practicable (ALARP).

Policy, Legislation or Guidance	Description
	Many of the risks identified and managed will serve to eliminate or reduce the risk of a major accident (and therefore environmental consequence) occurring during the construction and operation phases of the Proposed Scheme.
The Equipment and Protective Systems for Use in Potentially Explosive Atmospheres Regulations 1996 and 2016[14,15]	The Regulations implement measures for safety and consumer protection with respect to electrical equipment and any provisions concerning the composition, labelling, marketing, classification or description of electrical equipment intended to be used in potentially explosive atmospheres. The use of the correct level of intrinsically safe equipment and protective systems will likely minimise the likelihood of a large-scale release of CO_2 from the Proposed Scheme and therefore reduce the risk of a major accident.
Occupier's Liability Act 1984 (c.3)[16]	This Act amends the law of England and Wales as to the liability of persons as occupiers of premises for injury suffered by persons other than their visitors. The Act provides a legal framework for the prevention of harm to people from occupational safety and health hazards present on premises under the control of the occupier, including to those visiting the premises. The Proposed Scheme will include premises controlled by the Applicant that will attract visitors who could be impacted by MA&D whilst on/crossing those controlled premises.
The Pipelines Safety Regulations 1996[17]	The purpose of these Regulations is to ensure that pipelines are designed, constructed and operated properly to ensure their integrity and reduce risks.
Guidance	
Planning Practice Guidance (2021)[18]	Explains the processes and tools that can be used through the planning system in England. There is no specific guidance relating to MA&D.
IEMA: Major Accidents and Disasters in EIA: A Primer 2020[19]	The purpose of the primer is to increase awareness of the MA&D topic and its application within all stages of EIA. The primer outlines an assessment methodology based on known current practice within the UK and provides definitions of key terminology. The Primer is structured around a typical assessment approach and provides a proportionate method for considering major accidents and disasters through the stages of EIA.

Policy, Legislation or Guidance	Description
'Green Leaves III' Guidelines for Environmental Risk Assessment and Management (2011)[20]	Providing generic guidance for the assessment and management of environmental risks. A cyclical framework for risk management is presented that identifies four main components of risk assessment: • formulating the problem; • carrying out an assessment of the risk; • identifying and appraising the management options available; and • addressing the risk with a risk management strategy. A source-pathway-receptor model is suggested as a tool to assist in risk screening and an example is provided of applying the following filters to prioritise significant hazards for further investigation: • the plausibility of linkages between the source of a hazard and a receptor; • the relative potency of a hazard, availability of a pathway, or vulnerability of a receptor; • the likelihood of an event, based on historic occurrence or of changed circumstances; or • a view on the performance of current risk management measures that, if they were to fail, may increase the potential for future harm.
Guideline – Environmental Risk Tolerability for COMAH Establishments 2013[21]	Providing generic guidance on how to undertake environmental risk assessments required by the COMAH Regulations. It provides a definition of the types of harm that should be considered in an environmental risk assessment, and how the harm should be characterised for the assessment. In this context, the level of environmental harm that would be considered serious has been defined for various different receptor types in terms of the combination of the: • extent (the area/distance); • severity (the degree of harm within the area of impact); and • duration (the recovery period). For environmental harm to be considered serious then all parameters must exceed the receptor thresholds as defined in this guideline. The thresholds reflect expert opinion on levels of harm that would be considered serious, with consideration to various receptor specific areas of legislation (such as the Water Framework[22], Habitats[23] and Environmental Liability[24] Directives).

Policy, Legislation or Guidance	Description
	The guideline also provides: • a definition of the risk criteria to be used in assessing the tolerability of the environmental risk from an establishment and, where appropriate, individual scenarios; and guidance on how the risks may be evaluated.
ISO 31000:2018 Risk Management – Guidelines 2018[25]	This guidance identifies principles that need to be satisfied to make risk management effective. If the standards are adopted and applied the management of any risk should help minimise losses, improve resilience, improve controls and improve the identification of opportunities and threats. The ISO standard states that when defining risk criteria, the following factors should be considered: • the nature and types of causes and consequences that can occur and how they will be measured; • how likelihood will be defined; • the timeframe(s) of the likelihood or consequence(s); • how the level of risk is to be determined; • the views of stakeholders; • the level at which risk becomes acceptable or tolerable; and • whether combinations of multiple risks should be considered and, if so how, and which combinations should be considered.

20.3. CONSULTATION AND ENGAGEMENT

20.3.1. **Table 20-2** provides a summary of the consultation and engagement undertaken in support of the preparation of this assessment.

20.3.2. The HSE have been consulted as part of the EIA scoping process and statutory consultation. No specific comment has been made by the HSE in relation to the assessment of MA&D.

20.3.3. **Appendix 4-2: Scoping Opinion Responses (Volume 3)** provides a summary of the Planning Inspectorate and consultee comments on the EIA Scoping Opinion[26] and the Applicant's responses.

