

CHAPTER 9

CLIMATE

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INTRODUCTION

Background

- 9.1 This chapter of the Environmental Impact Assessment Report (EIAR), prepared by SLR Consulting Ireland, provides supporting information to accompany a Planning Application to Sligo County Council by Lagan Materials Ltd. in respect of any potential climate related impacts from the site associated with the planning application area and the wider quarry development at Aghamore Near, Aghamore Far and Carrownamaddoo townlands, Co. Sligo.
- 9.2 The quarry operations comprise extraction of limestone using blasting techniques; processing (crushing and screening) of the fragmented rock to produce aggregates for road construction, site development works and in the production of asphalt materials.
- 9.3 Further information on the site infrastructure, operations, environmental management systems, and controls at the quarry site is provided in Chapter 2 of this EIAR.
- 9.4 Ancillary manufacturing facilities at the site, located adjacent to the processing area, include an asphalt plant.

Scope of Work

- 9.5 The following sections of this Chapter describe the potential climate change impacts associated with the proposed development. The following issues are addressed separately:
- climate change legislative framework/policy context;
 - analysis of evolving environmental baseline trends;
 - identifying climate change concerns in relation to proposed development;
 - assessing effects (cumulative effects and uncertainty);
 - identifying alternatives and mitigation measures;
 - identifying monitoring and adaptive management.

Consultations / Consultees

- 9.6 A number of pre-planning consultation meetings have been held between officials of Sligo County Council and representatives of SLR Consulting Ireland and Lagan Materials Limited.
- 9.7 At the meetings, details of the proposed development were presented and issues likely to be of interest or concern were identified and discussed.
- 9.8 Following a review of published development plans and the site survey, it was considered that there was no requirement for any further formal consultations to be carried out in respect of climate for the purposes of this assessment.

Contributors / Author(s)

- 9.9 SLR Consulting Ireland undertook the impact assessment presented in this chapter on behalf of Lagan Materials Ltd. The lead consultant for the study was Aldona Binchy MSc. Eng PIEMA Environmental Engineering.

Limitations / Difficulties Encountered

- 9.10 There are currently no published guidelines and established methodology providing specifically for assessment of climate impacts from quarrying activities in Ireland. This Chapter of the EIAR has therefore been prepared on the basis of general cross-sectoral guidance.

ADDITIONAL INFORMATION

- 9.11 As outlined in Chapter 1, a planning application was submitted to Sligo County Council (Plan File Ref. No. 18/345 / ABP Ref. 305821-19) in August 2018 for similar development to that proposed as part of this application. In October 2019 Sligo County Council granted planning permission for the development (subject to 23 no. conditions). 2 no. third party appeals of the decision by Sligo County Council to grant permission for the proposed quarry development were made to An Bord Pleanala (ABP-305821-19). An Bord Pleanala refused permission for the proposed development on the 30th June 2020 for the 2 no. reasons – refer to Chapter 1 for further details.
- 9.12 In order to comprehensively address the reasons for refusal, and further comments contained within the An Bord Pleanala Inspectors Report a number of additional surveys / site investigations, field work and assessments have been carried out.
- 9.13 This Chapter 8 of the EIAR has been updated as follows:
- This assessment takes account of the revised planning application area and considers all activities associated with the revised application area, such as the recommencement of aggregate processing activities;
 - The assessment takes account of cumulative impacts.

Legislative Framework/ Policy Context

Adaptation to Climate Change

- 9.14 The Irish National Policy Position on Climate Action and Low Carbon Development¹ establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. It sets out the context for the objective; clarifies the level of greenhouse gas (GHG) mitigation ambition envisaged; and establishes the process to

¹<https://www.dcaae.gov.ie/en-ie/climate-action/publications/Pages/National-Policy-Position.aspx>

pursue and achieve the overall objective. Specifically, the National Policy Position envisages that policy development will be guided by a long-term vision based on:

- an aggregate reduction in carbon dioxide (CO₂) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors;
- in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

- 9.15 The evolution of climate policy in Ireland will be an iterative process based on the adoption by Government of a series of national plans over the period to 2050. Greenhouse gas mitigation and adaptation to the impacts of climate change are to be addressed in parallel national plans – respectively through National Mitigation Plans and National Climate Change Adaptation Frameworks. The plans will be continually updated, as well as being reviewed on a structured basis at appropriate intervals, and at a minimum, every five years. This will include early identification and ongoing updating of possible transition pathways to 2050 to inform sectoral strategic choices.
- 9.16 The Climate Action and Low Carbon Development Act 2015² was enacted in December 2015. The Act identified and provided for the development and submission to the Government of national mitigation and adaptation plans. It also established the institutional and governance framework within which these plans can be developed and implemented on a cyclical basis.
- 9.17 The Department of Communications, Climate Action & Environment (DCCA) published a National Adaptation Framework (NAF) in January 2018³. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts.
- 9.18 The NAF builds on the work already carried out under the National Climate Change Adaptation Network (NCCAF, 2012). Under the NAF a number of Government Departments will be required to prepare sectoral adaptation plans in relation to a priority area that they are responsible for. Local authorities are required to prepare local adaptation strategies. The NAF also aims to improve the enabling environment for adaptation through ongoing engagement with civil society, the private sector and the research community.
- 9.19 The production of aggregates was not specifically identified under the NAF to prepare sectoral adaptation plans in line with the requirements of the Climate Action and Low Carbon Development Act.
- 9.20 The Climate Action Plan 2019⁴ sets out the Irish Government’s plan to tackle climate breakdown and achieve net zero greenhouse gas emissions by 2050.
- 9.21 The Plan clearly identifies the nature and scale of the challenge. It outlines the current state of play across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and charts a course towards ambitious decarbonisation targets. Reflecting the central priority climate change will have in our political and administrative systems into the future, the Plan sets out governance arrangements including carbon-proofing our policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas.

