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Ms Grainne Oglesby
Administration Office,
Office of Environmental Sustainability.
Environmental Inspection Agency,
PO Box 3000,
Johnstown Castle Estate,
County Wexford.

7th April 2017

Re; Application for Waste Licence (W0211-01) Eras Eco Ltd, Foxhole, Youghal

Dear Ms Oglesby,

I refer to the Agency's letter dated the 16th December 2016 in accordance with Regulation 10(2)(b)(ii) of the EPA (Industrial Emissions)(Licensing) Regulations 2013. An initial response was submitted to the Agency on 14th March 2017.

On behalf of Eras Eco Ltd I enclose one original and one hardcopy of the further response. Also enclosed are two CD-ROM discs containing files of the application in searchable PDF format. The content of the electronic files is a true copy of the original application form and the supporting attachments.

The requested information is set out herein.

18. Revise the air dispersion model report on foot of any changes in the model's conclusions in accordance with the items listed above.

As referred to in the initial response to the Agency's information request it was noted that the location of the emission point from the biofilter had been changed and the OEE was aware of this. It was also noted that an existing emission point (odour control unit on Building 1) was not included in the dispersal model. Due to space constraints the location of the emission point from the CHP plant will be slightly different. The air dispersion model has been amended accordingly and the revised report is enclosed in Attachment 1.

41 *Provide a fully-costed Closure, Restoration and Aftercare Management Plan and an Environmental Liabilities Risk Assessment that reflect the activities at the installation proposed for licensing in this licence review.*

The Closure, Restoration and Aftercare Management Plan and the Environmental Liabilities Risk Assessment are enclosed in Attachment 2.

Yours Sincerely,

Jim O' Callaghan

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ODOUR AND AIR QUALITY IMPACT ASSESSMENT OF IDENTIFIED PROCESSES LOCATED IN ERAS ECO LTD, FOXHOLE, YOUGHAL, CO. CORK.

PERFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF O'CALLAGHAN MORAN AND ASSOCIATES LTD

PREPARED BY:	Dr. Brian Sheridan
ATTENTION:	Mr. Jim O Callaghan
DATE:	27th July 2016 & 23rd Feb 2017 & 03rd April 2017
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Project: Odour and Air quality impact assessment of identified processes located in Eras Eco Ltd, Foxhole, Youghal, Co. Cork.

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This document is submitted as part of an air quality and odour impact assessment of Eras Eco Ltd carried out on behalf of O Callaghan Moran and Associates Ltd. The results reported are representative of source specifics contained in the report.

Respectively submitted,

Brian Sheridan B.Sc. M.Sc. (Agr) Ph.D (Eng).

For and on behalf of Odour Monitoring Ireland™

Executive summary

Odour Monitoring Ireland Ltd was commissioned by O Callaghan Moran and Associates Ltd to perform an air quality impact assessment of their proposed facility operation utilising dispersion modelling AERMOD Prime 16181r in accordance with AG 4 guidance document. Pollutant emission rates were estimated from a review of historical monitoring data, existing IPC licence limits and equipment supplier emission limit values for the specific processes to be located in Eras Eco Ltd, Foxhole, Youghal, Co. Cork.

Following detailed dispersion modelling and screening of the emission from the identified processes, all predicted pollutant ground level concentrations were compared to limit values contained in SI 180 of 2011, Directive 2008/50/EC, AG4 guidance document and TaLuft 2002.

The following conclusions were formed during the study. Greater detail can be found within the document and it is recommended that the document be read in full. These include:

1. Process emission estimation and dispersion modeling was performed on emissions from the existing and proposed processes to be located in Eras Eco Ltd, Foxhole, Youghal, Co. Cork.
2. Dispersion modeling was performed in accordance with best international practice and AG4 guidance document on dispersion modelling with a minimum of five years of hourly sequential meteorological data from Cork 2008 to 2012 inclusive was used in the dispersion modeling assessment. AERMOD Prime 16181r was utilised for the dispersion modelling assessment.
3. With regard to Carbon monoxide, the maximum GLC + Baseline for CO from the operation of the facility is 1,030 µg/m3 for the maximum 8-hour averaging period. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 2000/69/EC and 2008/50/EC, this is up to 89% lower than the set limits.
4. With regard to Oxides of nitrogen, the maximum GLC+Baseline for NO2 as NOX for the 99.79th percentile for a 1-hour averaging period was 83 µg/m3. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is up to 58% lower than the set limits. An annual average was also generated for Scenario 3. When compared to the impact criteria, the annual average NO2 air quality impact for Scenario 3 is up to 16% lower than the limit.
5. With regard to Sulphur dioxide, the maximum GLC+Baseline for SO2 from the operation of the facility is 112 and 71 µg/m3 for the maximum 1-hour averaging period at the 99.73th percentile and 24-hour averaging period at the 99.18th percentile, respectively. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is from 68 and 43% lower than the set limits established for the 1 hour and 24 hour assessment criteria. An annual average was also generated for Scenario 6 to allow comparison with the SI 180 of 2011 and 2008/50/EC. When compared the annual average SO2 air quality impact criterion is 5% lower than the impact criterion. Please note that the biomass boiler was prescribed an SO2 emission rate as requested by the EPA. The Medium combustion directive prescribes that biomass based systems do not have an SO2 ELV.
6. With regard to Total Particulates as PM10, the maximum GLC+Baseline for PM as PM10 for Scenario 7 from the operation of the facility is 14 µg/m3 for the 90.4th percentile for a 24-hour averaging period. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is from 28% lower than the set limits. An annual average was also generated for Scenario 8 and 9 to allow comparison with the SI 180 of 2011 and 2008/50/EC for PM10 and PM2.5. When compared the annual average PM10 and PM2.5 air quality impact criterion is 32 and 47% lower than the impact criterion.

7. With regard to Hydrogen chloride, the maximum GLC+Baseline for HCL for the 98th percentile for a 1-hour averaging period was 8.90 g/m3. When combined predicted and baseline conditions are compared to the TaLuft S Limit values laid out in TaLuft 2002, this is up to 90% lower than the set limits. An annual average was also generated for Scenario 10. When compared to the impact criteria contained in H1 guidance document, the annual average HCL air quality impact for Scenario 10 is up to 89% lower than the limit.
8. With regard to Hydrogen fluoride, the maximum GLC+Baseline for HF for the 98th percentile for a 1-hour averaging period was 0.89 g/m3. When combined predicted and baseline conditions are compared to the TaLuft S Limit values laid out in TaLuft 2002, this is up to 68% lower than the set limits. An annual average was also generated for Scenario 12. When compared to the impact criteria contained in TaLuft 2002, the annual average HF air quality impact for Scenario 12 is up to 34% lower than the limit.
9. With regard to TNMVOC as benzene, the maximum GLC+Baseline for TNMVOC as benzene for the annual averaging period was 2.49 g/m3. When combined predicted and baseline conditions are compared to the proposed Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 2008/50/EC, this is up to 50% lower than the proposed set limits.
10. With regard to Odour, the odour plume spread from the facility is small and remains close to the facility. In addition the predicted ground level concentration at worst case residential / industrial receptors is approximately 65% lower (0.74 OuE/m3) than the odour impact criterion. Therefore it is predicted that the proposed facility design will not lead to odour impact in the vicinity of the facility with worst case residential/ industrial receptors perceiving an odour concentration less than 1.50 OuE/m3 at the 98th percentile of hourly averages for worst case meteorological year Cork 2012.
11. Based on the predicted emissions and emission limit value guarantees, the proposed operation of the Eras Eco Ltd facility located in foxhole, Youghal, Co. cork will not breach stated air quality regulations when in operation.