20.3.4. No comments were provided as part of the statutory consultation process in relation to MA&D.

Table 20-2: Consultation and Engagement Summary Table in relation to MA&D

Date and Method of Consultation	Consultee	Summary of Key Topics Discussed and Key Outcomes
24th August 2023, Email	Northern Gas Networks	Confirmation of the location of the pipelines referred to in the Scoping Opinion[27]. Northern Gas Networks confirmed that it does not cover the area of or around the Site.
6th September 2023, Email	Scotia Gas Networks (SGN) (the parent company of Southern Gas Networks)	The Applicant requested information on the location of gas assets in proximity to the Proposed Scheme.
7th September 2023, Email	SGN (the parent company of Southern Gas Networks)	SGN provided a Plant Protection working advice document and directed the Applicant to the 'Linesearch before u dig' website[28] to access maps illustrating the location of gas infrastructure.

20.4. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

20.4.1. The MA&D assessment of the Proposed Scheme these have been undertaken in line with the policy, legislation and guidance described in **Section 20.2**.

KEY DEFINITIONS

20.4.2. The definition of key terms used in this chapter are provided in **Table 20-3** below. These definitions have been developed by reference to the definitions used in EU and UK legislation and guidance relevant to major accidents and/or disasters[10, 17, 20, 29, 30, 31, 32, 33] as well as professional judgement in the context of the Proposed Scheme.

Table 20-3: MA&D Key Definitions

Term	Definition
(Major) Accident	An event that threatens immediate or delayed serious damage to human health, welfare and/or the environment and requires the use of resources beyond those of the Applicant or its appointed Contractor(s) to respond to the event. Serious damage includes the loss of life or permanent injury and/or permanent or long lasting damage to an environmental receptor that cannot be restored through minor clean-up and restoration efforts. The significance of this effect will consider the extent, severity and duration of harm and the sensitivity of the receptor.
Adaptive Capacity	The capacity of receptors to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
ALARP	'ALARP' stands for 'as low as reasonably practicable'. Reasonably practicable involves weighing a risk against the trouble, time and money needed to control it. Thus, ALARP describes the level to which the Health & Safety Executive (HSE) expects to see workplace risks controlled.
Consultation Zone	The HSE sets a Consultation Distance (CD) around major hazard sites and major accident hazard pipelines after assessing the risks and likely effects of major accidents at the major hazard site/pipeline. The area enclosed within the CD is referred to as the Consultation Zone and is the area within which there could be potentially significant consequences from major accidents to people (or to the environment). The Local Planning Authority is notified of the CD and has a statutory duty to consult the HSE on certain proposed schemes within the zone the CD forms.
Disaster	A naturally occurring phenomenon such as an extreme weather event (for example storm, flood, temperature) or ground-related hazard events (for example subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a Major Accident as defined above.
External Influencing Factor	A factor that occurs beyond the limits of the Proposed Scheme that may present a risk to the Proposed Scheme, e.g. if an external disaster occurred (e.g. earthquake, COMAH site major accident) it would increase the risk of serious damage to an environmental receptor associated with the Proposed Scheme.
Hazard	Anything with the potential to cause harm, including ill-health and injury, damage to property or the environment; or a combination of these.

Term	Definition
Internal Influencing Factor	A factor that occurs within the limits of the Proposed Scheme that may present a risk to the Proposed Scheme (e.g. flooding of surface water features within the Site).
Magnitude of Impact	The magnitude of an impact is typically defined by the following factors: • extent – the area over which an effect occurs; • duration – the time for which the effect occurs; • frequency – how often the effect occurs; and • severity – the degree of change relative to existing conditions.
MA&D Group	MA&D can be categorised as either a Natural Hazard (Disaster) or Technological or Manmade Hazard (Major Accident).
MA&D Category	A set of values used to categorise events within a related parent MA&D Group.
MA&D Type	A set of values used to subcategorise events within a MA&D Category.
Risk	The likelihood of an impact occurring combined with effect or consequence(s) of the impact on a receptor if it does occur.
Risk Event	An identified, unplanned event, which is considered relevant to the Proposed Scheme and has the potential to be a Major Accident and/or Disaster subject to assessment of its potential to result in a significant adverse effect on an environmental receptor.
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; and • recoverability – the temporal scale over, and extent to which, a receptor will recover following an effect.

Term	Definition
Vulnerability	In the context of Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[7] (on the assessment of the effects of certain public and private projects on the environment), the term refers to the *"exposure and resilience"* of the Proposed Scheme to the risk of a MA&D. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

POTENTIAL SIGNIFICANT EFFECTS

20.4.3. As identified in the EIA Scoping Report[34] and PEIR[35], in the response to the Planning Inspectorate's Scoping Opinion[27] and **Appendix 20-1: Major Accidents and Disasters Long List (Volume 3)**, the following MA&D event types are considered further in this assessment (the MA&D categories are included in brackets):

- Construction Phase:
  - Coastal Flooding (hydrological);
  - Fluvial Flooding (hydrological);
  - Major accident hazard chemical sites (industrial and urban accidents);
  - Major accident hazard pipelines (industrial and urban accidents);
  - Waterways (transport accidents);
  - Unexploded ordnance (malicious attacks); and
  - Flood defence failure (engineering accidents and failures).
- Operation Phase:
  - Coastal Flooding (hydrological);
  - Fluvial Flooding (hydrological);
  - Major accident hazard chemical sites (industrial and urban accidents);
  - Waterways (transport accidents);
  - Land (pollution accidents);
  - Water (pollution accidents); and
  - Flood defence failure (engineering accidents and failures).