²<https://www.dccae.gov.ie/en-ie/climate-action/legislation/Pages/Climate-Action-and-Low-Carbon-Development-Act-2015.aspx>

³<https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/default.aspx>

⁴<https://www.dccae.gov.ie/en-ie/climate-action/publications/Pages/Climate-Action-Plan.aspx>

- 9.22 This Plan clearly recognises that Ireland must significantly step up its commitments to tackle climate disruption. The leadership role both the Government and public bodies can play in taking early action on climate is fundamental to achieving our decarbonisation goals.

Sectoral Adaptation Plans

- 9.23 Under the non-statutory 2012 Framework, four Government Departments prepared draft sectoral plans covering 5 sectors. These plans are:

- Sectoral Adaptation Plan for Flood Risk Management (OPW, 2015);
- Adaptation Planning - Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector (DAFM, 2017);
- Adaptation Planning - Developing Resilience to Climate Change in the Irish Transport Sector (DTTAS, 2017);
- Adaptation Plan for the Electricity and Gas Networks Sector (DCCAIE, 2017).

- 9.24 As mentioned previously a number of Government Departments are required develop statutory sectoral adaptation plans under NAF. These are to be prepared in accordance with a six-step adaptation planning process described in the Sectoral Planning Guidelines for Climate Change Adaptation⁵. The guidelines aim to ensure that a coherent and consistent approach to adaptation planning will be adopted by the key sectors in Ireland. The completed plans include actions that:

- Mainstream (integrate) adaptation into key sectoral plans and policies;
- Identify and understand the key vulnerabilities, risks, and opportunities facing their sectors. This should include major cross cutting risks;
- Ensure that plans related to emergencies assigned to a sectoral department as lead Government department under the Strategic Emergency Planning Guidelines are climate proofed;
- Identify and collect information on the costs and benefits of adaptation within their sectors;
- Build capacity within their sectors to cope with climate change;
- Identify and address key research gaps within their sectors;
- Improve co-ordination with the local government sector;
- Develop appropriate monitoring and verification systems within their sectors.

- 9.25 Sectoral Adaptation Plans have already been published for the following twelve sectors under 7 Government Departments⁶:

- Seafood - Department of Agriculture, Food and the Marine
- Agriculture - Department of Agriculture, Food and the Marine

⁵<https://www.dccae.gov.ie/documents/SPG%20Climate%20Change%20Adaptation.pdf>

⁶<https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/sectoral-adaptation-planning/Pages/Sectoral.aspx>

- Forestry - Department of Agriculture, Food and the Marine
- Biodiversity - Department of Culture, Heritage and the Gaeltacht
- Built and Archaeological Heritage - Department of Culture, Heritage and the Gaeltacht
- Transport infrastructure - Department of Transport, Tourism and Sport
- Electricity and Gas Networks - Department of Communications, Climate Action and Environment
- Communications networks - Department of Communications, Climate Action and Environment
- Flood Risk Management - Office of Public Works
- Water Quality - Department of Housing, Planning and Local Government
- Water Services Infrastructure - Department of Housing, Planning and Local Government
- Health - Department of Health.

Local Level Adaptation

- 9.26 The National Adaptation Framework (NAF) identifies the critical role to be played by local authorities in addressing climate change adaptation. This will effectively build on their existing expertise and experience as first responders in emergency planning scenarios. Under the NAF each local authority has developed their own adaptation strategies in line with guidelines developed for the sector.
- 9.27 The NAF explores how local authorities might adopt a joint or regional approach to adaptation planning. In January 2018 the Department of the Environment, Climate and Communications entered into a five-year financial commitment of €10m establishing four Climate Action Regional Offices (CAROs). Building on a business case prepared by the local government sector itself, this commitment recognises the significant obligation which has been placed on local government to develop and implement its own climate action measures, as well as the need to build capacity within the sector to engage effectively with climate change – both in terms of mitigation and adaptation.
- 9.28 The Climate Action Regional Offices are being operated by a lead local authority in the four different regions that have been grouped together based on a climate risk assessment with a focus on the predominant risk(s) in each geographical area. The establishment of these offices enables a more coordinated engagement across the whole of government and will help build on the experience and expertise which exists across the sector.
- 9.29 **Table 9-1** summarises the adaptation actions to climate change in Ireland.

Table 9-1
Summary of Adaptation to Climate Change Actions in Ireland⁷

Item	Status	Programs
National Climate Adaptation Strategy	Legislation enacted. Statutory Framework adopted	Climate Action and Low Carbon Development Act 2015 National Adaptation Framework
Action Plans	Sectoral Adaptation Plans published. Local authority plans published.	Local Authority Adaptation Strategy Development Guidelines (2018) Sectoral Planning Guidelines for Climate Change Adaptation (2018) Local Authority Adaptation Support Tool
Impacts, Vulnerability and Adaptation Assessments	National Vulnerability Assessment	2012 National Climate Change Vulnerability Scoping Study Climate Change Impacts on Biodiversity in Ireland (2013) Climate change Impacts on Phenology in Ireland(2013) COCOADAPT (2013) 2013 Hydro Detect Project Robust Adaptation to Climate Change in the Water Sector in Ireland (2013) Ensemble of Regional Climate Projections for Ireland(2015) Urb-ADAPT Sectoral Adaptation Plan for Flood Risk Management (OPW, 2015). Adaptation Planning - Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector (DAFM, 2017) Adaptation Planning - Developing Resilience to Climate Change in the Irish Transport Sector (DTTAS, 2017). Adaptation Plan for the Electricity and Gas Networks Sector (DCCAE, 2017).
Research Programs	EPA Research Programme (Climate Pillar)	http://www.epa.ie
Climate services / Met Office	Established	http://www.met.ie
Web Portal	Established	http://www.climateireland.ie
Monitoring, Indicators, Methodologies	Established	Ensemble of regional climate model projections for Ireland (EPA 2015) http://www.climatecouncil.ie/
Training, Education	Ongoing / in development	http://www.climateireland.ie

