9. AIR & CLIMATE

9.1 Introduction

McCarthy Keville O'Sullivan (MKO), on behalf of Burkeway Homes Limited, has carried out an assessment of the potential impacts of the proposed strategic housing development (SHD) consisting of 121 no. dwelling houses together with a crèche facility, associated outdoor play areas, car parking and open space amenity development and a public linear park along the Trusky Stream at Bearna, Co. Galway on Air and Climate.

This Chapter provides a description of the baseline environment in terms of air and climate and identifies, describes, and assesses the potential significant direct and indirect effects of the proposed development on air and climate. Where required, appropriate mitigation measures to limit any identified likely significant impacts to air and climate are recommended and an assessment of residual impacts and significance of any such residual effects is also provided. Where appropriate, monitoring measures to ensure the implementation of the proposed mitigation are also described.

9.1.1 Statement of Authority

This section of the EIAR has been prepared by Eoin Gilson and reviewed by Michael Watson, both of MKO. Eoin is an Environmental scientist with and has been working in Environmental Consultancy since 2018. Eoin holds an MSc in Applied Environmental Science. Michael has over seventeen years' experience in the environmental sector and had worked for the Geological Survey of Ireland and then a prominent private environmental & hydrogeological consultancy prior to joining MKO in 2014. Michael completed an MA in Environmental Management at NUI, Maynooth in 1999. Michael is a professional geologist (PGeo) and full member of IEMA (MIEMA) as well as a Chartered Environmentalist (CEnv).

9.1.2 Relevant Guidance

The air quality and climate section of this EIAR has been prepared out in accordance with the 'EIA Directive' as amended by Directive 2014/52/EU. It has also been carried out in accordance with the guidance listed in Section 1.4.1 of Chapter 1: Introduction, where relevant and the 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment' (European Commission, 2013).

9.2 Air

9.2.1 Background

The Proposed Development is approximately 5.4 hectares of land located within the townlands of Trusky East, Trusky West, Freeport and Ahaglugger, approximately 6km to the west of Galway City. It is anticipated that the development will be completed over 4 separate phases and is expected to last approximately 2.5 years in total.

Due to the nature of the development, the general character of the surrounding environment and publicly available EPA information on air quality, air quality sampling, was considered to be unnecessary for this Environmental Impact Assessment Report (EIAR).

9.2.2 Air Quality Standards

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, deals with polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air.

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for $PM_{2.5}$ (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM10) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 9-1 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre ($\mu g/m^3$) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

The CAFE Directive was transposed in to Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). These Regulations supersede the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and the Ambient Air Quality Assessment and Management Regulations 1999 (S.I. No. 33 of 1999).

Table 9-1 European sites within likely zone of impact of the Proposed Development

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in	1st Jan 2005

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
					a calendar year	
Sulphur dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001
Sulphur dioxide (SO_2)	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM_{10})	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$)	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Particulate matter 2.5 ($PM_{2.5}$) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015
Particulate matter 2.5 ($PM_{2.5}$) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C_6H_6)	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

The Ozone Daughter Directive 2002/3/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 9-2 presents the limit and target values for ozone.

Table 9-2 Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8 hour mean	120 mg/m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m^3
Protection of vegetation	AOT40 calculated from 1 hour values from May to July	18,000 $mg/m^3.h$ averaged over 5 years	6,000 $mg/m^3.h$
Information Threshold	1 hour average	180 mg/m^3	-
Alert Threshold	1 hour average	240 mg/m^3	-

AOT_{40} is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 g/m^3 and is expressed as g/m^3 hours.

9.2.2.1 Air Quality and Health

The Environmental Protection Agency (EPA) 2016 report 'Ireland's Environment – An Assessment' noted that in Ireland, the premature deaths attributable to air pollution are estimated at 1,200 people per year. A more recent European Environmental Agency Report, 'Air Quality in Europe – 2018 Report' highlights the negative effects of air pollution on human health. The report assessed that poor air quality accounted for premature deaths of approximately 422,000 people in Europe in 2015, with regards to deaths relating to PM2.5. The estimated impacts on the population in Europe of exposure to NO2 and O3 concentrations in 2015 were around 79,000 and 17,700 premature deaths per year respectively, From this, 1,100 Irish deaths were attributable to fine particulate matter (PM2.5), 30 Irish deaths were attributable to nitrogen oxides (NO2) and 20 Irish deaths were attributable to Ozone (O3) (Source: Air Quality in Europe – 2018 Report', EEA, 2018). These emissions, along with others including nitrogen oxides (NOx) and sulphur oxides (SOx) are produced during fossil fuel based electricity generation in various amounts, depending on the fuel and technology used.