MATTERS SCOPED OUT

20.4.4. The following MA&D event types are those to which the Proposed Scheme is considered unlikely to be vulnerable and therefore have not been considered further in this assessment:

- Construction Phase only:
  - Land (pollution accidents); and
  - Water (pollution accidents).
- Construction and Operation Phase:
  - Earthquakes (geophysical);
  - Volcanic activity (geophysical);
  - Landslides (geophysical);
  - Sinkholes (geophysical);
  - Tsunamis (geophysical);
  - Pluvial flooding (hydrological);
  - Groundwater flooding (hydrological);

- Avalanches (hydrological);
- Cyclones, hurricanes, typhoons, storms and gales (climatological and meteorological);
- Thunderstorms (climatological and meteorological);
- Wave surges (climatological and meteorological);
- Extreme temperatures: heatwaves, low (sub-zero) temperatures and heavy snow (climatological and meteorological);
- Droughts (climatological and meteorological);
- Severe space weather: solar flares (climatological and meteorological):
- Severe space weather: solar energetic particles (climatological and meteorological);
- Severe space weather: coronal mass ejections (climatological and meteorological);
- Fog (climatological and meteorological);
- Wildfires: forest fire, bush/brush, pasture (climatological and meteorological);
- Poor air quality (climatological and meteorological);
- Disease epidemics (biological): viral, bacterial, parasitic, fungal and prion;
- Animal diseases (biological): avian influenza, west nile virus, rabies, foot and mouth and swine fever;
- Plants (biological);
- Extensive public demonstrations which could lead to violence and loss of life (societal);
- Widespread damage to societies and economies (societal);
- The need for large-scale multi-faceted humanitarian assistance (societal);
- The hindrance or prevention of humanitarian assistance by political and military constraints (societal);
- Significant security risks for humanitarian relief workers in some areas (societal);
- Famine (societal);
- Displaced population (societal);
- Nuclear (industrial and urban accidents);
- Fuel storage (industrial and urban accidents);
- Dam breaches (industrial and urban accidents);
- Mines and storage caverns (industrial and urban accidents);
- Fires (industrial and urban accidents);
- Road (transport accidents);
- Rail (transport accidents);
- Aviation (transport accidents);

  - Air (pollution accidents);
  - Electricity (utilities failures);
  - Gas (utilities failures);
  - Water supply (utilities failures);
  - Sewage system (utilities failures);
  - Attacks chemical biological radiological nuclear (malicious attacks);
  - Transport systems (malicious attacks);
  - Crowded places (malicious attacks);
  - Cyber (malicious attacks);
  - Infrastructure (malicious attacks);
  - Bridge failure (engineering accidents and failures);
  - Mast and tower collapse (engineering accidents and failures);
  - Property or bridge demolition accidents (engineering accidents and failures); and
  - Tunnel failure/fire (engineering accidents and failures).
- Operation Phase only:
  - Major accident hazard pipelines (industrial and urban accidents); and
  - Unexploded ordnance (malicious attacks).

BASELINE DATA COLLECTION

20.4.5. A desk-based data collection exercise has been undertaken, including a review of available information, to determine the baseline conditions.

20.4.6. The key sources of information used to determine the baseline for MA&D are:

- National Risk Register of Civil Emergencies[36];
- British Geological Survey (BGS) GeoIndex Onshore[37];
- Tsunamis Hazard Map[38];
- International Disaster Database[39];
- Health and Safety Executive's (HSE) Planning Advice Web App[40];
- HSE's COMAH 2015 Public Information Search[41];
- Linesearch before u dig[28];
- Ordnance Survey mapping;
- Google aerial and street view maps[42]; and
- Technical chapters (**Chapter 5: Air Quality (Volume 1)** to **Chapter 19: Marine Navigation (Volume 1)**).

ASSESSMENT METHODOLOGY

20.4.7. To date, there is no regulatory guidance on how to consider MA&D within the context of EIA. This assessment takes account of emerging EIA good practice[43,44,45] which

refers to other relevant documentation, including the Cabinet Office's National Risk Register[36]. The assessment presented within this chapter considers potential impacts from the construction and operation of the Proposed Scheme alongside Riverside 1 and Riverside 2.

20.4.8. The assessment of MA&D has been achieved through a review of available documentation and regulatory requirements. The assessment does not involve assessment from 'first principles' as it is recognised that existing legislation and health and safety requirements already identify risks and help to protect human beings and the environment.

20.4.9. The assessment presents any identified risks along with whether these are managed to be ALARP or require further precautionary mitigation actions beyond those already integrated into the design and execution of the Proposed Scheme.