⁷ <http://climate-adapt.eea.europa.eu/countries-regions/countries/ireland>

Green House Gas Emissions

- 9.30 Ireland is a party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which together provide an international legal framework for addressing climate change.
- 9.31 In December 2015, an ambitious new legally binding, global agreement on climate change was agreed in Paris. The Paris Agreement aims to restrict global temperature rise to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C. It aims to increase global ability to adapt to the adverse impacts of climate change and to foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten sustainable food production. It also seeks to achieve a balance between anthropogenic emissions by sources, and removals by sinks, of greenhouse gases in the second half of this century.
- 9.32 The first Irish National Mitigation Plan⁸ represents an initial step to set us on a pathway to achieve the level of decarbonisation required. It is a whole-of-Government Plan, reflecting in particular the central roles of the key Ministers responsible for the sectors covered by the Plan – Electricity Generation, the Built Environment, Transport and Agriculture, as well as drawing on the perspectives and responsibilities of a range of other Government Departments.
- 9.33 The measures that will be implemented through the plan will lay foundations for transitioning Ireland to a low carbon, climate resilient and environmentally sustainable economy by 2050. To support this ongoing work, the Plan also includes over 100 individual actions for various Ministers and public bodies to take forward.
- 9.34 Emissions reduction measures and actions set out in this National Mitigation Plan are aligned with and build upon commitments made in the 2015 Energy White Paper. The Paper will be guided by the following strategic objectives:
- policy will contribute to reductions in Ireland’s greenhouse gas emissions and enhancement of sinks in a manner that achieves the optimum benefits at least cost;
 - a stable and predictable policy and regulatory framework will be underpinned by rigorous analysis and appraisal, supported by strong research and analytical capacity;
 - the Government will pursue investment, innovation and enterprise opportunities towards building a competitive, low carbon, climate-resilient and environmentally sustainable economy; and
 - the citizen and communities will be at the centre of the transition.

Paris Agreement

- 9.35 The Paris Agreement entered into force on the 4th November 2016⁹.
- 9.36 The Paris Agreement aims to tackle 95% of global emissions through 188 Nationally Determined Contributions (NDCs) which will increase in ambition over time. Ireland’s contribution to the Paris Agreement will be via the NDC tabled by the EU on behalf of its Member States. This is a binding target for an overall reduction of at least 40% in greenhouse gas emissions by 2030 (relative to 1990

⁸ <https://www.dcaea.gov.ie/en-ie/climate-action/topics/national-mitigation-plan/Pages/default.aspx>

⁹ <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

levels). The target will be delivered by the EU by 2030 through reductions in the Emissions Trading Scheme (ETS) and non-ETS sectors of 43% and 30% respectively (relative to 2005).

Kyoto Protocol (2008 – 2012)

- 9.37 The EPA has overall responsibility for the national greenhouse gas inventory in Ireland’s national system, which was established in 2007 under Article 5 of the Kyoto Protocol¹⁰.
- 9.38 Ireland currently accounts for GHG emissions under the Kyoto Protocol. The Kyoto Protocol required Ireland to limit total national greenhouse gas emissions to 314.2 Mtonnes of CO_{2eq} over the five-year period 2008 – 2012 which is equivalent to 62.8 Mtonnes of CO_{2eq} per annum. The Kyoto Protocol limit is calculated as 13% above Ireland’s 1990 baseline value which was established and fixed at 55.61 Mtonnes of CO_{2eq} following an in-depth review of Ireland’s 2006 greenhouse gas inventory submission to the UNFCCC.¹¹

EU 2020 Targets for non-ETS sector emissions¹²

- 9.39 Under the EU Commission’s Climate and Energy Package, Ireland is required to deliver a 20% reduction in non-ETS greenhouse gas emissions by 2020 (relative to 2005 levels). In addition, Ireland also has binding annual emission limits for the period 2013-2020 to ensure a gradual move towards the 2020 target.
- 9.40 The non-ETS sectors cover those sectors that are outside the EU Emissions Trading Scheme and includes agriculture, transport, built environment (residential, commercial/institutional), waste and non-energy intensive industry. Member States are permitted to meet their annual targets through a number of mechanisms which include carry forward of a quantity of its annual emission allocation from the following year, use of transfers from other Member States and the limited use of international credits from project activities as long as certain criteria are met.

2015 Energy White Paper

- 9.41 The White Paper on Energy Policy, Ireland’s Transition to a Low Carbon Energy Future 2015-2030¹³, published in 2015, sets out a framework to guide energy policy in the period to 2030. The White Paper recognises that a radical transformation of our energy system is required to meet our national, EU and international climate objectives and sets a course for an energy sector where the State will provide the supports that enable consumers to become active energy citizens. It posits a policy approach where our energy system will change from one that is almost exclusively led by Government and utilities to one where individuals and communities are agents of change in the way Ireland generates, transmits, stores, conserves and uses energy. It sets out a vision, a framework and over 90 actions for Irish energy policy up to 2030 as we transition to a low carbon society and economy by 2050.

