8 Air Quality and Climate

8.1 Introduction

This chapter describes the likely significant effects of the proposed development on air quality and climate. Odour is addressed separately in **Chapter 9**.

Chapter 4 provides a full description of the proposed development and **Chapter 5** describes the Construction Strategy. The following aspects are particularly relevant to the air quality and climate assessment:

- Operation and Design: the use of energy efficient design throughout the scheme design reduces the annual CO_2 emissions of the proposed development. Key energy and resource efficiency measures are outlined in detail in **Section 8.5.1.2** including; WwTP location, gravity sewers, pump efficiencies, the use of PV panels and heat recovery at the WwTP.
- Operation: An emergency generator will be located at the WwTP for use during power outages.
- Construction: A generator will be used to power the TBM during the construction of the proposed development.

8.2 Assessment Methodology

8.2.1 General

Air quality assessments are concerned with the presence of airborne pollutants in the atmosphere. The likely significant effects of the proposed development on air quality have been assessed by considering the background concentration levels of pollutants in the atmosphere and the potential for likely significant effects during construction and operation of the proposed development. Predicted concentrations associated with the proposed development are then compared to the relevant limit values which are described in detail in **Section 8.2.2** to determine likely significant effects.

This assessment has also been undertaken with regard to the requirements of the Transport Infrastructure Ireland (TII), (formerly the National Roads Authority, guidelines[1]. These guidelines[1] provide a methodology for the assessment, management and mitigation of air quality at construction sites which can be adapted accordingly depending on the nature of the works.

The guidelines[1] state that increases in Annual Average Daily Traffic (AADT) flows of less than 5% and 10% during the operational and construction phases respectively are unlikely to result in significant air quality effects.

[1] TII (2011) Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes.

Likely significant effects on air quality are therefore assessed when the AADT flows increase above these thresholds during construction and operation of the proposed development.

Air dispersion modelling of pollutant emissions represents a widely accepted method of assessing potential risk of off-site impacts. To assess the likely significant effects of the construction phase of the proposed development on the ambient environment, dispersion modelling of odorous emissions was undertaken in accordance with the EPA guidance document[2]. The air dispersion modelling methodology is outlined in **Section 8.2.5.2**. There will be no operational air emissions.

The climate assessment for the construction and operational phase estimates the greenhouse gas (GHG) emission levels over the design life of the proposed development.

The results of the assessment have been compared against the EPA`s projected GHG emissions for both the non-Emission Trading Scheme (ETS) sector and total emissions for 2030[14].

An assessment of the potential risk of Asbestos Containing Materials (ACMs) being released to the environment has also been undertaken herein.

8.2.2 Guidance and Legislation

8.2.2.1 Limit Values

Limit values for a range of air pollutants have been set through European and national legislation. These limit values are set for the protection of human health and ecosystems.

On 12 April 2011, the Air Quality Standards (AQS) Regulations 2011 (S.I. No. 180 of 2011) came into force and transposed EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe into Irish law. The purpose of the AQS Regulations is to:

- Establish limit values and alert thresholds for concentrations of certain pollutants;
- To provide for the assessment of certain pollutants using methods and criteria common to other European Member States;
- To ensure that adequate information on certain pollutant concentrations is obtained and made publicly available; and
- To provide for the maintenance and improvement of ambient air quality where necessary.

The limit values established under the AQS Regulations relevant to this assessment are included in Table 8.1.

[2] EPA (2010) Air Dispersion Modelling from Industrial Installations Guidance Note AG4

Table 8.1: Limit values in the AQS Regulations

Pollutant	Limit value for the protection of:	Averaging period	Limit value ($\mu g/m^3$)	Basis of application of limit value	Limit value attainment date
NO_2	Human Health	1-hour	200	≤ 18 exceedances p.a. (99.79%ile)	1 January 2010
		Calendar year	40	Annual mean	1 January 2010
NOx	Vegetation	Calendar year	30	Annual mean	1 January 2010
PM_{10}	Human Health	24-hours	50	≤ 35 exceedances p.a. (90%ile)	1 January 2005
		Calendar year	40	Annual mean	1 January 2005
$PM_{2.5}$	Human Health	Calendar year	20 Note 1	Annual mean	1 January 2020

Note 1: Limit value to be reviewed by the Commission in light of further information on health and environmental effects, technical feasibility and experience of the Target Value in Member States.