20.4.10. The potential for identified relevant MA&D to result in a significant adverse environmental effect these have been evaluated using a risk-based approach. The approach has considered the environmental consequences of a MA&D, the likelihood of these consequences occurring, considering planned design and embedded mitigation, and the acceptability of the subsequent risk to the relevant receptor. The following process these have been applied to each of the MA&D categories included for assessment:

- identifying risks;
- screening these risks;
- defining the impact;
- assessing the risk; and
- appraising risk management options.

20.4.11. The Long List in **Appendix 20-1: Major Accidents and Disasters Long List (Volume 3)** provides the justification for whether Risk Event types are considered within the assessment.

Identify Risks

20.4.12. The assessed MA&D are considered to be rare events.

20.4.13. Low consequence events, whatever their likelihood, do not meet the definition of MA&D as defined in the IEMA Primer[19]. For example, minor spills which may occur during construction, but will be limited in area and volume and temporary in nature, do not meet the definition of a major accident. Such minor events will be dealt with by the measures included in the **Outline CoCP (Document Reference 7.4)** and do not fall within the scope of this assessment.

20.4.14. High likelihood and high consequence events also do not meet the definition of MA&D as the risk assessment and design process will identify and avoid or design out such risks. In addition, activities which fall into this category are highly regulated to minimise the risk to be ALARP.

20.4.15. This assessment focuses on low likelihood, but potentially high consequence events as illustrated in **Figure 20-1**, which is based on Figure 2 in the IEMA Primer[19].

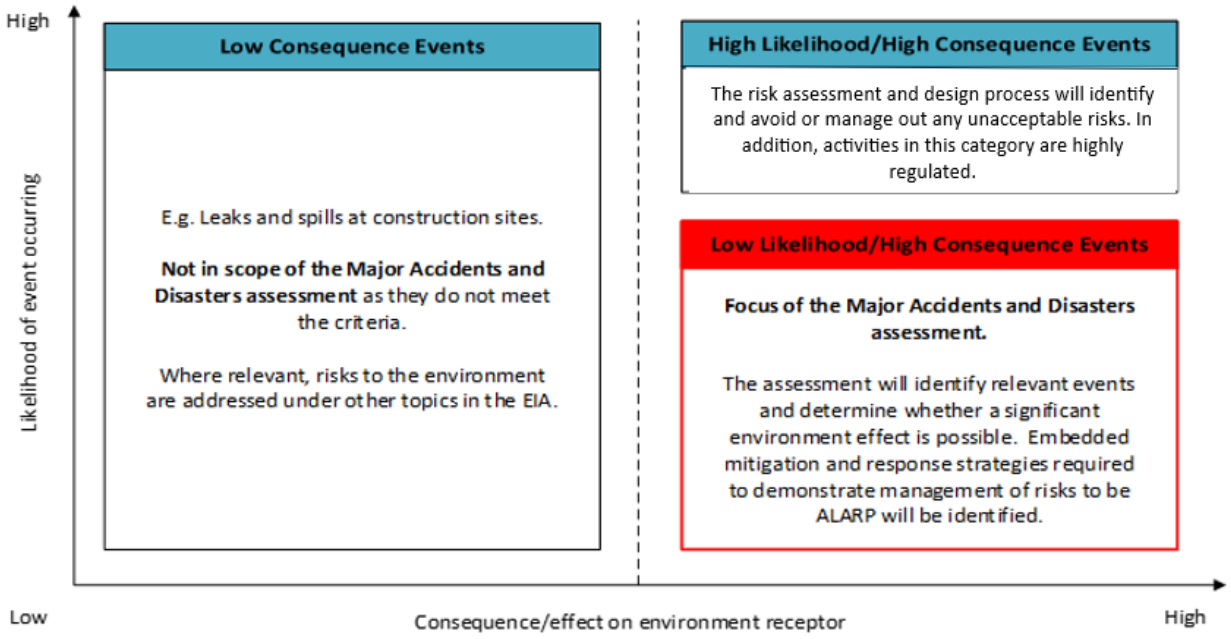

Figure 20-1: Graphical Representation of Major Accidents and Disasters Consequence Significance

20.4.16. Low likelihood events are defined, for the purposes of this assessment, as those which may occur during the lifetime of the Proposed Scheme: no more than once in 10 years for the construction phase; and no more than once in 100 years for the operation phase. This is an upper boundary for low likelihood.

20.4.17. Very low likelihood events are also included in the assessment, which may only occur at most once in every 1,000 years. Mitigation measures will reflect what is reasonable for such rare events, considering their potential consequence, within the guiding principle of risks being ALARP.

20.4.18. High consequence events are considered to lead to a significant adverse effect.

20.4.19. The risk identification process has used existing sources of information, such as risk assessments undertaken for the Proposed Scheme (e.g. HAZID and QRA) as part of other processes (many of which are required by law) or Risk Events identified within the UK's current National Risk Register[36]. No additional risk assessments have been undertaken and the risk identification activity has focused on collating and reviewing the existing sources of information prepared specifically for the Proposed Scheme.