¹⁰ http://unfccc.int/kyoto_protocol/items/2830.php

¹¹ http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/nc6_br1_ire.pdf

¹² https://www.epa.ie/pubs/reports/air/airemissions/GHG_report2014.pdf

¹³ <https://www.dccae.gov.ie/en-ie/energy/publications/Pages/White-Paper-on-Energy-Policy.aspx>

Catchment Flood Risk Assessment and Management (CFRAM) Programme¹⁴

- 9.42 The Catchment Flood Risk Assessment and Management (CFRAM) Programme (see www.cfram.ie) is the mechanism established to facilitate future adaptation to climate change. It provides for long-term flood risk management in Ireland and the embedment of flood risk assessment in the future development of capital projects. The future scenario flood maps produced under the CFRAM Programme facilitate this approach, inform other industrial sectors, and provide a valuable resource for local adaptation planning and sustainable land use management and planning.

EIA Directive 2014/52/EU

- 9.43 Directive 2014/52/EU¹⁵ of the European parliament and of the Council of 16th April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment had to be transposed into national law by 16th May 2017, necessitating changes in laws, regulations, and administrative provisions across a number of legislative codes.
- 9.44 Key changes introduced in the 2014 Directive (in Annex IV - Information referred to in Article 5(1) – Information for the Environmental Impact Assessment Report) and the national transposing regulations (the European Union (Planning and Development)(Environmental Impact Assessment) Regulations, S.I. No. 296 of 2018) include a requirement for information on the impact of a project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change to be provided in the Environmental Impact Assessment Report.

Guidelines

*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (EC, 2013)*¹⁶

- 9.45 EU Guidelines provide recommendations how to integrate climate change and biodiversity in Environmental Impact Assessment (EIA). The need for action on climate change and biodiversity loss is recognised across Europe and around the world. The guidelines contain explanation as to why climate change and biodiversity are so important in EIA, present the relevant EU-level policy background, provide advice on how to integrate climate change and biodiversity into selected stages of the EIA process. The annexes provide sources of further reading and links to other relevant information, data, and tools.

*Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2017)*¹⁷

- 9.46 IEMA Guidance provides information to assist practitioners with addressing greenhouse gas (GHG) emissions assessment and mitigation in statutory and non-statutory Environmental Impact Assessment (EIA). It complements IEMA's earlier guide on Climate Change Resilience and Adaptation and builds on the Climate Change Mitigation and EIA overarching principles. The requirement to consider this topic has resulted from the 2014 amendment to the EIA Directive.

¹⁴ <https://www.cfram.ie/>

¹⁵ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052>

¹⁶ <http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf>

¹⁷ https://www.iaia.org/pdf/wab/EIA%20Guide_GHG%20Assessment%20and%20Significance_IEMA_16May17.pdf

Climate Change and Major Projects (EC, 2016)¹⁸

9.47 This publication provides guidance for assessing vulnerability and risk from Climate Change for major projects funded by the European Regional Development Fund (ERDF) and the Cohesion Fund and listed in the concerned operational programmes.

Sectoral Planning Guidelines for Climate Change Adaptation¹⁹

9.48 The guidelines aim to ensure that a coherent and consistent approach to adaptation planning is adopted by the key sectors in Ireland. Sectors preparing sectoral adaptation plans under the NAF are required to prepare their plans in line with the process described in these guidelines while also being aware of the overall requirements regarding the development of sectoral adaptation plans.

Local Authority Adaptation Strategy Development Guidelines²⁰

9.49 Guidance was produced to provide a consistent and coherent process for local authorities in helping them develop local adaptation strategies and contain information on the process of developing an adaptation strategy:

- provide background information on what adaptation entails and provides the rationale behind implementing a local scale adaptation strategy;
- outline the initial steps required in launching a strategy development process, describing key roles and who can fulfil them, and setting out important factors to consider in the early stages of strategy development;
- explains how to assess the role that weather extremes and periods of climate variability currently play within the local jurisdiction, and it describes why doing so is a fundamental element of working towards a more climate-resilient future;
- moves from the present to the identification of future climate risks, describing a staged risk assessment process and positioning the adaptation strategy within more detailed risk assessments undertaken during shorter term decision-making processes such as statutory plan-making;
- on the basis of the risk assessment process undertaken determination of adaptation goals and objectives and the types of adaptation actions that are available and outlines how each might be identified, assessed, prioritised and implemented is described;
- outlines the steps required to move from a phase of planning to one of implementation, and it explains the importance of monitoring and evaluation in ensuring that the strategy is achieving its anticipated adaptation objectives.