There are no statutory limits for dust at a European or national level. However, TA Luft[3] provides a guideline for the rate of dust deposition of 350mg/m^2/day averaged over one year. The EPA concurs[4] that this guideline may be applied, although the EPA typically applies the guideline limit as a 30-day average.

8.2.3 Study Area

The proposed development is located in Arklow, County Wicklow. The WwTP site is located on the eastern periphery of Arklow Town, approximately 20m from the coastline. The proposed development is contained within the planning boundary as shown in **Figure 1.1 in Volume 3**.

The closest sensitive receptors to the WwTP are located approximately 100m to the west of the site, approximately 185m to the north-west of the site and approximately 260m to the south of the site (the latter being across the Avoca River). In addition, the lands adjacent to the WwTP are zoned for Waterfront (WZ), which includes for a mix of residential, commercial, employment, leisure and tourism uses. These lands have been included as future sensitive receptors for the operational assessment.

[3] TA Luft (2002) *Technical Instructions on Air Quality.*
[4] EPA (2006) *Environmental Management in the Extractive Industry (Non-Scheduled Minerals).*

A number of sensitive receptors are also located along the route of the interceptor sewers, at River Walk, South Quay and North Quay (Refer to **Figure 8.1 in Volume 3)**.

The proposed development interacts with a number of different zoned areas, as outlined in the Arklow LAP and described in **Section 6.4.2 of Chapter 6**. Along North Quay, the proposed development crosses the Open Space (OS2) and Waterfront (WZ) zoned areas. The proposed development is also adjacent to Community & Education (CE) and Open Space (OSI) zoning objectives.

Along River Walk and South Quay, the proposed development crosses the Town Centre (TC), Open Space (OS1), Open Space (OS2) and Existing Residential (RE) zoning objectives. These have been considered in the assessment herein.

8.2.4 Categorisation of the Baseline Environment

A desk-based study of the baseline environment of the proposed development area was undertaken in order to inform this assessment. The EPA's Air Quality Reports[5] were used in order to determine the baseline air quality for the years 2014, 2015 and 2016 (refer to **Section 8.3** for further details).

Traffic modelling (as described in **Section 7.3 in Chapter 7**) was used for existing and projected traffic volumes within the study area.

8.2.5 Impact Assessment Methodology

8.2.5.1 Significance Criteria

Significance criteria have been adopted from the TII Guidelines and are presented in Table 8.2 through to Table 8.5. These criteria provide a basis for assessing the level of effects due to the additional traffic present during construction.

Table 8.2: Definition of magnitude for changes in ambient pollutant concentrations

Magnitude of Change	**Annual Mean NO_2/PM_{10}**	**No. days with PM_{10} greater than 50 ug/m^3**	**Annual Mean $PM_{2.5}$**
Large	Increase/decrease 4 ≥ µg/m^3	Increase/decrease >4 days	Increase/decrease ≥2.5 µg/m^3
Medium	Increase/decrease 2-<4µg/m^3	Increase/decrease 3 or 4 days	Increase/decrease 1.25 -<2.5µg/m^3
Small	Increase/decrease 0.4-<2µg/m^3	Increase/decrease 1 or 2 days	Increase/decrease 0.25-<1.25µg/m^3
Imperceptible	Increase/decrease <0.4µg/m^3	Increase/decrease <1 day	Increase/decrease <0.25µg/m^3

[5]EPA (2018) Annual Air Quality Reports, Available at: http://www.epa.ie/air/quality/

Table 8.3: Air quality effect descriptors for changes to annual mean nitrogen dioxide and PM_{10} and $PM_{2.5}$ concentrations at a receptor

Absolute Concentration in Relation to Objective/Limit Value	**Change in Concentration**[6]		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36≤40µg/m^3 of NO_2 or PM_{10}) (22.5≤25µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30≤36µg/m^3 of NO_2 or PM_{10}) (18.75≤22.5µg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30µg/m^3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value Without Scheme (≥40µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Sight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (36-<40µg/m^3 of NO_2 or PM_{10}) (22.5-<25µg/m^3 of $PM_{2.5}$)	Sight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (30-<36µg/m^3 of NO_2 or PM_{10}) (18.75-<22.5µg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<30µg/m^3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

[6] Where the magnitude is imperceptible, then the likely significant effect description is negligible.