20.4.20. To identify whether a Risk Event has the potential to be a MA&D event, which also has the potential to have a significant adverse effect on an environmental receptor, three components need to be present: a source, a pathway (between source and receptor) and a receptor. As such, and as recommended by DEFRA[20], the assessment uses the following conceptual model:

- the source is the original cause of the hazard, which has the potential to cause harm;
- the pathway is the route by which the source can reach the receptor; and
- the receptor is the specific component of the environment that could be adversely affected, if the source reaches it.

20.4.21. Risk Events which do not have all three components have been screened out from the assessment.

Screen Risks

20.4.22. The following MA&D screening process has been used to identify those Risk Events that will require further consideration within the assessment:

- is there a potential source, and/or pathway and/or receptor? If not, no further assessment required;
- is there a relevant environmental receptor present in the locations where the Risk Event could occur, and a pathway whereby the source of harm can reach the receptor? If not, no further assessment required; and
- does the potential impact on the environmental receptor meet the definition of a significant adverse effect? If not, no further assessment required.

20.4.23. For those Risk Events which are not screened out during the three-step process, the following assessment methodology has been used. The assessment forms the basis for recommending additional mitigation measures, as appropriate.

Define Impact

20.4.24. Several mechanisms are in place to reduce the vulnerability of the Proposed Scheme to MA&D or to mitigate significant effects on the environment should they occur. All measures to manage and reduce the risk of significant adverse effects occurring due to the vulnerability of the Proposed Scheme to MA&D are considered to be embedded mitigation measures for the purposes of the assessment. It has been assumed that:

- the construction phase of the Proposed Scheme will be managed through the implementation of a Construction Phase Plan (required under the CDM Regulations 2015[9]) and the **Outline CoCP (Document Reference 7.4)**;
- the design, installation, commissioning, operation and maintenance of plant, buildings, drainage systems, equipment, and machinery, including associated systems, will consider Good Engineering Practice; and
- the operation and maintenance of the Proposed Scheme will be managed through the implementation of an Operational EMP which will be written in accordance with the measures set out in the **Mitigation Schedule (Document Reference 7.8)**.

20.4.25. The measures of relevance to the assessment are described in the relevant chapters.

20.4.26. A reasonable worst case environmental impact(s) has been identified for each Risk Event included for assessment. Impacts have been identified in consultation with relevant disciplines for each environmental factor assessed within this ES. The

environmental impacts were identified through a qualitative process that seeks to answer the question '*could this event constitute a major accident or disaster in terms of the definitions provided?*'. Where relevant, specific sensitive receptors around the Proposed Scheme are considered. The Risk Record (**Appendix 20-2: ES Risk Record (Volume 3)**) records the outcome of this process.

Assess Risk

20.4.27. The likelihood of the reasonable worst case environmental effects occurring these have been evaluated considering the following:

- the likelihood of the Risk Event occurring considering the measures already embedded into the design and execution of the Proposed Scheme; and
- the likelihood that an environmental receptor is affected by the Risk Event.

20.4.28. Likelihood assessments evaluate whether the effect (for example, loss of life) is a possible outcome of the Risk Event.

20.4.29. This evaluation refers to existing risk assessments as well as consultation with relevant discipline specialists.

20.4.30. The assessment of the risk has been carried out in line with the IEMA Primer[19]. Where likely significant adverse effects are identified, mitigation measures must be in place, commensurate with the likelihood of the event occurring. The assessment considers, in consultation with relevant environmental topics, whether the risk to the environmental receptor is managed to be ALARP with the embedded mitigation measures. If gaps are identified, where the embedded mitigation measures do not manage risks to an environmental receptor to be ALARP, then additional measures will be required. The Risk Record presented in **Appendix 20-2: ES Risk Record (Volume 3)** records the outcome of the assessment.

Appraise Risk Management Options

20.4.31. Risk management options fall into the following categories:

- Eliminate (or 'avoid') the risk by adopting alternative processes to eradicate the source of the hazard or remove the receptor.
- Reduce the risk by adapting processes such that either the likelihood or the impact of the Risk Event can be decreased.
- Isolate the risk by using physical measures to ensure that should the Risk Event occur, it can be effectively isolated such that there is no pathway.
- Control the risk by ensuring that appropriate measures are in place (for example emergency response) so that should a Risk Event occur, it can be controlled and managed appropriately. The mitigation hierarchy of repair and compensate any significant damage to environmental receptors may then apply following a control measure.
- Exploit the risk if it presents potential benefits or new opportunities.

20.4.32. As safety risks will be required to be adequately addressed within the regulatory framework for the Proposed Scheme, it is not anticipated that significant residual effects, in terms of safety risks, will be identified as an output of the assessment.

SIGNIFICANCE CRITERIA

20.4.33. By definition, a MA&D would have a major significant effect on the environment. Accordingly, any risks that could result in a MA&D without suitable mitigation, management or regulatory controls in place will be assessed as significant.

