# 5.0 AIR QUALITY, CLIMATE & ODOUR

## 5.1 INTRODUCTION

This section has been prepared by Panther Environmental Solutions Ltd., using the information provided within Attachment 5.1 Odour, Air Quality and Greenhouse Gas Assessment by Katestone Environmental Pty Ltd. The assessment (Attachment 5.1) addresses the potential impact of the proposed development upon air quality and climate.

The scope of works for the assessment include:

- Odour Impact Assessment:
  - Development of an odour emissions inventory for the plant;
  - Development of meteorological dataset suitable for the site;
  - Dispersion modelling to assess the potential for odour impacts.
- Air Quality Impact:
  - Development of an inventory of air contaminants from sources at the plant;
  - Dispersion modelling to assess the potential for adverse impacts;
  - Assessment of the potential traffic impacts of $NO_2$, CO, $PM_{10}$, $PM_{2.5}$ and benzene using the screening model methods described in the Design Manual for Roads and Bridges (DMRB) published by the UK Highways Agency;
  - Compare predicted pollutant concentrations with the relevant air quality standards.
- Climate Change Assessment

## 5.2 DESCRIPTION OF EXISTING ENVIRONMENT

### 5.2.1 LOCAL TERRAIN AND LAND-USE

The site is located in a rural location surrounded by pasture to the west and east and peat bogs and forest to the north and south. The Mullaghakaraun Bog is immediately north of the site's most northerly boundary and there is a forest immediately south of the most southern boundary.

The River Feeghroe runs from northeast to southwest along the site's eastern boundary.

The site is in an area of very flat terrain. It sits at an elevation of approximately 51 metres (m) above sea level. The terrain rises gently to the northeast of the site and falls gently to the south and west of the site. There are no major terrain features that would affect local wind flows in the vicinity of the site.

### 5.2.2 LOCAL METEOROLOGY

Meteorological parameters recorded at the closest Met Eireann Observation Station to the site at Gurteen College were extracted and processed to assess meteorological conditions. The observation station at Gurteen College is approximately 15 km southwest of the site and is 70 m above sea level. The terrain surrounding the observation station is relatively flat and used as pasture. The land between the observation station and the site is also flat. There are peat bogs to the north and northeast of the observation station. The data from the observation station at Gurteen College is considered representative of the site due to:

- The close proximity of the observation station to the site;
- The similar nature of the terrain at both locations;
- The similar nature of land use at both locations;
- The absence of major terrain features between the observation station and the site.

#### ***5.2.2.1 Windspeed and Direction***

Wind speed and wind direction are important parameters for the transport and dispersion of air pollutants from a source. A wind rose representing the annual distribution of winds between 2013 and 2017 is presented in Figure 3 of Attachment 5.1. The annual distribution for each modelled year is presented in Figure 4 of Attachment 5.1.

The prevailing wind direction in Ireland is between south and west. These winds have a strong influence on wind patterns at Gurteen College. Winds at all times of day are heavily influenced by the prevailing winds. During the afternoon there is a greater component of winds from the west-southwest compared to all other times of day as indicated in the diurnal wind roses.

The seasonal distribution of wind speed and wind direction is presented in Figure 6 of Attachment 5.1. The strongest winds at Gurteen College occur most frequently from the southwest during the winter months. The greatest proportion of light winds occur during summer and autumn. There is a distinct north-easterly component to the wind rose in spring. A significant proportion of light northerly winds occur during spring.

### 5.2.3 SENSITIVE RECEPTORS

The sensitive receptors that are of interest are located in close proximity to the site, and are presented in Figure 7 of Attachment 5.1.

Under the Birds Directive (79/409/EEC) and Habitats Directive (92/43/EEC), Ireland has identified 154 sites as Special Protection Areas (SPA) (NPWS, 2018a) and approximately 13,500 square kilometres of land, lakes and marine environments as Special Areas of Conservation (SAC) (NPWS, 2018b). These are known as Natura 2000 sites and the biodiversity of these sites is required to be protected.

It is well documented that certain forms of atmospheric nitrogen and their deposition into the environment are a threat to biodiversity. Ammonia has been found to reduce biodiversity at Natura 2000 sites. There are two Natura 2000 sites in the vicinity of the site, namely: Shannon Callows and All Saints Bog. There is also a proposed Natural Heritage Area at Lough Coura, east of the site.