Table 8.4: Air quality effect descriptors for changes to number of days with PM_{10} concentration greater than 50 µg/m^3 at a receptor

Absolute Concentration in Relation to Objective/Limit Value	**Changes in Concentration**		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (32-<35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (26-<32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value Without Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (32-<35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (26-<32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

Table 8.5: Assessment criteria for the effect of dust emissions from construction activities with standard mitigation in place

Source		**Potential distance for Significant Effects (Distance from Source)**		
Scale	**Description**	**Soiling**	**PM_{10}[7]**	**Vegetation Effects**
Major	Large construction sites, with high use of haul routes	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul routes	50m	15m	15m
Minor	Minor construction sites, with limited use of haul routes	25m	10m	10m

[7] Significance based on the PM_{10} Limit Values specified in SI No. 180 of 2011, which allows 35 daily exceedances/year of 50 µg/m³

8.2.5.2 Construction Phase

Dust and Asbestos Assessment Methodology

The TII guidelines[1] state that dust emissions from construction sites can lead to soiling, elevated PM_{10} concentrations and can cause effects on vegetation such as reduction in light required for photosynthesis and an increase in leaf temperature due to changed surface optical properties.

The likely significant effects of dust emissions during construction are assessed by considering the proximity of sensitive receptors to the construction works. The likely significant effects of construction dust on sensitive habitats are also considered.

During the construction phase of the proposed development it is possible that disturbance of Asbestos Containing Materials (ACMs) on site could cause asbestos fibres to be released into the ambient environment. The likely significant effects of ACM disturbance during construction are therefore also assessed.

Air Dispersion Modelling

There is the potential for elevated ground level concentrations of Nitrogen Dioxide (NO_2) and Particulate Matter (PM) to be generated from the generator powering the Tunnel Boring Machine (TBM) during the construction phase of the proposed development. Detailed air dispersion modelling has been undertaken for the generator using the EPA approved Breeze AERMOD software package[8]. As outlined in **Section 8.2.1**, the air dispersion modelling has been undertaken in accordance with the EPA Guidance[2].

The model was used to predict ground level concentrations over a 1-hour averaging period for Nitrogen Dioxide and a 24-hour averaging period for Particulate Matter.

As the generator will be located within various work areas, the modelling assessment was undertaken to represent any working area by locating sensitive receptors between 15m and 200m from the generator at 10m grid intervals.

Meteorological data from Met Éireann's station at Dublin Airport was used for the years 2011 to 2015 inclusive. The meteorological data includes hourly values for wind speed, wind direction, atmospheric stability, ambient temperature and mixing height.

A CAT C32 100kVA diesel generator, or equivalent, will be used for powering the TBM. **Table 8.6** outlines the emission source data for this generator.

[8] Breeze AERMOD version 16216r, released January 2017.

Table 8.6: Emission source input data

Parameter	Unit	Generator
Stack Height	m	4.5
Stack Diameter	m	0.4
Flow Rate	m^3/s	3.2
Temperature	^oC	464
NO_x concentration	mg/Nm^3	2,928
NO_x emission rate	g/s	3.47
PM_{10} concentration	mg/Nm^3	11.9
PM_{10} emission rate	g/s	0.014

Traffic Assessment Methodology

The air quality assessment utilises traffic data outlined in **Chapter 7** to assess the likely significant effects of construction traffic on air quality.

As noted in **Section 8.2.1**, the TII guidelines[1] state that increases in AADT flows during the construction phase of less than 10% are unlikely to result in significant effects on air quality. As described in **Section 8.4.2.3**, there are four construction stages where construction traffic will result in a significant increase (>10%) in AADT flows due to traffic diversions and two locations where a significant increase will occur due to construction vehicles.