9.2.3 Air Quality Zones

The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs.
- Zone B: Cork City and environs.
- Zone C: 16 urban areas with population greater than 15,000.
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The site of the proposed development lies within Zone D, which represents the remainder of the country.

9.2.4 Existing Air Quality

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The ambient air quality monitoring carried out closest to the subject site is at Bohermore in Galway City. This monitoring location lies within Zone C which comprises urban areas with populations greater than 15,000.

For the purposes of this assessment, air quality monitoring data from the station at Bohermore in Galway City is used. Data for Bohermore in Galway City is available in the EPA report 'Ambient Air Monitoring in Galway City; March 13th 2001 – 23rd October 2001.' Similar measurement values for all air quality parameters would be expected for the proposed development site.

9.2.4.1 Sulphur Dioxide (SO2)

Data for sulphur dioxide (SO2) monitoring carried out in Galway City for 2001 is shown in Table 9-3.

Table 9-3 Sulphur Dioxide Data for Galway City in 2001

Parameter	Measurement
No. of measured values	3,672
Percentage Coverage	68.6%
Maximum hourly value	87.8 µg/m3

Parameter	Measurement
98 percentile for hourly values	42.3 µg/m3
Mean hourly value	10.0 µg/m3

The hourly limit value was not exceeded during the measurement period. The lower assessment threshold was not exceeded during the measurement period. The mean hourly value of 10 µg.m-3 exceeds the lower assessment threshold for the protection of ecosystems but not the upper assessment threshold. However, this threshold may not be relevant to monitoring in an urban environment. Air quality of the proposed development site would be expected to be similar.

9.2.4.2 Particulate Matter (PM10)

Sources of particulate matter include vehicle exhaust emissions, soil and road surfaces, construction works and industrial emissions. No limit values were exceeded during this measurement period in Galway City. PM10 monitoring results from 2001 are presented in Table 9-4 below.

Table 9-4 Particulate Matter (PM_{10}) Data for Galway City in 2001

Parameter	Measurement
No. of measured values	187
Percentage Coverage	83.8%
Maximum daily value	49.9 µg/m3
98 percentile for daily values	45.8 µg/m3
Mean daily value	22.1 µg/m3

The twenty four hour limit value for the protection of human health (50µg.m-3) was not exceeded during the measurement period. The upper assessment threshold was exceeded on 32 days (17.1% of measured values), the lower assessment threshold was exceeded on 96 days (51.3% of measured values). The directive stipulates that each of the assessment thresholds should not be exceeded more than 7 times in a calendar year. The mean of the daily values during the measurement period (22.2 µg.m-3) is below the annual limit value for the protection of human health (40 µg.m-3). Air quality of the proposed development site would be expected to be similar in terms of PM10 levels.

9.2.4.3 Nitrogen Dioxide (NO_2)

The values for the concentrations of nitrogen dioxide recorded in Galway City from 2001 are displayed in Table 9-5 below. Daily and annual limit values for the protection of human health were not exceeded during the assessment.

Table 9-5 Nitrogen Dioxide and Oxides of Nitrogen Data Galway City 2001

Parameter	Measurement
No. of measured values	4,531

Parameter	Measurement
Percentage Coverage	84.6%
Maximum hourly value (NO_2)	120.7 µg/m3
98 percentile for hourly values (NO_2)	50.5 µg/m3
Mean hourly value (NO_2)	19.9 µg/m3
Mean hourly value (NO_x)	34.8 µg/m3

The hourly limit value was not exceeded during the measurement period. One hourly mean NO2 value was above the lower assessment threshold, the directive stipulates that the lower assessment threshold should not be exceeded more than 18 times in a calendar year. With the exception of this value, all other hourly mean NO2 values were below the lower assessment threshold. The mean hourly NO2 value (19.9µg.m-3) during the measurement period was below the annual lower assessment threshold for the protection of human health (26 µg.m-3). The mean hourly value of NOX (34.8 µg.m-3 NO2) during the measurement period exceeded the annual limit value for the protection of vegetation (30 µg.m-3 NO2). However, the applicability of this limit to urban air pollution monitoring is questionable.