### 5.2.4 BACKGROUND AIR QUALITY

Under the Clean Air for Europe Directive, EU member states must designate "Zones" for the purpose of managing air quality. In Ireland, four zones were defined in the Air Quality Standards Regulations (2011). The site of the proposed development is in Zone D, that represents rural Ireland.

Background air quality data for Zone D was obtained from the report Air Quality in Ireland 2017 – Indicators of Air Quality by the EPA. A summary of the background data is provided in Table 5.1.

**Table 5.1:** Ambient background data

| POLLUTANT | AVERAGING PERIOD | VALUE (μG/M$^3$) | SOURCE |
|---|---|---|---|
| Nitrogen dioxide | 1-hour | 112 | Maximum from Castlebar |
| | Annual | 7.4 | Average from Castlebar |
| Sulfur dioxide | 1-hour | 14.8 | Maximum from Shannon Estuary |
| | 24-hour | 4.1 | Maximum from Shannon Estuary |
| | Annual | 2.3 | Annual from Shannon Estuary |
| Carbon monoxide | 8-hour | 1,240 | Maximum from Portlaoise (Zone C) |
| $PM_{10}$ | 24-hour | 11.1[1] | Average from Castlebar |
| | Annual | 11.2 | Average from Castlebar |
| $PM_{2.5}$ | Annual | 9.2 | Average from Longford |

**Note:**
[1] UK DEFRA and EPA advise that the 36th high 24-hour mean process contribution can be added to the annual mean background PM10

## 5.3 METHODOLOGY

The assessment was conducted in accordance with recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). AERMOD was used to predict ground-level concentrations of odour and air contaminants across the model domain due to sources at the site.

The assessment methodology included:

- For odour:
  - Selection of relevant odour assessment criteria
  - Derivation of an odour emissions inventory for the site based on data from the literature.

- For air contaminants

  - Selection of relevant air quality assessment criteria
  - Derivation of an emissions inventory for the site based on data from the literature.

- Characterisation of meteorological conditions in the region and generation of a representative meteorological dataset using observations from Gurteen College.

- Dispersion modelling using the regulatory dispersion model, AERMOD, to predict ground-level concentrations of odour across a Cartesian grid that covers the study area.

- Comparison of the predicted ground-level concentrations of odour against the relevant odour/air contaminant assessment criteria.

The methodologies used for the Odour, Air Quality and Greenhouse Gas Assessment are discussed in detail in Attachment 5.1.

## 5.4 REGULATORY FRAMEWORK AND ASSESSMENT CRITERIA

**Environmental Protection Agency Act 1992**

The Environmental Protection Agency Act 1992 (EPA Act) and Part 2 of the Protection of the Environment Act 2003 are collectively referred to as the Environmental Protection Agency Acts 1992 and 2003. The Environmental Protection Agency Acts 1992 and 2003 provide for the management of air emissions from activities (meaning any process, development or operation) specified in the First Schedule of the Environmental Protection Agency Acts 1992 and 2003.

**Odour**

In 2001, the EPA issued an assessment framework that "aims to define a set of criteria for odour exposure to achieve a common environmental quality objective in licencing procedures" (EPA, 2001). This framework is specific to intensive pig units; however, in the absence of other environmental quality objectives specified by EPA, the criterion for odour exposure to intensive pig units has been adopted for this assessment. The Environmental Quality criteria are:

- Target value: C98, 1-hour ≤ 1.5 ouE/$m^3$
- Limit value for new pig production units: C98, 1- hour ≤ 3.0 ouE/$m^3$
- Limit value for existing pig production units: C98, 1-hour ≤ 6.0 ouE/$m^3$

**Air contaminants**

The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published in May 2008. It replaced the Framework Directive and the first, second and third Daughter Directives. The fourth Daughter Directive (2004/107/EC) will be included in CAFE at a later stage. The limit and target values for both Directives are outlined below.

The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) (DEHLG, 2011). It replaces 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 S.I. No. 33 of 1999.

**Ammonia**

EPA is currently working on an assessment approach to consider the impacts from intensive agricultural developments on Natura 2000 sites, including relevant assessment criteria. EPA currently adopts the assessment approach detailed by the Environment Agency in England (Environment Agency, 2018), which allows approval without further consideration of a development in isolation if is likely to cause an impact less than 4% of the "Critical Level".