20.5. STUDY AREA

20.5.1. MA&D types both within and outside the Site have been assessed, along with potential internal and external influencing factors. The following influencing factors and associated distances from the Site Boundary were adopted for setting the Study Area:

- Manmade features:
  - Airports and airfields within approximately 13km (the legal distance of the safeguarding zone for licensed airports in the UK);
  - COMAH facilities within approximately 3km (distance to furthest COMAH installation centre point whose CZ overlaps the Proposed Scheme);
  - Major Accident Hazard Pipelines (MAHP) within approximately 1km (distance to furthest MAHP whose CZ overlaps the Proposed Scheme);
  - Nuclear installations within approximately 3km (distance to the Land Use Planning Outer Consultation Zone);
  - Bulk fuel storage facilities (including Liquified Natural Gas, Liquified Petroleum Gas) within approximately 500m;
  - Rail infrastructure within approximately 100m; and
  - Transmission lines (gas, electrical, oil/fuels) within the Site.
- Natural features with the potential to create risks within:
  - 3km (chiefly hydrological and geological, for example dam failure and seismic activity respectively); and
  - 1km (chiefly hydrological and geological, for example flood risk and unstable ground conditions respectively).

20.5.2. The internal and external influencing factors, which may have high adverse consequences on the Proposed Scheme, were reviewed for the varying distances identified in **Paragraph 20.5.1** above. As presented in the EIA Scoping Report[34], it was identified that the key factors were within a 2km radius around the Proposed Scheme. Therefore, the extent of the Study Area used for the MA&D ES assessment is 2km.

SENSITIVE RECEPTORS

20.5.3. In line with Schedule 4 of the EIA Regulations[7] the following sensitive receptors were considered with respect to MA&D:

- members of the public and local communities;
- infrastructure and the built environment;
- the natural environment, including ecosystems, land and soil quality, air quality, surface and groundwater resources and landscape;
- the historic environment, including archaeology and built heritage; and
- the interaction between the factors above.

20.5.4. The specific potential receptors of effects resulting from MA&D are reported in the relevant other chapters as described in **Section 20.1**.

20.5.5. Certain receptors have been excluded from the assessment, for the reasons described in **Table 20-4** below.

Table 20-4: Excluded Receptors

Term	Definition
Staff of the Applicant and/or their suppliers, whether during the construction or operation phase of the Proposed Scheme.	Employer's commitment and obligations to manage risks to employees are addressed in the Health and Safety At Work etc. Act 1974[8].
Members of the public who are wilfully trespassing, for example, a breach of the Proposed Scheme's perimeter fencing.	Outside the occupier's legal requirements under the Occupiers' Liability Act 1984[16].

20.6. BASELINE CONDITIONS AND FUTURE BASELINE

BASELINE

20.6.1. The baseline relevant to MA&D comprises:

- features external to the Proposed Scheme that contribute a potential source of hazard to the Proposed Scheme;
- sensitive environmental receptors at risk of significant effect; and
- current (without the Proposed Scheme) MA&D risks in the locality.

20.6.2. There are four COMAH sites within a 5km radius of the Proposed Scheme:

- Crossness Sewage Treatment Works, Thames Water Utilities Limited (Lower Tier) (approximately 100m to the west of the Site Boundary);
- Rainham, Flogas Britain Limited (Fuel storage/distribution) (Upper Tier) (approximately 410m northeast of the Site Boundary);

- Dagenham, Stolthaven Dagenham Limited (Chemical installations - distribution, Fuel storage/distribution) (Upper Tier) (approximately 1.3km northwest of the Site Boundary); and
- Riverside Sewage Treatment Works, Thames Water Utilities Limited (Lower Tier) (approximately 1.45km northwest of the Site Boundary).

20.6.3. The presence of these sites could increase the vulnerability of the Proposed Scheme to a MA&D or a MA&D at the Proposed Scheme could initiate a major event at a COMAH facility.

20.6.4. Baseline information from the following chapters has also been used to inform the MA&D assessment:

- **Chapter 5: Air Quality (Volume 1);**
- **Chapter 7: Terrestrial Biodiversity (Volume 1);**
- **Chapter 8: Marine Biodiversity (Volume 1);**
- **Chapter 11: Water Environment and Flood Risk (Volume 1);**
- **Chapter 12: Climate Resilience (Volume 1);**
- **Chapter 14: Population, Health and Land Use (Volume 1);**
- **Chapter 17: Ground Conditions and Soils (Volume 1);**
- **Chapter 18: Landside Transport (Volume 1);** and
- **Chapter 19: Marine Navigation (Volume 1).**

FUTURE BASELINE

20.6.5. The future baseline is not anticipated to differ significantly from the current baseline with regards to the vulnerability of the Proposed Scheme to the risk of major accident(s) and/or disaster(s) with Riverside 2 (at the time of writing, construction works for Riverside 2 are being undertaken) being operational.

20.7. EMBEDDED DESIGN, MITIGATION AND ENHANCEMENT MEASURES

20.7.1. This section sets out the embedded design, mitigation and enhancement measures in place to address the vulnerability of the Proposed Scheme to the risk of MA&D events. The **Design Principles and Design Code (Document Reference 5.7)** are commitments which will govern the design of the Proposed Scheme during the detailed design stage. The **Design Principles and Design Code (Document Reference 5.7)** are considered to be embedded mitigation for the purposes of the assessment presented in this chapter.