9.2.4.4 Carbon Monoxide (CO)

Carbon monoxide data has been sourced from air quality monitoring carried out in Galway City (March to October 2001) and is presented in Table 9-6. The mean hourly concentration of carbon monoxide recorded was 0.5 mg/m3. The carbon monoxide limit value for the protection of human health is 10 mg/m3. On no occasions were values in excess of the 10 mg limit value set out in Directives 2000/69/EC or 2008/69/EC recorded.

Table 9-6 Carbon Monoxide Data for Galway City 2001

Parameter	Measurement
No. of hours	5,356
No. of measured values	4,533
Percentage Coverage	84.6%
Maximum hourly value	2.8 mg/m3
98 percentile for hourly values	1.3 mg/m3
Mean hourly value	0.5 mg/m3
Maximum 8-hour mean	1.6 mg/m3
98 percentile for 8-hour mean	1.1 mg/m3

9.2.4.5 Ozone (O_3)

Ozone data for the Mace Head Atmospheric Research Station for 2008 is presented in Table 9-7. The maximum daily eight-hour mean limit of 120 µg/m3 was exceeded on three days. The legislation stipulates that this limit should not be exceeded on more than 25 days.

Table 9-7 Summary statistics for rolling 8-hr O3 concentrations in 2008: Mace Head

Parameter	Measurement
Annual Mean	77 µg/m3
Median	77 µg/m3
% Data Capture	100%
No. of days > 120	3 days
Maximum 8-hour value	132 µg/m3

9.2.5 Likely and Significant Air Quality Impacts of the Proposed Development and Associated Mitigation Measures

9.2.5.1 "Do-Nothing" Scenario

If the proposed development were not to proceed, there would be no change to existing air quality conditions in the area and therefore there would be no negative effects. There would be no potential for minor emissions to occur as a result of the construction and operational phases of the proposed development.

9.2.5.2 Construction Phase Potential Impacts and Mitigation Measures

9.2.5.2.1 *General Air Quality*

The construction of the proposed development will require the use of machinery and plant, thereby giving rise to exhaust emissions. This is likely to have a short to medium-term slight negative effect, which will be reduced through the use of the best practices mitigation measures as presented below.

Mitigation

- All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.
- Machinery were switched off when not in use.
- Aggregate materials for the construction infrastructure will be sourced onsite from the proposed cut areas, where possible, which further reduced potential emissions.

Residual Effect

Following implementation of the mitigation measures outlined above, residual impacts will be Short term (2.5 years), Imperceptible, Negative

9.2.5.2.2 *Dust Emissions*

The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction. Due to the nature of the site, which comprises thin soils overlaid on weather bedrock, there is reduced potential sources of dust generation

Dust generation rates depend on the site activity, particle size (in particular the silt content, defined as particles smaller than 75 microns in size), the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under "wet day" conditions where rainfall greater than 0.2 mm has fallen. Information collected from Shannon Meteorological Station (1981-2010) identified that typically 211 days per annum are "wet". Thus, for greater than 55% of the time no significant dust generation will be likely due to meteorological conditions. Without mitigation, the likely effect of construction phase dust emissions will be short term, slight, and negative.

Mitigation

- All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.
- Overburden will be progressively removed from the working area in advance of construction.
- Dampening down the dust at the source by the use of barriers such as debris netting on scaffolding around the building to block dust escaping where the building is within 10m of the site boundary where residential properties exist.
- Site roadways will be maintained in a stoned hard core condition not allowing soil to accumulate which when dry can create dust.
- Wheel wash equipment will be set up at the site exit gate for all construction vehicles to pass through prior to leaving the site thus ensuring that no dirt etc. is transported outside the site onto the roadways.
- Plant and equipment that have the potential to create volumes of dust will have appropriate attachments to allow water source to dampen dust to not allow it to get airborne.
- Deploy Road Sweeper as required on External Roads.
- Dust levels will be monitored visually, on a daily basis by the project Environmental Officer. If dust levels become an issue, then all dust generating activities on site will cease until such time as weather conditions improve (e.g. wind levels drop or rain falls) or mitigation measures such as damping down of the ground are completed.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-2). A CEMP is included with this application and includes further details of the above dust suppression measures and dust monitoring measures.