The regulatory framework and assessment criteria with regards the Odour, Air Quality and Greenhouse Gas Assessment are discussed in detail in Attachment 5.1.

## 5.5 EMISSIONS

Air contaminants and greenhouse gases will be generated from:

- Construction activities,
- Emissions from the combustion of LPG in onsite boilers,
- Emissions from logistics associated with the site,
- Cattle contained at the site,
- Manure storage,
- Treatment of wastewater.

Emissions data with regards the Odour, Air Quality and Greenhouse Gas Assessment are discussed in detail in Attachment 5.1.

## 5.6 RESULTS

The sensitive receptors that are of interest are located in close proximity to the site. The closest sensitive receptors are presented in Figure 5.1 below.

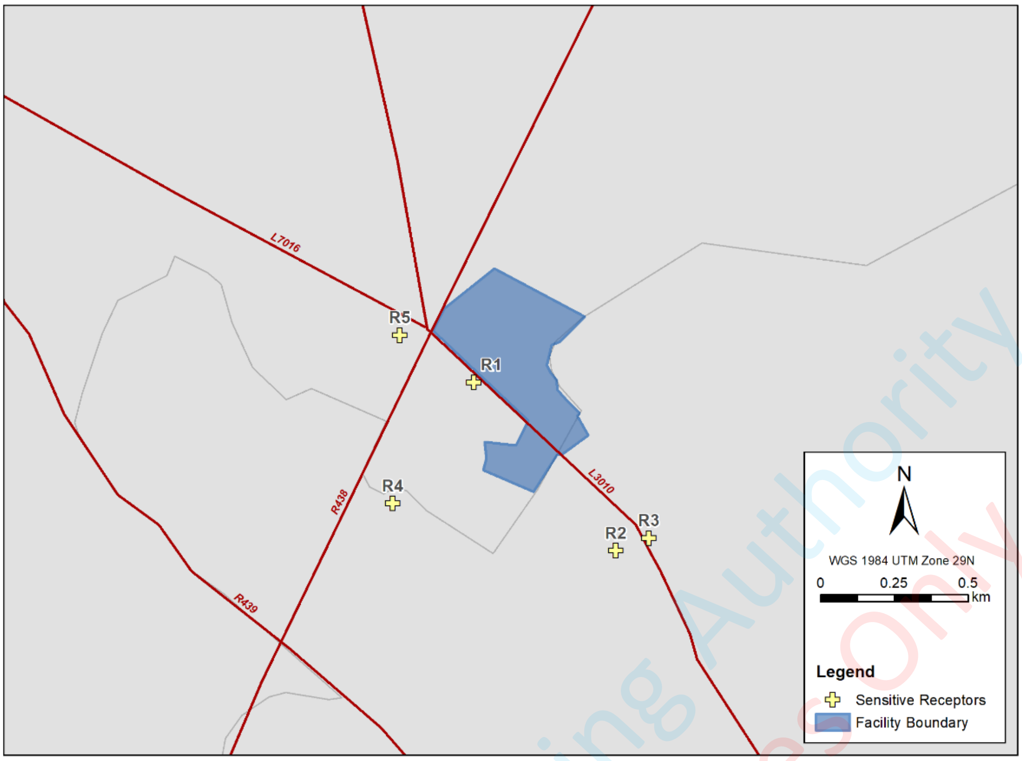


**Figure 5.1**: Modelled sensitive receptors in the assessment of odour and air contaminant emissions

### 5.6.1 ODOUR RESULTS

Predicted 1-hour average, 98th percentile, ground-level concentrations of odour due to the proposed development at the nearest sensitive receptors are presented in Table 9. Plate 1 is a contour plot presenting the highest 1-hour, 98th percentile ground-level concentrations across the model domain during the five-year period.

The results show that predicted concentrations are well below the criterion of 1.5 ouE/m3.