The UK Design Manual for Roads and Bridges (DMRB) Screening Method spreadsheet[9] is used in this assessment to assess the likely significant effects of construction traffic on sensitive receptors. This spreadsheet calculates annual average concentrations of NO_x, NO_2 and PM.

The DMRB spreadsheet method computes concentrations of pollutants based on factors including:

- Distance of receptors to the centreline of each road;
- Annual Average Daily Traffic (AADT) flows;
- Design speed of each road;
- Heavy Goods Vehicle (HGV) percentage;
- Road type; and
- Background pollutant concentrations.

Annual average concentrations for the traffic related pollutants NO_x, NO_2 and PM were modelled at each sensitive receptor identified in **Section 8.4.2.3**. The predicted concentrations of each pollutant are compared to the AQS limit values, as outlined in Table 8.1.

[9] DMRB (2007) Design Manual for Roads and Bridges (DMRB) Screening Method (Version 1.03c) spreadsheet.

Climate Assessment Methodology

In October 2014, the European Council reached political agreement on headline greenhouse gas emissions reduction targets in the context of the 2030 Climate and Energy Framework. An overall EU reduction of at least 40% in greenhouse gas emissions by 2030 compared to 1990 levels is to be delivered collectively by the EU.

EU greenhouse gas emission reduction targets and reduction obligations for Ireland are split into two broad categories. The first category covers the large energy and power (i.e. energy intensive) industry which have their emissions controlled under the EU Emissions Trading Scheme (ETS). The second category deals with the non-Emissions Trading Scheme (non-ETS) sectors such as agriculture, transport, residential, commercial, waste and non-energy intensive industry. The proposed development will operate within the non- ETS sector.

Ireland's 2030 target is to achieve a 30% reduction of non-Emissions Trading Scheme sector emissions on 2005 levels with annual binding limits set for each year over the period 2021-2030.

A climate impact assessment was carried out in order to determine the likely significant effects of greenhouse gas emissions (Mt CO_2 equivalent) predicted due to the construction phase of the proposed development, relative to Ireland's projected baseline for 2020, as reported by the EPA.

8.2.5.3 Operational Phase

Process Operations Assessment Methodology

Operational emissions to the atmosphere from the proposed development will be solely restricted to emissions from the Inlet Works Building and Process Building vent stacks. Detailed odour emission dispersion modelling has been carried out for the proposed development. Based on the level of detail involved, this assessment is described in detail in **Chapter 9**.

The WwTP will have an emergency power supply from a standby diesel generator located in the Process Building which will provide up to 24 hours' backup supply. The intention is that the generator would operate in the event of power outages. Preliminary estimates suggest a generator set of 1,250kVA will be used.

As this generator is the same size as the generator proposed to power the TBM (1,250kVA), in the event of power outages, the impact rating associated with its use is not considered significant. Refer to **Section 8.4.2.2** for details of the assessment of the TBM generator.

Traffic Assessment Methodology

As described in **Section 8.2.1**, and in accordance with TII guidance, likely significant effects on air quality are assessed where there is a significant (>5%) increase in AADT flows during the operation of the proposed development.

Climate Assessment Methodology

A climate assessment was carried out in order to determine the likely significant effects of greenhouse gas emissions (Mt CO_2 equivalent) predicted due to the operation of the proposed development, relative to Ireland's projected baseline for 2020, as reported by the EPA.

8.3 Baseline Conditions

8.3.1 Air Quality

As outlined in **Section 8.2.3**, the proposed development is located along the north and south quays of the Avoca river, with the WwTP site located on the eastern periphery of Arklow Town, adjacent to the coast. The AQS Regulations describe the air quality zoning adopted in Ireland as follows:

- Zone A (Dublin Conurbation);
- Zone B (Cork Conurbation);
- Zone C (16 Cities and Towns with population greater than 15,000); and
- Zone D (Rural Ireland: areas not in Zones A, B and C).

The proposed development falls within 'Rural Ireland' and is therefore located in Zone D.