Residual Effect

Following implementation of the mitigation measures outlined above, residual impacts of dust generation from the construction phase will be Short-term Imperceptible Negative

9.2.5.3 Operational Phase Potential Impacts and Mitigation Measures

There will be no impact on the environment or human health from dust emissions in the vicinity of the proposed development site once the development has been built and all construction vehicles and personal are offsite.

Any further works which may need to occur on site as part of maintenance and repairs during the operation of the site, may cause localised imperceptible, temporary dust emissions, and is unlikely to have any negative significant impact on human health.

Mitigation

No mitigation will be required on site during the majority of the operational phase for the proposed development, as the impact is assessed as being imperceptible, and will not be noticed within the area which already contains many residential developments.

Residual Effect

Short term Imperceptible Negative Impact

9.2.5.4 Assessment of Potential for Impacts on Health

Whilst the construction phase of the proposed development is likely to lead to dust and vehicle emissions, the implementation of the mitigation measures described above will prevent or minimise potential effects and the residual effects will be imperceptible. The CEMP submitted with this application provides that the proposed development will be constructed in accordance with good management practice including good site design and layout, adopting appropriate working methods, choosing the right equipment and ensuring that the workforce understands the company's responsibilities and is familiar with good working practice and dust suppression techniques. The potential for health effects arising from the construction stage are considered short term, imperceptible, and negative as the potential for both exhaust and dust emissions will be limited and controlled through the mitigation measures described above.

During the operational phase, there will be no impact on human health from dust emissions in the vicinity of the proposed development site once the development has been built and all construction vehicles and personal are offsite.

9.3 Climate

9.3.1 Climate Change and Greenhouse Gases

Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

9.3.1.1 Greenhouse Gas Emission Targets

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding.

Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

9.3.1.1.1 *Doha Amendment to the Kyoto Protocol*

In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first.

Under the protocol, countries must meet their targets primarily through national measures, although market based mechanisms (such as international emissions trading can also be utilised).

9.3.1.1.2 *COP21 Paris Agreement*

COP21 was the 21st session of the Conference of the Parties (COP) to the United Nations Convention. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30th November to 12th December 2015.

COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2°C above pre-industrial levels and even to tend towards 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

9.3.1.1.3 *Emissions Projections*

In 2016, the EPA published an update on Ireland's Greenhouse Gas Emission Projections to 2020. Ireland's target is to achieve a 20% reduction of non-Emissions Trading Scheme (non-ETS) sector

emissions, i.e. agriculture, transport, residential, commercial, non-energy intensive industry and waste, on 2005 levels, with annual binding limits set for each year over the period 2013 – 2020.

Greenhouse gas emissions are projected to 2020 using two scenarios; 'With Measures' and 'With Additional Measures'. The 'With Measures' scenario assumes that no additional policies and measures, beyond those already in place by the end of 2014 are implemented. The 'With Additional Measures' scenario assumes implementation of the 'With Measures' scenario in addition to full achievement of Government renewable and energy efficiency targets for 2020, as set out in the National Renewable Energy Action Plan and the National Energy Efficiency Action Plan.

The EPA Emission Projections Update notes the following key trends:

- Ireland's non-Emissions Trading Scheme (ETS) emissions are projected to be 6% and 11% below 2005 levels in 2020 under the 'With Measures' and 'With Additional Measures' scenarios, respectively. The target for Ireland is a 20% reduction.
- Ireland is projected to exceed its annual binding limits in 2016 and 2017 under both scenarios, 'With Measures' and 'With Additional Measures'.
- Over the period 2013 – 2020, Ireland is projected to cumulatively exceed its compliance obligations by 12 Mt CO_2 (metric tonnes of Carbon Dioxide) equivalent under the 'With Measures' scenario and 3 Mt CO_2 equivalent under the 'With Additional Measures' scenario.

The EPA report states that "Failure to meet 2020 renewable and energy efficiency targets will result in Ireland's emission levels moving even further from its emission reduction targets". The report also concludes:

- The latest projections estimate that by 2020 non-ETS emissions will be at best 11% below 2005 levels compared to the 20% reduction target. Emission trends from agriculture and transport are key determinants in meeting targets, however emissions from both sectors are projected to increase in the period to 2020.
- It is clear that Ireland faces significant challenges in meeting emission reduction targets for 2020 and beyond. ('Greenhouse Gas Emission Projections to 2020 – An Update', EPA, 2016).