**Table 5.2**: Predicted 1-hour, 98th percentile concentrations of odour

| RECEPTOR | ODOUR ($OU_E/m^3$) 1-HOUR, 98TH PERCENTILE |
|---|---|
| R1 | 1.2 |
| R2 | 0.3 |
| R3 | 0.3 |
| R4 | 0.5 |
| R5 | 0.4 |
| Criteria Level | 1.5 $OU_E/m^3$ |

### 5.6.2 AIR CONTAMINANT RESULTS

The predicted ground-level concentrations of CO, NO2, SO2, PM10 and PM2.5 due to the proposed development at the nearest sensitive receptors are presented in Table 5.3 Also provided in Table 5.2 is the highest cumulative ground-level concentrations at any sensitive receptor due to the proposed development and ambient background.

**Table 5.3**: Predicted ground-level concentrations of air contaminants

| Receptor | CO (µg/M$^3$) | NO (µg/M$^3$) | | $PM_{10}$ (µg/M$^3$) | | $PM_{2.5}$ (µg/M$^3$) | $SO_2$ (µg/M$^3$) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Maximum 8-hr | 1-hour 19th high | Annual | 24-hour 36th high | Annual | Annual | 1-hour 19th high | 24-hour 4th high | Annual |
| R1 | 0.55 | 8.1 | 0.15 | 0.03 | 0.008 | 0.0026 | 0.7 | 0.11 | 0.013 |
| R2 | 0.27 | 2.5 | 0.03 | 0.006 | 0.002 | 0.0006 | 0.2 | 0.03 | 0.003 |
| R3 | 0.16 | 1.6 | 0.03 | 0.005 | 0.002 | 0.0005 | 0.1 | 0.02 | 0.003 |
| R4 | 0.19 | 2.2 | 0.04 | 0.008 | 0.002 | 0.0007 | 0.2 | 0.04 | 0.003 |
| R5 | 0.22 | 2.7 | 0.05 | 0.011 | 0.003 | 0.0009 | 0.2 | 0.04 | 0.005 |
| Background | 1240 | 122 | 7.4 | 11.2[1] | 11.2 | 9.2 | 14.8 | 4.1 | 2.3 |
| Max including Background | 1240 | 120 | 7.6 | 11.2[1] | 11.2 | 9.2 | 15.5 | 4.2 | 2.3 |
| Criteria Level | 10000 | 200 | 40 | 50 | 40 | 25 | 350 | 125 | 20 |

[1] UK DEFRA and EPA advise that 36th high 24-hour mean process contribution can be added to the annual mean background $PM_{10}$