20.7.2. The Applicant has committed to constructing and managing the Proposed Scheme in accordance with the following non-exclusive list of standards and systems:

- Programme of hazard studies of the Carbon Capture Facility to produce an inherently safe design and to ensure residual risks are managed to be ALARP.
- Environmental, Health & Safety Management systems.

- CDM Health & Safety Plan (relevant to construction phase only).
- Supplier management environmental, health & safety standards (e.g. Construction Skills Certification Scheme).
- Risk management systems.
- **Outline CoCP (Document Reference 7.4)** for construction phase environmental mitigation.
- **Outline EPRP (Document Reference 7.11)** for operation phase emergency preparedness and response planning.
- **Appendix 19-1: Preliminary Navigational Risk Assessment (Volume 3)** for construction and operational phase navigational risk management.

20.8. ASSESSMENT OF VULNERABILITY TO THE RISK OF MAJOR ACCIDENTS AND DISASTERS

20.8.1. This section details the output of the assessment of the vulnerability of the Proposed Scheme to the risk of MA&D during both the construction and operation phases, taking into account the embedded design, mitigation and enhancement measures detailed in **Section 20.7**.

20.8.2. The choice between demolition or retention of the Belvedere Power Station Jetty (disused) will not change the outcomes of the assessment of impacts and effects reported within this chapter. It is considered unlikely that the demolition or retention would result in significant changes to the MA&D Risk Event as similar risks will be associated with the Proposed Jetty.

POTENTIAL MAJOR ACCIDENT AND DISASTER EVENTS

20.8.3. Based on the information known at this stage of the Proposed Scheme, MA&D events to which the Proposed Scheme may be vulnerable during construction and operation are summarised below.

Construction Phase

20.8.4. Three MA&D events have been identified to which the Proposed Scheme may be vulnerable during the construction phase as detailed in **Table 20-5** below. All events that have been considered are set out in **Appendix 20-2: ES Risk Record (Volume 3)**.

20.8.5. The MA&D events presented are relevant to both construction programme options, as set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**.

Table 20-5: Potential MA&D Events Grouped by High Level Risk Event (Construction Phase)

Risk Record Entry Number	MA&D Category[1]	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event Did Occur
4	Transport accidents	Marine vessel containing construction materials collides with the Proposed Jetty or other jetties within the Site.	Collapse/damage to structures	Damage to the marine vessel/jetty/other vessel with the potential to cause loss of life or permanent injury which requires ongoing disability support.
6	Engineering accidents and failures	Striking of underground services/utilities.	Fire and/or explosion or release of harmful gas.	Fire and/or explosion affects neighbouring plant, equipment and/or those people in the immediate area. With the potential to cause loss of life or permanent injury; or significant structural property damage.
7	Engineering accidents and failures	Equipment dropped/collapse of Access Trestle onto the England Coast Path (FP3/NCN1).	Harm to people.	Death and/or injury to members of the public.

[1] Potential MA&D events have been identified within each of the MA&D Categories scoped in as presented in Appendix 20-1: MAD Long List.

20.8.6. Based on the assumptions and mitigation measures put forward in other relevant chapters (and set out in **Appendix 20-2: ES Risk Record (Volume 3)**), it is considered that the identified potential major accident(s) and/or disaster(s) events above would all be managed to be ALARP.

Operation Phase

20.8.7. Sixteen MA&D events have been identified to which the Proposed Scheme may be vulnerable during the operation phase as detailed in **Table 20-6** below. All events that have been considered are set out in **Appendix 20-2: ES Risk Record (Volume 3)**.

Table 20-6: Potential MA&D Events Grouped by High Level Risk Event (Operation Phase)

Risk Record Entry Number	MA&D Category[b]	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event Did Occur
12	Industrial and urban accidents	Unconfined vapour explosion on the Carbon Capture Facility initiating a major event on the adjacent COMAH installation.	Fire and/or explosion or release of harmful gas.	Unconfined vapour explosion onsite leading to structural damage and harm to people onsite and users of PRoW.
14	Industrial and urban accidents	Major fire on the Carbon Capture Facility initiating a major event on the adjacent COMAH installation due to the lack of firewater capacity.	Fire and/or explosion or release of harmful gas.	Fire contained within the Site with drift of airborne combustion products offsite, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
15	Industrial and urban accidents	Large scale release of CO_2 resulting from a loss of containment event involving a pipeline and/or storage tank.	Explosion or release of harmful gas.	CO_2 toxicity and fogging hazard affects neighbouring properties and/or those people in the immediate area (including users of public rights of way and open spaces) potentially causing loss of life or permanent injury which requires ongoing disability support.

[b] Potential MA&D events have been identified within each of the MA&D Categories scoped in as presented in Appendix 20-1: MAD Long List.