¹⁸ https://ec.europa.eu/clima/sites/clima/files/docs/major_projects_en.pdf

¹⁹ <https://www.dccae.gov.ie/documents/SPG%20Climate%20Change%20Adaptation.pdf>

²⁰ <https://www.dccae.gov.ie/documents/LA%20Adaptation%20Guidelines.pdf>

RECEIVING ENVIRONMENT

Climate Environmental Baseline

Regional Context

- 9.50 Observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising sea level are unequivocal evidence of warming of the climate system globally. Global mean temperature has increased by 0.8°C compared with pre-industrial times for land and oceans, and by 1.0°C for land alone. Most of the observed increase in global average temperatures is very likely due to increases in anthropogenic greenhouse gas concentrations.
- 9.51 In future years, landmasses are expected to warm more than the oceans, and northern, middle and high latitudes. Despite possible reductions in average summer precipitation over much of Europe, precipitation amounts exceeding the 95th percentile are very likely in many areas; thus, episodes of severe flooding may become more frequent despite the general trend towards drier summer conditions. In an ensemble-based approach using outputs from 20 global climate models (GCMs), the Mediterranean, north-east and north-west Europe are identified as warming hot spots but with regional and seasonal variations in the pattern and amplitude of warming.
- 9.52 Regional climate models (RCMs) also project rising temperatures for Europe until the end of the 21st century, with an accelerated increase in the second half of the century. For precipitation, the larger-scale summer pattern shows a gradient from increases in Northern Scandinavia to decreases in the Mediterranean region. By contrast, increases in wintertime precipitation primarily north of 45°N are a consistent feature of RCM projections over Europe, with decreases over the Mediterranean. Overall, then, there are consistent projections of change for northern and north-west Europe, including Ireland.
- 9.53 Ireland has a typical maritime climate, with relatively mild and moist winters and cool, cloudy summers. The prevailing winds are south-westerly in direction. The climate is influenced by warm maritime air associated with the Gulf Stream which has the effect of moderating the climate, and results in high average annual humidity across the country. The area of least precipitation is along the eastern seaboard of the country, in the rain shadow of the Leinster uplands.
- 9.54 Mean seasonal temperature will change across Ireland. A number of studies have applied selected IPCC Special Reports on Emissions Scenarios (SRESs) to model climatic changes across Ireland at a regional scale. Despite the different methods and scenario combinations used, there is agreement in projected changes in temperature for Ireland. However, there are more disparities in the magnitude and sign for the precipitation changes projected for the island.
- 9.55 **Table 9-2** summarises climate impact projections for Ireland, estimates of projections confidence are derived from published projection data from the Local Authority Adaptation Strategy Development Guidelines.

Table 9-2
Climate Impacts Projections: 30-year overview²¹

Variable	Summary	Confidence	Projected changes
Sea Levels Rise	Strong increase	High	Projections of sea level rise to 2100 suggest a global increase in the range of 0.09-0.88m with a mean value of 0.48. For 2050, it is reasonable to assume a sea level rise in the region of 25 cm above present levels. It should be noted that due to an as yet limited understanding of some of the important effects that contribute to rates of increase, these estimates of sea level rise may prove optimistic, and estimates of up to 4-6 m have been projected by some models.
Storm surge	Strong increase	Medium	An increase in the numbers of intense cyclones and associated strong winds are expected over the north - east Atlantic. By the 2050s, storm surge heights in the range of 50-100cm are expected to increase in frequency for all coastal areas with exception of the southern coast.
Costal Erosion	Moderate increase	Low	Currently approximately 20% of Ireland's coastline is at risk of costal erosion, particularly areas of the south and east coast and also in isolated areas on the west coast. Rates of increase will be determined by local circumstances; however, it is expected that areas of the south-west are likely to experience the largest increase.
Cold Snaps/ Frost	Moderate decrease (winter/night)	High	By mid-century, minimum temperatures during winter are projected to increase by ~2°C in the south-east and ~2.9°C in the north. This change will result in fewer frost days and milder high-time temperatures.
Heatwaves	Strong increase (summer)	High	Seven significant heatwaves (defined as 5+ days@>25°C) have been recorded in Ireland over the past 30 years, resulting in approximately 300 excess deaths. By mid-century, a projected increase in summer maximum daily temperature of approximately 2°C will likely intensify heatwaves, with maximum temperatures increasing and heatwave duration lengthening.
Dry Spells	Strong increase (summer)	Medium	There have been seven periods of insignificant rainfall in Ireland in the past 40 years. Of these, the events of 1976 and 1995 were the most severe, averaging 52 and 40 days in duration respectively across Irish rainfall stations. An approximate 20% decrease in summer precipitation receipts in many areas is strongly indicated under a high emissions scenario. This decrease is likely to result in progressively longer periods without significant rainfall, posing potentially severe challenges to water sensitive sectors and regions.
Extreme Rainfall	Strong increase (winter)	Low	Heavy precipitation days (in which more than 20mm of rainfalls) are likely to increase in frequency in winter. By the 2050s an increase in the number of heavy precipitation days of around 20% above the level of 1981-2000 is projected under both low- medium and high emissions scenarios. This may have serious consequences for flood risk in sensitive catchments.
Flooding	Moderate increase (winter)	Low	An Irish Reference Network of hydrometric stations has been established to assess signals of climate change in Irish hydrology. This network has detected an increasing trend in high river flows since 2000. Projections of future flows are beset by uncertainty at the catchment scale, but a broad signal of wetter winters and drier summers is evident across a number of independent studies.

²¹ Local Authority Adaptation Strategy Development Guideline, EPA 2016:
http://www.epa.ie/pubs/reports/research/climate/EPA_Research_Report164.pdf

Variable	Summary	Confidence	Projected changes
Wind Speed	Minor increase (winter)	Medium	Observed wind speed over Ireland has not changed significantly in recent times, but it is anticipated that the distribution of wind will alter slightly in future, with winters marginally windier and summers marginally less so. Though the average wind speed is anticipated to change in only a minor way over the coming decades, the frequency of extreme windstorms is expected to increase due to alternations in the origin and track of tropical cyclones.

Local Context

- 9.56 The closest weather station to the application site and are considered representative of conditions experienced at the application site is Mullingar Meteorological Station, which is located approximately 100km to the south-east of the application site.
- 9.57 The moderating influence of the Atlantic Ocean is felt throughout Ireland. The annual mean temperature for different areas in Ireland varies between mountainous regions, lowlands and the coast. Mean daily maximum temperatures are typically between 7.4 to 19.2°C and mean daily minimum temperatures are typically between 1.5 to 11.1°C for the general Mullingar area (refer to **Table 9-3**)

Table 9-3
Average Temperatures Mullingar 1979-2008

TEMPERATURE (DEGREES CELSIUS)													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Mean Daily Max	7.4	7.9	9.8	12.1	14.9	17.3	19.2	18.9	16.7	13.2	9.9	7.9	12.9
Mean Daily Min	1.5	1.5	2.8	4.1	6.3	9.2	11.1	10.8	8.9	6.2	3.5	2.2	5.7
Mean Temp.	4.5	4.7	6.3	8.1	10.6	13.2	15.2	14.8	12.8	9.7	6.7	5.0	9.3