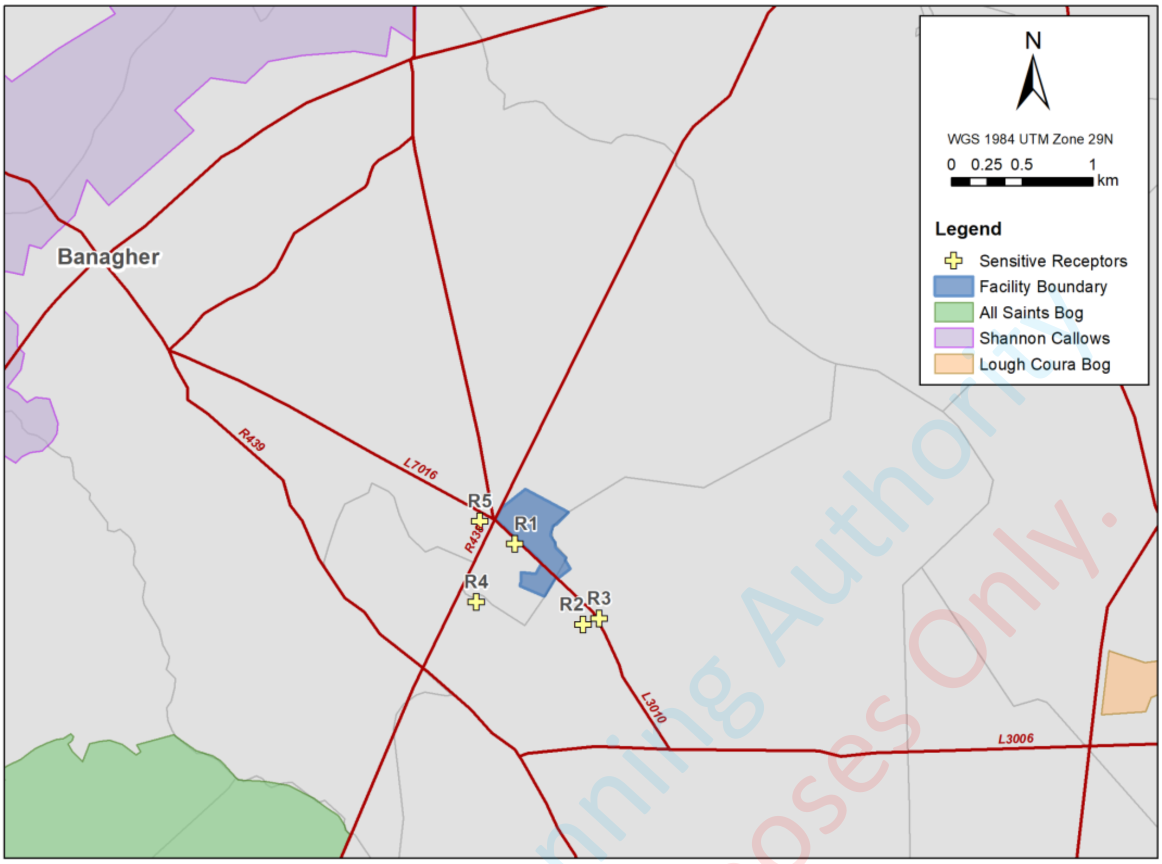


**Figure 5.2**: Modelled sensitive receptors in the assessment of ammonia emissions

Predicted ground-level concentrations of ammonia due to the proposed development in isolation at the Natura sites near the site are presented in Table 5.4.

**Table 5.4**: Predicted annual average concentrations of ammonia

| NATURA SITE | AMMONIA (µg/M³) |
|---|---|
| | ANNUAL AVERAGE |
| All Saints Bog | 0.01 |
| Shannon Callows | 0.006 |
| Lough Coura Bog | 0.004 |
| **Criteria Level** | **0.04** |

The results of air modelling for airborne contaminants show:

- Ground-level concentrations of NO2 due to the proposed development plus ambient background are predicted to comply with the criteria levels at all the sensitive receptors. The incremental increase in NO2 concentrations predicted due to the proposed development is less than 4% of the criteria levels.

- Ground-level concentrations of CO due to the proposed development plus ambient background are predicted to comply with the criterion level at all the sensitive receptors. The incremental increase in CO concentrations predicted due to the proposed development is less than 0.01% of the criterion level.

- Ground-level concentrations of SO2 due to the proposed development plus ambient background are predicted to comply with the criteria levels at all the sensitive receptors. The incremental increase in SO2 concentrations predicted due to the proposed development is less than 0.2% of the criteria levels.

- Ground-level concentrations of PM10 due to the proposed development plus ambient background are predicted to comply with the criteria levels at all the sensitive receptors. The incremental increase in PM10 concentrations predicted due to the proposed development is less than 0.06% of the criteria levels.

- Ground-level concentrations of PM2.5 due to the proposed development plus ambient background are predicted to comply with the criteria levels at all the sensitive receptors. The incremental increase in PM2.5 concentrations predicted due to the proposed development is less than 0.01% of the criteria levels.

- Ground-level concentrations of NH3 due to the proposed development are predicted to comply with the criteria levels at all the sensitive receptors. The incremental increase in NH3 concentrations predicted due to the proposed development is approximately 25% of the screening criteria levels.

Contour plots are provided for the various air contaminants due to the proposed development in Attachment 5.1.

## 5.7 ROAD TRAFFIC ASSESSMENT

Road transport sources from a development can account for emissions of several air pollutants, although most of the pollutants emitted by road vehicles are also produced by a wide range of industrial, commercial and domestic processes. The pollutants of most concern near roads are nitrogen dioxide ($NO_2$) and particles ($PM_{10}$) in relation to human health and oxides of nitrogen (NOx) in relation to vegetation and ecosystems.

The assessment of potential transport related air quality impacts for the proposed development was conducted using the screening method set out in the Design Manual for Roads and Bridges (DMRB) Section 11.3.1, published in May 2007 (DMRB HA207/07).

A regional air quality simple assessment has been conducted for the proposed development using the DMRB Screening Method spreadsheet (v1.03c). The screening level assessment uses the traffic information for the proposed development coupled with road length to estimate the change in annual emissions of air pollutants released by vehicles.