The annual mean background concentration levels of NO_x, NO_2, $PM_{2.5}$ and PM_{10} from EPA monitoring undertaken during 2014 - 2016 are presented in Table 8.7. Concentrations of each pollutant recorded in Zone D are averaged to represent typical background levels. Average concentrations were obtained from all stations where data is captured for at least 90% of the time, in accordance with the AQS Regulations.

Table 8.7: Annual mean background pollutant concentrations for Zone D

Background Values	**Annual Average NO_x ($\mu g/m^3$)**	**Annual Average NO_2 ($\mu g/m^3$)**	**Annual Average PM_{10} ($\mu g/m^3$)**	**Annual Average $PM_{2.5}$ ($\mu g/m^3$)**
2014	7.5	5.5	10.5	5
2015	7.3	4	12	8
2016	10.0	6.3	13.1	9
Average	**8.3**	**5.3**	**11.9**	**7.3**
Limit	**30**	**40**	**40**	**20**

8.3.2 Climate

In November 2017, the EPA reported[10] that total national greenhouse gas emissions in 2016 were estimated to be 61.19 million tonnes carbon dioxide equivalent (Mt CO_{2eq}). This is 3.5% higher (2.06 Mt CO_{2eq}) than emissions in 2015 and returns greenhouse gas emissions to 2009 levels. Ireland's greenhouse gas emissions for non-ETS sectors were recorded to be 43.80 Mt $CO_{2\ eq}$ in 2016.

The EPA projects[10] total greenhouse gas emissions and non-ETS sector emissions (Mt CO_2 eq.) to 2035, refer to **Table 8.8.**

Table 8.8: Projected Emissions for the ETS Sector and Total Emissions (Source: EPA[10])

	Year	**Non-ETS Sector Only (MT CO_2 eq.)**	**Total (Mt CO_{2eq})**
Projections (with existing measures)[11]	2020	45.64	61.56
	2025	47.74	65.39
	2030	47.14	66.49
	2035	47.31	69.21
Projections (with additional measures)[12]	2020	44.83	59.09
	2025	46.78	62.27
	2030	46.04	62.89
	2035	46.04	64.84

Current projections by the EPA indicate that Ireland will exceed its greenhouse gas emissions reduction targets.

8.4 Likely Significant Effects

8.4.1 Do-Nothing Scenario

In the scenario where the proposed development did not proceed as planned, none of the likely significant construction or operational effects as set out in this chapter would occur.

[10] EPA (2017) Ireland's Provisional Greenhouse Gas Emissions 1990-2016
[11] *With Existing Measures* scenario assumes that no additional policies and measures, beyond those already in place by the end of 2015, are implemented. (EPA, 2017)
[12] *With Additional Measures* scenario assumes further implementation of Government renewable and energy efficiency targets for 2020, as set out in the National Renewable Energy Action Plan (NREAP) and the National Energy Efficiency Action Plan (NEEAP). (EPA, 2017)

8.4.2 Assessment of effects during construction

8.4.2.1 Dust and Asbestos

Chapter 5 provides a description of the proposed strategy and methods of construction for the proposed development. Dust emissions are likely to arise from the following construction activities:

- Site excavation;
- Rock breaking;
- Tunnelling;
- Trenching;
- Crushing;
- Stockpiling of separated particles;
- Demolition;
- Handling of construction materials;
- Construction traffic movements; and
- Landscaping.

In general, any additional airborne concentrations of particulate matter arising from construction would be small and very local to the construction site (minimising human exposure). Particles generated by most construction activities tend to be larger than 10µm in diameter which are too large to enter the human lung.

The construction phase of the proposed development is considered to be of a moderate scale, based on the greatest level of construction along the proposed development, refer to **Table 8.5.** This has the potential to result in soiling effects within 50m and PM_{10} and vegetation effects within 15 m of the works with standard mitigation in place.

As shown in **Figure 8.1 of Volume 3**, a number of sensitive receptors are located along the route of the interceptor sewers, at the North and South Quays; the closest of which is located approximately 10m from the proposed construction works.