- 9.58 The east of Ireland, which is sheltered from Atlantic frontal systems, is sunnier than the west. The sunniest months are May and June. The mean daily duration recording of sunshine for the area around Mullingar is 3.6 hours. December is the dullest month, with 1.6 hours of mean daily duration. May is the sunniest month, with 5.8 hours of mean daily duration, explained largely by its long days and finer weather.
- 9.59 Results from the synoptic meteorological station at Mullingar, located approx. 35km north-east of the application site over the period 1990-2010, indicate that the main wind direction is from a west and south-westerly direction, with winds between 200° and 280°. The lowest frequency is for winds blowing from the north and northeast direction.
- 9.60 A windrose for the wind data recorded at Mullingar station is presented in **Figure 9-1**.
- 9.61 During the period 1970-2008, the mean monthly total for the year rate of precipitation was 941.3 mm/ year at Mullingar station, with winter months receiving the heaviest amounts. The average rainfall data indicates that the greatest daily total (58.2mm) falls in the month of August (refer to **Table 9-4**).

Table 9-4
Average Precipitation Mullingar (mm) 1979-2008

RAINFALL (MM)													
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Mean Monthly Total	91.7	72.0	78.3	62.1	68.7	70.5	61.8	80.8	73.8	102.1	82.4	97.1	941.3
Greatest Daily Total	30.3	24.7	29.5	27.6	26.1	52.9	26.6	58.2	42.1	48.8	43.7	38.8	58.2

IMPACT ASSESSMENT

Methodology

- 9.62 In Ireland some sectors have independently begun the process of identifying key vulnerabilities for their activities. The report by the Irish Academy of Engineering, Ireland at Risk Critical Infrastructure – Adaptation for Climate Change (The Irish Academy of Engineering, 2009) and the report by the Heritage Council and Fáilte Ireland (the National Tourism Development Authority), Climate Change, Heritage and Tourism, Implications for Ireland's Coast and Inland Waterways (ed. Kelly and Stack, 2009) are examples of initiatives of this kind.
- 9.63 Other research work on adaptation in specific sectors has been carried out or commissioned by other Government Departments/bodies such as the OPW, CoFoRD (programme of competitive forest research for development research programme, etc. (e.g. CLIMADAPT).
- 9.64 A National Climate Change Vulnerability Scoping Study (Sweeney and Coll, 2012) was undertaken to identify first generation vulnerabilities for Ireland based on a sensitivity analysis across key sectors. The analysis identified a clustering of impacts and their importance in relation to an assessment of likely resilience by sector. The assessment methodology used was an impacts-first, science-first classical approach. The priority sectors identified are biodiversity and fisheries; water resources and the built coastal environment; forestry and agriculture.
- 9.65 As each sector develops its sectoral adaptation plan (under the Climate Action and Low Carbon Development Act 2015), detailed vulnerability and risk analysis will be required. Some preliminary work has been undertaken on costing the impacts of climate change in Ireland. This is now being supported by more detailed analysis of the current and future costs of flood risk management.
- 9.66 The implementation of adaptation is being supported by the development of a suite of guidelines, tools and approaches. These include the Local Authority Adaptation Strategy Development Guideline; and the Irish climate information platform “Climate Ireland”, which includes data, information, tools and approaches for local level adaptation decision making. Work is ongoing to develop sectoral decision-making tools and supports.
- 9.67 The EPA is currently funding a research project called Urb-Adapt which aims to identify the impact of climate change on Dublin city and surrounding towns within the greater Dublin region. The project aims to identify possible risks to the population living in that area and future risks posed to it by the changing climate.

- 9.68 There are no specific tools developed for assessing climate change for extraction industry. The Climate Change and Major Project guideline on how to make vulnerable investments resilient to climate change provides methodology for undertaking a vulnerability and risk assessment.
- 9.69 Climate change adaptation and mitigation shall be integrated in the preparation and approval of proposed development. Adaptation seeks to ensure adequate resilience of proposed development to the adverse impacts of climate change based on Vulnerability. Mitigation seeks to reduce the emissions greenhouse.

Development Vulnerability

- 9.70 The vulnerability of a system (e.g. development) is defined as: “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and 31 extremes. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity” (IPCC, 2007).
- 9.71 Sensitivity in the context of vulnerability assessment is defined as: “the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g. a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g. damages caused by an increase in the frequency of coastal flooding due to sea level rise) (IPCC, 2007).
- 9.72 Adaptive capacity in the context of vulnerability assessment is defined as: “the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.” (IPCC, 2007).
- 9.73 The timescale for the project vulnerability assessment shall correspond to the lifespan of the development. During the lifespan, there could be significant changes in frequency and intensity of weather events due to climate change, which should be taken into account. A detailed methodology for the development vulnerability assessment is provided in **Appendix 9- A**.

Greenhouse Gases Emissions

- 9.74 All projects have the potential to emit greenhouse gas (GHG) emissions to atmosphere during the construction, operational and decommissioning phase of the development. Direct GHG emissions may be caused by operational activities, and project decommissioning. Indirect GHG emissions may be due to increased demand for energy and indirect GHG activities. Indirect GHG activities are linked to the implementation of the proposed project and may include transport, office space heating of buildings or loss of habitats that provide carbon sequestration, (e.g. through land-use change).
- 9.75 The significance of project’s GHG emissions should be based on its net impact, which may be positive or negative. Where GHG emissions cannot be avoided, the significance of a project’s emissions shall be reduced by mitigation or project design. Where GHG emissions remain significant but cannot be reduced further approaches to compensate project emissions should be considered.
- 9.76 Currently in Ireland, there is no set methodology to evaluate significance criteria or a defined threshold for GHG emissions for mineral extraction industry. Due to the inconsistencies between

the different methods and their assumptions for assessment, there is no single agreed method by which to assess a project carbon budget. The method of assessment varies according to the type and scale of the development.