The results of the regional air quality assessment are detailed in Table 5.4 and show that based on the anticipated traffic data, annual emissions of CO, THC, NOx, PM10 and carbon increase with the proposed development. This is due to the increase in vehicle movements per year. The largest change in annual emissions is for NOx which increase by 22% on the L3010 due to increased movements on this road with the proposed development. However, the magnitude of annual emissions regionally is small compared to likely annual emissions from vehicles using the major roads in the region (M6 and M4), located approximately 20km away.

**Table 5.5**: Simple regional air quality assessment results

| Scenario | Year | Total Emissions | | | | |
|---|---|---|---|---|---|---|
| | | **CO** | **THC** | **NOx** | **PM10** | **Carbon** |
| | | **Kg/year** | | | | **1 / year** |
| Without Development | 2021 | 2,287 | 307 | 1,341 | 37 | 177 |
| With Development | | 2,542 | 359 | 1,630 | 42 | 207 |
| Change with development | | 255 | 52 | 289 | 5 | 30 |
| | | 11% | 17% | 22% | 15% | 17% |

## 5.8 CLIMATE CHANGE ASSESSMENT

### 5.8.1 METHODOLOGY AND EMISSION SOURCES

The highest annual GHG emissions associated with the proposed development have been considered on an annual basis. In addition to this, GHG emissions have been categorised according the ‘scope’ of emissions as defined by the Greenhouse Gas Protocol:

- Scope 1 – direct emissions from owned or controlled sources
- Scope 2 – indirect emissions associated with the use of purchased electricity
- Scope 3 – indirect emissions (excluding Scope 2 emissions) associated with the value chain of the reporting company.

Scope 1 and Scope 2 emissions have been reported in assessment (Attachment 5.1). A summary of estimated emissions associated with the proposed development, expressed as tonnes carbon dioxide equivalent (tCO2-e) is presented. The emissions factors (EF) and substance properties used in the assessment are summarised in Table 5.6.

**Table 5.6:** Greenhouse gas source substances - properties

| SUBSTANCE | PROPERTIES | | | | | | REFERENCE |
|---|---|---|---|---|---|---|---|
| | NET CALORIFIC VALUE | | EMISSION FACTOR (EF) | | DENSITY | | |
| LPG | 47.3 | GJ/t | 63 | kgCO2-e/ GJ | 0.55 | t/m3 | European Commission, 2012 |
| Electricity | 3.6 | MJ/kWh | 0.428 | kgCO2-e/ GJ | | | National Inventory Report, 2019 |
| Methane ($CH_4$) | | | 25 | kgCO2-e/ kgCH4 | | | European Commission, 2018 |
| Nitrous Oxide ($N_2O$) | | | 298 | kgCO2-e/ kgN2O | | | European Commission, 2018 |

GHG emissions associated with manure management have been estimated based on country specific EF provided in Ireland's National Inventory Report 2019. The range of EF associated with non-dairy cattle range from 0.25 kgCH4/head/year for "female cattle >2 years" (1990) to 7.09 kgCH4/head/year for "male cattle 1-2 years" (1990). To provide an indication of maximum annual emissions associated with manure management an EF of 7.09 kgCH4/head/year has been used in this assessment.

Activities associated with the operational phase of the proposed development that will result in GHG emissions, organised according to scope, are:

- Scope 1
  - LPG combustion for boilers and forklifts
  - Treatment of wastewater
  - Manure management

- Scope 2
  - Purchased electricity.

The estimation of the highest anticipated annual GHG emissions associated with each of these activities has been made based on the following activity data:

- LPG
  - Annual consumption – 80m3.

- WWTP
  - Effluent throughput of 250 L/day
  - Effluent COD 8,000 mg/L
  - Water treatment consists of a combination of aerobic and anoxic treatment processes.

- Manure management
  - 450 head of cattle onsite on a continuous basis (to provide an indication of maximum.

- Purchased electricity.
    - Annual consumption - 922 MWh

### 5.8.2 GREENHOUSE GAS ASSESSMENT

The energy use and GHG emissions associated with the proposed development are summarised in Table 5.7. The highest annual GHG emissions associated with the proposed development have been estimated to be 1,111 tCO2-e (Scope 1: 716 tCO2-e and Scope 2: 395 tCO2-e) with annual energy used estimated to be 5,398 GJ.