As the closest of these sensitive receptors is located approximately 10m away from the proposed interceptor sewer there is potential for soiling, PM_{10} and vegetation effects arising from construction activities along the North and South Quays. However, with the implementation of the standard mitigation measures outlined in **Section 8.5.1**, no significant negative effects are envisaged.

An Asbestos Demolition Survey Report has been undertaken for the proposed development, and known ACMs have been identified on site, largely in the form of asbestos cement. This survey has identified asbestos in the following areas on the site:

- The wall and roof cladding of the Old Wallboard building comprises asbestos cement sheets;
- The wall and roof cladding of the Stores building is asbestos sheet cladding;
- The ceiling of the stores building is asbestos sheet cladding;
- The roof cladding to the high section of the Wallboard building is asbestos cement sheets;
- The wall and roof cladding of the Masterglaze building is asbestos cement sheets;
- Rope seals to the lights in the Masterglaze building contain asbestos;
- Lino with asbestos paper backing is present in the electrical room of the Wallboard building;
- Vinyl floor tiles and bitumen containing asbestos are present in the locker room of the Wallboard building;
- Rain water goods in the buildings contain asbestos;
- The internal walls and ceiling of the prefab building contain asbestos;
- Asbestos cement debris is present around and within all of the buildings on the site; and
- Asbestos cement debris is present in the existing rock armour revetment on the seaward side of the site.

During the construction phase of the proposed development it is possible that disturbance of ACMs on site could cause asbestos fibres to be released into the ambient environment. However, with the implementation of the standard mitigation measures outlined in **Section 8.5.1**, no significant negative effects are envisaged.

8.4.2.2 Generator Emissions for Tunnelling

A CAT C32 1,250kVA diesel generator, or equivalent, will be used for powering the TBM. The location of the generator will vary throughout the works, whilst always remaining within a working area. An air dispersion modelling assessment was carried out to assess the short-term effects of the emissions associated with the operation of the generator.

Table 8.9 presents the results of the assessment.

Table 8.9: Predicted ground level concentrations of pollutants from construction generator

Parameter	Background Concentration (µg/m^3)	Predicted Concentration (µg/m^3)	Total Concentration (µg/m^3)	Limit Value (µg/m^3)	Distance of highest concentration from generator (m)
Nitrogen Dioxide (1 hour)	10.6[13]	175.3	185.9	200	50m
Particulate Matter (24-hour)	11.9	0.4	12.3	50	60m

The results in Table 8.9 show that compliance with the AQS Regulations can be achieved using the input data presented in Table 8.6. Additional measures, such as increasing the stack height or increasing the exit velocity can reduce the ground level concentrations of pollutants even further.

As the generator will only be operational during the construction phase of the proposed development and will be relocated throughout the working area as the tunnel progresses, the predicted air quality effects are not considered significant.

8.4.2.3 Traffic

The traffic assessment predicts pollutants where construction traffic increases by more than 10% and where significant traffic increase due to diversions are proposed.

Table 8.10 presents the locations where construction traffic will increase by more than 10%, as described in **Chapter 7**.

Table 8.10: Significant traffic increases from construction traffic.

Location	Traffic volume - existing	Traffic volume – due to construction vehicles
North Quay	6,050	6,639
Harbour Road	726	816

For locations where significant changes to traffic are predicted due to diversions, Table 8.11 outlines the stages, durations and predicted increases.

[13] Double the annual background concentration for 1-hr values, in accordance with EPA Guidance.

Table 8.11: Significant traffic increases due to diversions during construction.

Construction Stage	Duration	Traffic volume - existing	Traffic volume – due to rerouting	Road effected
Stage E South Quay / South Green	2 months	2,614	3,735	South Green Harbour Road
Stage F South Quay / Harbour Road	5 months	2,614	3,735	South Green Harbour Road
Stage H North Quay (East of Ferrybank)	2 weeks	Estimated at 3,000	9,000 (6,000 above baseline)	Seaview Avenue
Stage I North Quay (West of Bridgewater Ferrybank)	2 weeks	Estimated at 3,000	9,000 (6,000 above baseline)	Seaview Avenue

Table 8.12 presents the results for the predicted air quality increases from traffic during the construction phase due to construction vehicles and diversions.