9.3.1.1.4 *Progress to Date*

The 'Europe 2020 Strategy' is the EU's agenda for growth and jobs for the current decade. The Europe 2020 Strategy targets on climate change and energy include:

- Reducing greenhouse gas (GHG) emissions by at least 20% compared with 1990 levels;
- Increasing the share of renewable energy in final energy consumption to 20%; and
- Moving towards a 20% increase in energy efficiency.

Regarding progress on targets, the 'Europe 2020 indicators – climate change and energy' report provides a summary of recent statistics on climate change and energy in the EU.

In 2015, EU greenhouse gas emissions, including emissions from international aviation and indirect carbon dioxide (CO_2) emissions, were down by 22.1% when compared with 1990 levels. However, regarding the progress of individual Member States, and Ireland in particular, the Europe 2020 indicators include the following statements:

- 24 countries are on track to meet their GHG targets, except Austria, Belgium, Ireland and Luxembourg.
- Luxembourg emitted the most GHG per capita in the EU in 2014 ... followed by Estonia, Ireland and the Netherlands.

- In 2015, Malta was the farthest from reaching their national target, followed by Ireland, Belgium and Luxembourg.

9.3.2 Climate and Weather in the Existing Environment

County Galway has a temperate oceanic climate, resulting in mild winters and cool summers. The prevailing wind direction is between south and west which bring moist air and frequent rain. According to Met Éireann, the average number of wet days per year in the west of Ireland is 225. The wettest months are December and January and April is usually the driest. July is the warmest month with an average temperature of 15.7° Celsius. The Met Éireann weather station at Shannon, County Clare is the nearest weather and climate monitoring station with 30-year averages from 1981-2010, to the subject site, located approximately 63km south of the site. Meteorological data recorded at Shannon over the 30-year period from 1981-2010 is shown in Table 9-8 overleaf. The wettest months are October and December, and April is the driest. July is the warmest month with a mean daily temperature of 16.4° Celsius.

9.3.2.1 Wind

The wind field characteristics of the area are important climatological elements in examining the potential for the generation of fugitive dust emissions from the site. Fugitive dust emissions from a surface occur if the winds are sufficiently strong and turbulent and the surface is dry and loose, together causing re-suspension of particulate matter from the ground. A wind speed at ground level in excess of about five metres per second is considered to be the threshold above which re-suspension of fine sized material from an exposed surface may occur. The surface needs to have a relatively low moisture content for this type of dust emission to take place and any wetting either by rainfall or sprayers, will greatly reduce the potential of fugitive dust emissions. The mean annual wind speed at the station, in Shannon, is 4.6 metres per second.

9.3.2.2 Rainfall

Long term rainfall data was obtained from the monitoring station at Shannon. The 30-year annual average rainfall for Shannon is 978 mm/yr. This is considered to be high when compared to the annual average rainfall for Dublin (Merrion Square) which recorded annual average rainfall of 730 mm/yr over the same period. This will be due to Galway's oceanic position on the Atlantic seaboard.

Table 9-8 Data from Met Éireann Weather Station, Dublin Airport, Co. Dublin 1981 to 2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	8.8	9.2	11.1	13.3	16.0	18.3	19.8	19.6	17.7	14.3	11.1	9.0	14.0
mean daily min	3.2	3.2	4.5	5.7	8.2	10.9	12.9	12.7	10.8	8.2	5.5	3.6	7.4
mean temperature	6.0	6.2	7.8	9.5	12.1	14.6	16.4	16.2	14.2	11.2	8.3	6.3	10.7
absolute max.	14.8	15.5	18.3	23.5	27.2	30.2	30.6	29.8	26.1	22.3	17.6	15.3	30.6
min. maximum	-2.4	0.9	3.5	5.4	8.0	11.8	13.8	13.0	11.1	7.0	0.8	-6.0	-6.0
max. minimum	11.8	12.3	11.7	13.0	15.3	17.8	19.4	19.3	17.8	16.3	13.4	12.9	19.4
absolute min.	-11.2	-5.5	-5.8	-2.3	0.2	3.6	6.7	4.4	1.7	-2.0	-6.6	-11.4	-11.4
mean num. of days with air frost	5.3	5.1	2.1	0.7	0.0	0.0	0.0	0.0	0.0	0.5	2.3	4.8	20.8
mean num. of days with ground frost	13.7	12.6	11.0	8.3	3.3	0.3	0.0	0.1	1.2	3.8	9.5	12.5	76.3
RELATIVE HUMIDITY (%)													
mean at 0900UTC	87.1	87.0	85.0	79.8	76.3	76.8	80.0	82.1	84.7	87.0	88.9	88.4	83.6
mean at 1500UTC	80.5	74.6	70.5	64.4	63.3	65.1	68.0	68.2	69.2	75.2	80.5	83.1	71.9
SUNSHINE (hours)													
mean daily duration	1.6	2.3	3.2	5.1	5.8	5.2	4.5	4.5	3.9	2.9	2.0	1.4	3.5