- 9.77 Due to a lack of guidelines and an established methodology, the assessment of significance of the GHG emissions is based on whether the development's GHG emissions cumulatively represent a considerable contribution to the global atmosphere and whether the development as continued or extended will replace existing development that would have a higher GHG profile.
- 9.78 Where the GHG emissions cannot be avoided, the mitigation should aim to reduce the development emissions at all stages.

Assessment

Development Vulnerability

- 9.79 The aim of the vulnerability assessment is to identify the relevant climate hazards for the project at the foreseen location. Detailed development vulnerability assessment for the proposed development is presented in **Appendix 9-B**.
- 9.80 Based on the development vulnerability assessment, measures to improve the resilience of the project to extreme rainfall, flood, flash flood, storms, and winds are required.

Greenhouse Gas Emissions

- 9.81 For the purpose of this assessment, GHG emissions have been calculated for the proposed development based on the potential cumulative annual energy usage for future years.
- 9.82 The proposed development provides for extraction in line with previously permitted levels, i.e. up to 300,000 tonnes of rock per year. However, it is expected that extraction rates will vary from 150,000 to 300,000 tonnes per annum, depending on market demand. The quarry will use the existing established access and traffic routes.
- 9.83 Ancillary manufacturing facilities at the site, located adjacent to the processing area, include an asphalt plant.
- 9.84 Based on a 50-week year, 5.5 days per week, and 24 tonne loads, the above operations will, on a cumulative basis, result in an average of maximum of 164 daily HGV return trips (82 HGVs inward and 82 HGVs outward). It has been assumed that the average distance travelled for one movement will be 50km.
- 9.85 It is estimated that ca. 3,000l/week of diesel will be consumed to power the generator on site.
- 9.86 Total cumulative annual GHG emissions for the proposed development are presented in **Table 9-5**.

Table 9-5
GHG Emissions Calculations

Type	Value	Distance Travelled(km)	Conversion factor	Calculated	Total annual CO ₂ e kg
Traffic (movements)	21450	50	0.71266	1528.6557	-
Energy (Diesel)	144,000l		2.60016	390024	-
TOTAL					391552.6557

- 9.87 Based on the calculated total of 391552.6557 CO₂e kg and a comparison to Ireland's 2018 emissions value of 60.51 MTonnes of CO₂e, it is assessed that proposed operations would represent a maximum of just 0.000647 % of Ireland's annual CO₂e emissions for the duration.
- 9.88 Based on the scale and extent of proposed activities, GHG emissions are assessed as not making a significant contribution to the global atmosphere.

MITIGATION

- 9.89 Mitigation is designed to increase the resilience of the development, or wider environmental receptors, to climate change and focuses on increasing capacity to absorb climate related shocks.

Project Adaptation against Expected Climate Change Effects

- 9.90 In the context of climate change, measures to increase the adaptive capacity of the proposed development and disaster risk reduction strategies can be developed with a view to reducing vulnerability and increasing the resilience of the planned development. Significant incidents related to the climate change that affect operation of the proposed development should be recorded for future analysis.
- 9.91 Based on a development vulnerability assessment (refer to **Appendix 9-B**), measures to improve the resilience of the project to extreme rainfall, flash flood, storms, and winds are required. **Table 9-6** details specific mitigation measures for the proposed development relating to climate change adaptation.

Table 9-6
Mitigation Measures Related to Climate Change Adaptation

Main Concerns Related to:	Proposed Alternatives or Mitigation Measures
Extreme Rainfall, Flood, Flash Flood	Consider design that allows for rising water levels and ground water levels.
	Design adequate project's drainage.
Storms and Winds	Ensure the project design that can withstand increases high winds and storms
	Ensure the choice of equipment working at the project is weather efficient.

Risk Reduction Mechanism	Secure insurance for damage of assets / incidences.
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Proposed Reduction of GHG Emissions

- 9.92 Lagan Materials Ltd shall adopt GHG monitoring programme at the proposed development. Based on the GHG monitoring results Lagan Ltd shall establish short, medium, and long-term objectives and targets for GHG reduction programme and energy management plan.
- 9.93 **Table 9-7** details specific mitigation measures for the Aghamore Quarry related to GHG reduction programme.

Table 9-7
Mitigation Measures Related to GHG Reduction Programme

Main Concerns Related to:	Proposed Alternatives or Mitigation Measures
Increased demand for energy	Consider using renewable energy sources/ suppliers. Use low carbon construction materials.
Direct GHG emissions	Use energy efficient machinery/ energy.
GHG emissions related to transport	Unnecessary equipment/ transport journeys should be avoided by management of transport and travel demands. Equipment should not be left idling.

MONITORING

Project Adaptation against Expected Climate Change Effects

- 9.94 A framework and set of indicators shall be developed to assess project preparedness for adaptation against climate change. Provision shall be made for a periodic review of plans and the allocation of reporting responsibilities for a regime to measure and evaluate progress on adaptation. This process shall include updates from implementation the adaptation plans on regular basis. Enhancement and monitoring related to projects' predicted impacts with climate change should be set out in an Environmental Management Plan.

GHG Emissions

- 9.95 Monitor report and review GHG reduction progress.

APPENDICES

APPENDIX 9-A

Development Vulnerability Assessment Methodology

DEVELOPMENT VULNERABILITY ASSESSMENT METHODOLOGY

The scale for assessing the likelihood of a climate hazard is presented in **Table 9A-1**. The output of the likelihood analysis is an estimation of the likelihood for each of the essential climate variables and hazards.