Table 8.12: Predicted air quality increases during the construction phase

Road Location	Scenario	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (Days > 50 µg/m³)
	Limit Values	*40*	*40*	*25*	*35*
North Quay	Existing	7.0	12.3	8.6	<1
	From construction vehicles	7.1	12.3	8.6	<1
	Increase	0.1	0.1	0.1	0
	Impact Rating	Negligible	Negligible	Negligible	Negligible
Harbour Road	Existing	5.6	12.0	8.4	<1
	From construction vehicles	5.7	12.0	8.4	<1
	Increase	0.1	0.1	0	0
	Impact Rating	Negligible	Negligible	Negligible	Negligible
South Green	Existing	6.3	12.1	8.5	<1
	During diversions	6.7	12.2	8.5	<1
	Increase	0.4	0.1	0	0
	Impact Rating	Negligible	Negligible	Negligible	Negligible
Harbour Green	Existing	6.3	12.1	8.5	<1
	During diversions	6.7	12.2	8.5	<1
	Increase	0.4	0.1	0	0
	Impact Rating	Negligible	Negligible	Negligible	Negligible

Road Location	Scenario	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (Days > 50 µg/m³)
	Limit Values	*40*	*40*	*25*	*35*
Seaview Avenue	Existing	6.5	12.1	8.5	<1
	During diversions	8.2	12.6	8.8	<1
	Increase	1.7	0.5	0.3	0
	Impact Rating	Negligible	Negligible	Negligible	Negligible

Negligible effects on air quality are predicted at all receptors as a result of the change in traffic emissions due to the proposed scheme.

8.4.2.4 Climate

The likely significant effects of the construction phase of the proposed development is outlined in **Section 8.5.2.3**.

8.4.3 Assessment of effects during operation

8.4.3.1 Process Operations

Normal operational impacts on air quality are solely generated from odour emissions from the vent stacks. This is assessed in **Chapter 9**.

As outlined in **Section 8.2.5.3**, the proposed generator for use in emergency situations at the WwTP is the same size (1,250kVA), as the generator proposed to power the TBM (1,250kVA). The likely significant effects associated with its use is considered as not significant. Refer to **Section 8.5.1.2** for details of the assessment of the TBM generator.

8.4.3.2 Traffic

As outlined in **Section 8.2.6**, emissions from operational vehicles are assessed where operational traffic results in a significant (>5%) increase in AADT (annual average daily traffic) flows near sensitive receptors.

Traffic levels during the operational phase will be light, as detailed in **Chapter 7**. As no increase in traffic >5% is likely to be generated during the operational phase of the proposed development, a negligible effect on air quality is predicted.

8.4.3.3 Climate

As outlined in **Section 8.3.2**, the EPA reported in 2017 that total national greenhouse gas emissions were estimated to be 61.19 Mt CO_2 eq. in 2016. Greenhouse gas emissions for non-ETS sectors were recorded to be 43.80 Mt CO_2 eq. in 2016.

Table 8.8 outlines a range of future projections for both total carbon emissions and ETS carbon emissions in Ireland (Mt CO_2 eq), as set out by the EPA[14].

The predicted annual CO_2 emissions from the proposed development, including the construction phase, as outlined in the Carbon Footprint Analysis carried out by the project design team is 3,968 tonnes CO_2 eq per annum (198,400 CO_2 eq over the 50-year design life of the proposed development).

The projected increase of CO_2 upon full implementation of the proposed development is 0.009% of Irelands Non-ETS Sector projections for 2020, and 0.006% of Ireland's total projections for 2020. Note that the projections 'with existing measures' (as defined in Table 8.8) are used as a worst-case scenario comparison assessment. This likely significant effect is considered to be an imperceptible on climate. This impact rating is based on EPA guidelines which defines an imperceptible impact as an effect capable of measurement but without significant consequences.

8.4.4 Cumulative

This section considers the potential for cumulative effect arising from the proposed development in association with other developments. Specifically, it considers a worst-case scenario, where both the proposed development and the proposed Arklow Flood Relief Scheme (or section thereof) are under construction at the same time.