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
greatest daily duration	8.1	10.2	11.0	13.6	15.6	15.8	15.7	14.4	12.2	10.1	8.3	7.1	15.8
mean no. of days with no sun	9.2	6.4	5.7	2.4	1.9	2.0	2.4	2.3	2.9	5.5	7.8	11.1	59.8
RAINFALL (mm)													
mean monthly total	102.3	76.2	78.7	59.2	64.8	69.8	65.9	82.0	75.6	104.9	94.1	104.0	977.6
greatest daily total	38.2	29.4	28.1	40.2	25.0	40.6	39.5	51.0	52.3	36.9	26.9	41.2	52.3
mean num. of days with >= 0.2mm	20	16	19	16	16	15	16	18	16	20	20	19	211
mean num. of days with >= 1.0mm	16	12	14	11	12	11	12	13	12	16	15	15	159
mean num. of days with >= 5.0mm	8	5	5	4	4	4	4	5	4	7	6	7	63
WIND (knots)													
mean monthly speed	10.3	10.2	10.0	9.0	8.9	8.5	8.5	8.2	8.4	9.2	9.1	9.4	9.1
max. gust	75	80	65	62	59	51	52	55	62	71	66	83	83
max. mean 10-minute speed	52	46	44	40	37	37	38	35	40	47	41	57	57
mean num. of days with gales	1.7	0.9	0.8	0.3	0.2	0.1	0.0	0.1	0.1	0.6	0.7	1.2	6.7
WEATHER (mean no. of days with..)													
snow or sleet	2.3	2.3	1.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.3	8.0
snow lying at 0900UTC	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
hail	3.6	3.3	3.4	2.2	1.2	0.1	0.1	0.1	0.3	0.9	1.1	2.4	18.6
thunder	0.9	0.5	0.4	0.3	0.5	0.5	0.8	0.4	0.2	0.4	0.4	0.5	5.7
fog	3.3	2.0	2.1	1.9	1.5	1.4	1.4	2.0	2.9	2.9	3.9	4.2	29.6

9.3.3 Likely and Significant Climate Impacts and Mitigation Measures

9.3.3.1 'Do-Nothing' Scenario

If the proposed development were not to proceed, there would be no change to existing climate conditions and therefore there would be no negative effects. There would be no potential for minor emissions to occur as a result of the construction and operational phases of the proposed development.

9.3.3.2 Construction Phase Potential Impacts and Mitigation Measures

The construction of the proposed development will require the operation of construction vehicles and plant. Greenhouse gas emissions, e.g. carbon dioxide (CO2), carbon monoxide and nitrogen oxides associated with vehicles and plant will arise as a result of the construction activities. This potential impact will be slight, given the insignificant quantity of greenhouse gases that will be emitted, and will be restricted to the duration of the construction phase. Therefore, this is a short-term slight negative impact. Mitigation measures to reduce this impact are presented below.

The transport ofconstruction materials to the site will also give rise to greenhouse gas emissions associated with the transport vehicles. This constitutes a slight negative impact in terms of air quality. Mitigation measures in relation to greenhouse gas emissions are presented below.

Mitigation Measures

- All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.
- Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions.

Residual Effect

[With the implementation of the mitigation measures discussed above there will be a Short-term Imperceptible Negative Impact on Climate as a result of greenhouse gas emissions ...]

9.3.3.3 Operational Phase Potential Impacts and Mitigation Measures

The proposed development includes a residential development which will be landscaped with green areas and trees and also provides a public linear park along the Trusky Stream. The proposed residential development is designed to comply with Building Regulations Part L 2017 nZEB (near zero energy building). Therefore, the climate impacts from the proposed development are expected to be imperceptible. Full details of the thermal performance and energy saving measures incorporated into the proposed development are set out in the Energy Statement Report, which forms Appendix 9-1 of this EIAR. Mitigation Measures

As the proposed development will have no significant negative effects on climate, mitigation measures are not proposed other than the measures outlined in the Energy Statement Report in Appendix 9-1 of this EIAR. These measures will minimise any effect that the development might have on climate in the long-term.