**Table 5.7:** Summary of annual energy use and GHG emissions

| EMISSION SOURCE | ENERGY (GJ) | GHG EMISSIONS (TCO2-E) | | |
|---|---|---|---|---|
| | | SCOPE 1 | SCOPE 2 | TOTAL EMISSIONS (SCOPE 1 + SCOPE 2) |
| LPG | 2,079 | 131 | - | 131 |
| WWTP | | 473 | - | 473 |
| Manure Management | | 113 | - | 113 |
| Electricity | 3,319 | - | 395 | 395 |
| TOTAL | 5,398 | 716 | 395 | 1,111 |

Annual GHG emissions, of 1,111 tCO2-e, associated with the project compared to 2017 emissions are:

- 0.002% of annual total national GHG emissions
- 0.006% of annual GHG emissions for the agriculture sector.

### 5.8.3 MANAGEMENT AND MITIGATION OF GHG EMISSIONS

Management and mitigation of GHG emissions has been integrated into the design of the proposed development including:

- Selection of an aerobic/anoxic WWTP (avoiding the need for anaerobic digestion)
- Use of LPG fuel for boilers
- LED lighting throughout the facility.

Other factors that have the potential to further mitigate GHG emissions associated with the proposed development, but have not been factored into the estimates of annual GHG emissions, include:

- The constructed wetland is likely to act as carbon (GHG) sink.
- Waste segregation, management and disposal practices that will be adopted for animal by-products will mitigate Scope 3 GHG emissions.

### 5.8.4 CLIMATE VULNERABILITY

In addition to the potential impact of the proposed development on climate change as a result of GHG emissions, the potential vulnerability of the proposed development to the impacts of climate change is considered within Attachment 5.1, and discussed briefly within this section. The key impacts of climate change on agriculture based on 'Integrating Climate Change into Strategic Environmental Assessment in Ireland – A Guidance Note' (EPA, 2015) are summarised in Table 5.8. The nature of operations of the proposed development, including short term housing of cattle and enclosed beef processing operations, provide a high level of resilience to the potential impacts of climate change. Water availability is likely to have the most significant impact on operation of the project in terms of:

- Animal welfare – cattle require access the water
- Cleaning operations – water relied upon for the majority of cleaning operations.

**Table 5.8:** Key impacts of climate change on agriculture (EPA, 2015)

| RELATED ASPECTS | EFFECTS ON AGRICULTURE |
|---|---|
| • Air temperature<br>• Soil temperature<br>• Extreme weather events<br>• Water availability | • Decrease in soil condition<br>• Increase in pests, pathogens and invasive species<br>• Increase in plant growth<br>• Animal welfare<br>• Infrastructure and access to the land |

## 5.9 CONCLUSIONS

The air quality assessment was conducted in accordance with recognised techniques for dispersion modelling specified in EPA's Air Dispersion Modelling Guidance Note (AG4). AERMOD was used to predict ground-level concentrations of odour and air contaminants across the model domain due to sources at the site.

The air quality assessment found:

- The predicted concentrations of odour are well below the criterion of 1.5 ouE/m3 due to the proposed development at sensitive receptors;
- The predicted concentrations of NO2, CO, SO2, PM10 and PM2.5 are well below the relevant criteria levels due to the proposed development at sensitive receptors;
- the predicted concentrations of ammonia are well be the relevant criteria due to the proposed development at the Natura sites located near the site.

The road traffic assessment found the proposed development's potential impact on roadside local air quality is negligible and the magnitude of annual emission on regional air quality is low compared to major regional roads in the vicinity of the proposed development.

An assessment of the potential change in road traffic emissions with the proposed development has been undertaken using the DMRB methodology. The assessment found that changes in local air quality (at the roadside) due to the proposed development are likely to be negligible. This is due to the relatively small volume of traffic on the existing road network and the small addition from the proposed development.

The assessment of regional air quality found that the proposed development is likely to result in increases in annual emissions of air pollutants; however, the magnitude of these is small compared to emissions from the major roads in the region.

## 5.10 REFERENCES

Any reference documentation is referred to directly within the EIAR or within Attachment 5.1.