The construction of the proposed Arklow Flood Relief Scheme is considered to be of a moderate scale based on the greatest level of construction as it is currently understood (Refer to **Table 8.5** for further detail). This has the potential to result in soiling effects within 50 m and PM_{10} and vegetation effects within 15m of the works with standard mitigation in place.

During the construction phase of the proposed Arklow Flood Relief Scheme, a temporary diesel generator may also be used to power equipment. As outlined in **Section 8.5.1.2**, the effects associated with its use are not considered significant.

In relation to construction traffic, the proposed Arklow Flood Relief Scheme is not considered to give rise to any additional effects over and above those stated in **Section 8.5.1.3** for the proposed development (Refer to **Chapter 7** for further detail).

The proposed development and the proposed Arklow Flood Relief Scheme is not likely to give rise to any significant effects during construction or operation phase once mitigation measures, as outlined in **Section 8.5**, are implemented.

[14] Ireland's Greenhouse Gas Emission Projections 2016-2035, EPA, 2017. Available at http://www.epa.ie/pubs/reports/air/airemissions/ghgprojections2016-2035/EPA_2017_GHG_Emission_Projections_Summary_Report.pdf

8.5 Mitigation Measures and Monitoring

8.5.1 Mitigation

8.5.1.1 Mitigation During Construction

The assessment of likely significant effects during construction (contained in **Section 8.4.2**) includes for the implementation of 'standard mitigation', as stated in the TII guidance[1]. This includes the following measures:

- Spraying of exposed earthwork activities and site haul roads during dry weather;
- Provision of wheel washes at exit points;
- Covering of stockpiles;
- Control of vehicle speeds, speed restrictions and vehicle access; and
- Sweeping of hard surface roads.

In addition, the following measures will be implemented for the proposed development:

- A c. 2.4m hoarding will be provided around the site works to minimise the dispersion of dust from the working areas;
- Generators will be located away from sensitive receptors in so far as practicable;
- Stockpiles will be located as far as possible from sensitive receptors and covered and/or dampened during dry weather.

Employee awareness is also an important way that dust may be controlled on any site. Staff training and the management of operations will ensure that all dust suppression methods are implemented and continuously inspected.

Where asbestos is uncovered on site during construction, the ACM will be double-bagged and removed from the site by a competent contractor and disposed of in accordance with the relevant procedures and legislation.

8.5.1.2 Mitigation During Operation

As there are no significant effects on air quality predicted during the operational of the proposed development, no mitigation measures are proposed.

In relation to climate, the use of energy efficient design throughout the WwTP reduces the annual CO_2 emissions of the proposed development. Key energy and resource efficiency measures incorporated include:

- The WwTP has been located as close as possible to the load centre in Arklow town; and adjacent to the Irish Sea (i.e. the target location for final discharge of effluent) and all treated effluent discharges will be conveyed to the long sea outfall via gravity flow to minimise pumping requirements (and thus associated energy use).

- All wastewater in the interceptor sewer network and the WwTP will be conveyed by gravity to the WwTP to minimise pumping requirements (and thus associated energy use).
- Soft start pumps/efficient pump selection will be utilised throughout;
- On-site renewable energy in the form of PV panels that use solar energy have been incorporated into the plant design to optimise the generation and use of renewable energy at the WwTP.
- The buildings on the WwTP site will be naturally ventilated where possible, with heating limited to mitigate the effects of frost and condensation in the Inlet Works and Process Building only. Occupied spaces would have heat recovery ventilation systems. The combination of these HVAC elements would minimise associated energy use in the building during operation.

8.5.2 Monitoring

8.5.2.1 Monitoring During Construction

Dust monitoring will be undertaken at a range of nearest sensitive receptors during the construction phase. The TA Luft dust deposition limit values of 350 mg/m^2/day (averaged over one year) will be applied as a 30-day average.

8.5.2.2 Monitoring During Operation

As no significant effects are predicted to occur during the operation of the proposed development, therefore no monitoring measures are required.

8.6 Residual Effects

No significant residual effects are predicted on air quality and climate during the construction or operation of the proposed development with the implementation of the mitigation measures outlined herein.

8.7 References

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