Residual Effect

There will be a Long-term, Imperceptible, Neutral Effect on climate associated with the proposed project.

9.3.3.4 Assessment of Potential for Impacts on Human Health

Whilst the construction phase of the proposed development has the potential to lead to slight increases in greenhouse gas emissions, the implementation of the mitigation measures described abovewill prevent or minimise potential effects of this and the residual effects will be short term and imperceptible. The CEMP submitted with this application provides that the proposed development will be constructed in accordance with good management practice including good site design and layout, adopting appropriate working methods, choosing appropriate materials and equipment and ensuring that the workforce understands the company's responsibilities and is familiar with good working practice and emission minimisation techniques. The potential for health effects are considered imperceptible as the potential for greenhouse gas emissions will be limited and controlled through site and project design and mitigation measures.

Residual Effect

There will be a Short-term Imperceptible Negative Impact on Human Health as a result of the construction phase of the proposed development.

9.4 Cumulative effects resulting from Interactions between various elements of the proposed development

The interaction of the various elements of the proposed development was considered and assessed in this EIAR with regards air and climate. The potential for each individual element of the proposed development on its own to result in significant effects on air and climate was considered in the impact assessment. The entire project including the interactions between all its elements was also considered and assessed for its potential to result in significant effects on air and climate in the impact assessment presented.

All interactions between the various elements of the project were considered and assessed both individually and cumulatively within this chapter. Where necessary, mitigation was employed to ensure that no cumulative effects will arise as a result of the interaction of the various elements of the development with one another.

9.5 Potential Cumulative In-Combination Effects

The potential cumulative effects on air and climate arising from the proposed development, in combination with other developments in the vicinity, including all those listed in Chapter 15 of this EIAR, are now considered.

It is noted that the other land use activities in the area are mostly residential and agricultural. The majority of the developments listed in Chapter 15 consist of modifications to, or extensions of, existing houses or buildings and it was determined that there was no potential for cumulative impacts on Air and Climate from these project in combination with the Proposed development. There are no other large developments proposed in the immediate vicinity of the proposed development.

There are a number of small scale developments in the Bearna area that are imminent or have been granted permission. The list of development projects is as follows:

- 105 unit SHD Bearna Village : Freeport — Ref: pre-planning
- 48 unit development - An Maolán: — Ref: 19/1749
- 20 unit development – An Cnocán Carrach — Ref: 19/314
- 15 unit development - Rinn Na Mara — Ref: 16/147

In addition, the proposed N6 Galway City Ring Road is located within 1km of the proposed development. It was determined that, due to proximity and scale, the five projects listed above have the potential for cumulative effects in combination with the proposed development. Where appropriate the application documentation, EIAR and NIS have been reviewed to inform the assessment.

9.5.1 General Air Quality

Agriculture, residential heating, transport vehicles and other local construction activities and the construction of the proposed development will require the consumption of fossil fuels and therefore will lead to a minor level of air emissions cumulatively. However, with the implementation of the mitigation measures discussed above, there will be no significant cumulative impacts arising from the construction phase of the proposed development (as the air quality impacts will be imperceptible) and other local existing and planned developments Cumulative impacts resulting from the proposed development, in combination with other projects, will be negative, short term, and imperceptible

9.5.2 Dust Emissions

Dust emissions from the other land use activities in the area are likely to be imperceptible and localised to the immediate area of those projects. The N6 works area is proposed to occur c0.7km from this site and will be subject to strict dust control measures and so there will be no impact in-combination with this project. The potential for dust emissions from the construction phase of the proposed development exist but the residual effects will be imperceptible given the proposed mitigation measures in Sections 9.2.5.2.2 above. Therefore, cumulative impacts resulting from the proposed development, in combination with other projects, will be negative, short term, and imperceptible

9.5.3 Climate

The construction of the proposed development, in conjunction with other developments in the area (listed in Chapter 15 of this EIAR), will require plant items which consume fossil fuels and therefore will lead to a minor emission of greenhouse gases cumulatively. However, given the small-scale operations and proposed mitigation measures for the proposed development, the cumulative impacts will be short term, negative, and imperceptible in the context of the potential for impacts on climate change. There is no potential for significant cumulative climate impacts between the operational phase of the proposed development and the other projects listed in Chapter 15.