Table 9A- 1
Scale of Likelihood of Climate Hazard

TERM	QUALITATIVE	QUANTITATIVE
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to Occur	50%
Likely	Likely to Occur	80%
Almost certain	Very likely to occur	95%

The scale for assessing the potential impact of a climate hazard is presented in **Table 9A-2**. The impact analysis provides an assessment of the potential impact of each of the essential climate variables and hazards.

Table 9A- 2
Example Table for Climate Hazard Impact Analysis

RISK AREAS	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
Asset damage, engineering, operational					
Safety and Health					
Environment					
Social					
Financial					
Reputation					

The matrix for assessing the sensitivity of project to climate hazards is presented in **Table 9A-3**. The sensitivity is summarised, along with the ranking of the relevant climate variables and hazards relating to the project.

Table 9A- 3
Example Table for Sensitivity of Project to Climate Hazards

	Extreme rainfall, flood , flash flood	Heath	Drought	Wildlife Fires	Storms and winds	Landslides	Cold Spells and snow	Freeze –thaw damage	Rising sea levels
On site assets									
Inputs - Water									
Inputs - Energy									
Outputs - product									
Transport links									

The matrix for assessing exposure of a project to climate hazards is presented in **Table 9A-4**. The exposure analysis ranks climate variables and hazards as low, medium or high based on current and future climate.

Table 9A- 4
Example Table of Exposure of the Project to Climate Hazards

	Extreme rainfall, flood , flash flood	Heat	Drought	Wildlife Fires	Storms and winds	Landslides	Cold Spells and snow	Freeze –thaw damage	Rising sea levels
Current Climate									
Future Climate									

An example of the vulnerability of a project to climate hazards is presented in **Table 9A-5**. The vulnerability combines the sensitivity and the exposure analysis.

Table 9A- 5
Example Table for Vulnerability Analysis of Project to Climate Hazards

SENSITIVITY	EXPOSURE (CURRENT & FUTURE CLIMATE)		
	Low	Medium	High
Low			
Medium			
High			

APPENDIX 9-B

Development Vulnerability Assessment

DEVELOPMENT VULNERABILITY ASSESSMENT

The likelihood analysis of the proposed development to climate hazards is presented in **Table 9B-1**.

The proposed development has been assessed to be moderate affected by extreme rainfall, flash (pluvial) flood, storms, and winds. The proposed development would be unlikely affected to cold spells, landslides and snow. The proposed development would not be affected by heat, drought, wildlife fires and freeze – thaw damage. The proposed development will not be affected by rising sea level.

Table 9B- 1
Analysis of Likelihood of Climate Hazards

	Extreme rainfall, flash flood	Flood	Heat	Drought	Wildlife Fires	Storms and winds	Landslides	Cold Spells and snow	Freeze –thaw damage	Rising sea levels
Rare		✓	✓	✓	✓				✓	✓
Unlikely							✓	✓		
Moderate	✓					✓				
Likely										
Almost certain										

Table 9B-2 shows the climate hazard impact analysis of the proposed development. It was assessed that climate hazards will have major impacts on health and safety, the environment and financial areas, moderate impacts on asset damage and engineering, operational, social and reputation areas.

Table 9B- 2
Climate Hazard Impact Analysis

RISK AREAS	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
Asset damage, engineering, operational			✓		
Safety and Health				✓	
Environment				✓	
Social			✓		
Financial				✓	
Reputation			✓		

Table 9B-3 below assesses the sensitivity of the project to climate hazard. It was assessed that site assets, energy inputs and transport links are of high sensitivity to extreme rainfall, flood, flash floods, storms and winds; water inputs will be highly sensitive to droughts. On site assets will be medium sensitive to cold spells and snow and freeze – thaw damage. Transport links will be medium sensitive to cold spells and snow.

Table 9B- 3
Sensitivity of Project to Climate Hazards

	Extreme rainfall, flash flood	Flood	Heath	Drought	Wildlife Fires	Storms and winds	Landslides	Cold Spells and snow	Freeze –thaw damage	Rising sea levels
On site assets	High	Low	Low	Low	Low	High	Low	Medium	Medium	Low
Inputs - Water	Low	Low	Low	High	Low	Low	Low	Low	Low	Low
Inputs - Energy	High	Low	Low	Low	Low	High	Low	Low	Low	Low
Transport Links	High	Low	Low	Low	Low	High	Low	Medium	Low	Low

In **Table 9B-4**, the exposure of the project to climate hazards was assessed. In the current climate, the exposure of the project extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium. The project was assessed to have high exposure to rainfall, flash flood, storms, and winds.

Table 9B- 4
Exposure of the Development to Climate Hazards without Mitigation

	Extreme rainfall, flash flood	Flood	Heat	Drought	Wildlife Fires	Storms and Winds	Landslides	Cold Spells and Snow	Freeze –thaw damage	Rising sea levels
Current Climate	Medium	Low	Low	Low	Low	Medium	Low	Low	Low	Low
Future Climate	High	Low	Low	Low	Low	High	Low	Low	Low	Low

Table 9B-5 shows the vulnerability analysis of the project to climate hazards; it combines the sensitivity and the exposure analysis. The project was assessed to be most sensitive to extreme rainfall, flash flood, storms, and winds.

Table 9B- 5
Vulnerability Analysis of Project to Climate Hazards

SENSITIVITY	EXPOSURE (CURRENT & FUTURE CLIMATE)		
	Low	Medium	High
Low	Rising sea levels, Flood, Landslides, Freeze –thaw damage, Drought, Heat, Wildlife Fires		
Medium		Cold Spells and Snow	
High			Extreme Rainfall, Flash Flood, Storms and Winds

FIGURES

Figure 9-1
Windrose for Mullingar Meteorology Station