Risk Record Entry Number	MA&D Category[b]	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event Did Occur
16	Industrial and urban accidents	Large scale release of CO_2 resulting from a loss of containment event involving a pipeline and/or connection to the marine vessel.	Explosion or release of harmful gas.	CO_2 toxicity and fogging hazard affects neighbouring properties and/or those people in the immediate area (including users of public rights of way and open spaces) potentially causing loss of life or permanent injury which requires ongoing disability support.
17	Industrial and urban accidents	Major fire at Riverside 1 and/or 2 facilities initiating a major event at the Carbon Capture Facility.	Fire and/or explosion or release of harmful gas.	Fire contained within the Site with drift of airborne combustion products offsite, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
18	Transport accidents (waterways)	Large scale release of CO_2 resulting from a loss of containment event involving a marine vessel.	Explosion or release of harmful gas.	CO_2 toxicity and fogging hazard affects neighbouring properties and/or those people in the immediate area, potentially causing loss of life or permanent injury which requires ongoing disability support.
20	Pollution accidents (land)	Loss of containment of hazardous materials/ waste into the soil/ groundwater.	Harm to ecological receptors.	Localised contamination of the soil, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.

Risk Record Entry Number	MA&D Category[b]	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event Did Occur
21	Pollution accidents (water)	Loss of containment of hazardous materials/ waste into surface water features.	Harm to ecological receptors.	Localised contamination of surface water features, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
24	Pollution accidents (water)	Untreated waste water discharged into the foul sewer which may impact the Thames Water wastewater treatment plant.	Harm to ecological receptors.	Impact on operations of Thames Water wastewater treatment works which may impact surface water features, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
26	Pollution accidents (land and water)	Loss of containment of solvent from storage tanks, Capture Plant vessel, pipework or associated equipment into the soil/groundwater/surface water features.	Harm to ecological receptors.	Localised contamination of the soil/surface water features, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
27	Pollution accidents (land and water)	Loss of containment of solvent during road tanker unloading into the	Harm to ecological receptors.	Localised contamination of the soil/surface water features, potentially causing permanent or long-lasting damage to environmental

Risk Record Entry Number	MA&D Category[b]	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event Did Occur
		soil/groundwater/surface water features.		receptor(s) that cannot be restored through minor clean-up and restoration efforts.
28	Pollution accidents (land and water)	Loss of containment of solvent, due to overfilling of the fresh solvent storage tank, into the soil/groundwater/surface water features.	Harm to ecological receptors.	Localised contamination of the soil/surface water features, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
29	Pollution accidents (land and water)	Loss of containment of waste solvent during road tanker loading into the soil/groundwater/surface water features.	Harm to ecological receptors.	Localised contamination of the soil/surface water features, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
30	Pollution accidents (land and water)	Loss of containment of waste solvent, due to overfilling of the road tanker, into the soil/groundwater/surface water features.	Harm to ecological receptors.	Localised contamination of the soil/surface water features, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.
31	Pollution accidents (land and water)	Loss of containment of hazardous materials during road tanker unloading into the	Harm to ecological receptors.	Localised contamination of the soil/surface water features, potentially causing permanent or long-lasting damage to environmental

Risk Record Entry Number	MA&D Category[b]	Risk Description	Risk Event (High Level)	Reasonable Worst Consequence if Event Did Occur
		soil/groundwater/surface water features.		receptor(s) that cannot be restored through minor clean-up and restoration efforts.
32	Pollution accidents (land and water)	Loss of containment of hazardous materials, due to overfilling of chemical storage tanks, into the soil/groundwater/surface water features.	Harm to ecological receptors.	Localised contamination of the soil/surface water features, potentially causing permanent or long-lasting damage to environmental receptor(s) that cannot be restored through minor clean-up and restoration efforts.

20.8.8. Based on the assumptions and mitigation measures put forward in other relevant chapters (and set out in **Appendix 20-2: ES Risk Record (Volume 3)**), it is considered that the identified potential major accident(s) and/or disaster(s) events above would all be managed to be ALARP.

20.9. ADDITIONAL DESIGN, MITIGATION AND ENHANCEMENT MEASURES

20.9.1. Additional design, mitigation and enhancement measures are set out in **Appendix 20-2: ES Risk Record (Volume 3)**. All of the measures identified are either required by regulatory drivers (e.g. CDM Regulations[9], Health and Safety at Work etc. Act[8]) or are considered to be Good Engineering Practice.

20.10. MONITORING

20.10.1. No monitoring specifically driven by MA&D is considered to be proportionate or to be required.

20.11. LIMITATIONS AND ASSUMPTIONS

20.11.1. This section outlines the limitations, uncertainties, and assumptions made in assessing the vulnerability of the Proposed Scheme to a MA&D reported in this chapter.

- The design of the Proposed Scheme and its implementation is guided by other industry standards and codes, many of which are mandatory. These require infrastructure and systems to be designed so that risks to people and the environment are either eliminated or reduced to levels that are ALARP.
- Environmental effects associated with unplanned events that do not meet the definition of a major accident and/or disaster e.g., minor leaks and spills that may be contained within the construction sites are addressed in other relevant chapters.

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