1. Introduction and scope

1.1 Introduction

Odour Monitoring Ireland Ltd was commissioned by Eras Eco Ltd to perform an odour and air quality dispersion modelling assessment of the proposed emissions from the waste recycling facility located in Eras Eco Ltd, Foxhole, Youghal, Co. Cork. Pollutant emission data was taken from historical reports, IPC licence limits and from process emission data from equipment suppliers. Various existing and proposed emission points will lead to the generation of specific pollutants and by using atmospheric dispersion modelling, the potential impact of these pollutants are assessed and compared to relevant ambient odour and air quality objectives and limits including SI 180 of 2011 and the methodology contained within the Irish EPA publication “Odour impacts and odour emissions controls for Intensive Agricultural Facilities” the Environment Agency Horizontal Guidance notes for Odour, Parts 1 and 2 and AG4 Guidance document on Dispersion modelling. These documents laid out general methodologies for assessing the risks with odours and pollutants from the site. Background air quality data was obtained from available baseline air quality data generated by the Irish EPA and other referenced publications.

The main compounds assessed included Carbon monoxide (CO), Oxides of nitrogen (NO_X as NO_2), Sulphur dioxide (SO_2), Total Particulate matter (PM as PM_{10} and $PM_{2.5}$), Total Organic Carbon as Non methane Volatile organic compounds, Hydrogen fluoride and chloride and Odour. Average modelling scenarios were performed to allow for comparison with relevant air quality impact criteria as described in *Section 2.8*. These included 1-hour mean, 8-hour mean, 24-hour mean, Annual mean and maximum number of exceedences expressed as percentiles (see *Table 2.1 and 2.2*). All processes and source characteristics as outlined within the emission tables (*see Table 3.1 to 3.5*) was utilised to construct the basis of the dispersion model. Five years of hourly sequential meteorological data (Cork 2008 to 2012 inclusive) was used within the dispersion model in order to provide statistical significant conservative ground level concentration estimates. The worst case year was Cork 2012.

This report presents the materials and methods, results and discussion and conclusions formed throughout the study.

1.2 Scope of the study

The main objective of the odour and air quality impact assessment is to ascertain whether the levels of emissions from the facility will result in ground level impact in the vicinity of the site operations. Ground level impact refers to the impact at ground level in excess of the air quality impact criteria contained in *Section 2.8* of this document.

The methodology adapted involved a number of distinct steps. These included:

- Calculation of emission rates for such air components from measured and historical data for each process including licence limits;
- Prediction of ground level concentrations (GLC's) of compounds dispersed from the stack sources located within the facility;
- Comparison between dispersed GLC's + Background concentrations (*see Section 4 and 5*) and relevant air quality objectives and limits for these air pollutants.

1.3 Model assumptions

The approach adopted in this assessment is considered a worst case investigation in respect of emissions to the atmosphere from a facility.

These assumptions used within the dispersion modelling assessment include:

- Emissions to the atmosphere from the process operation were assumed to occur simultaneously 24 hrs each day over a standard year.
- The Particulate matter is treated as an ideal gas and therefore no removal due to deposition (wet or dry) is accounted for in modelling scenarios,
- The total particulate matter emitted from the stack sources is assumed to be all PM_{10} or $PM_{2.5}$. This is unlikely since varying particulate fraction size will be emitted from the process (up to less than 10µm particle diameter),
- Maximum GLC's + Background were compared with relevant air quality objects and limits;
- Five years of hourly sequential meteorological data from Cork 2008 to 2012 inclusive was used in the modelling screen which will provide statistical significant results in terms of the short and long term assessment. The worst case year for Cork was 2012 and was used for data analysis. This is in keeping with current national and international recommendations (EPA Guidance AG4). In addition, AERMOD incorporates a meteorological pre-processor AERMET PRO. The AERMET PRO meteorological preprocessor requires the input of surface characteristics, including surface roughness (z0), Bowen Ratio and Albedo by sector and season, as well as hourly observations of wind speed, wind direction, cloud cover, and temperature. The values of Albedo, Bowen Ratio and surface roughness depend on land-use type (e.g., urban, cultivated land etc) and vary with seasons and wind direction. The assessment of appropriate land-use type was carried out to a distance of 10km from the meteorological station for Bowen Ratio and Albedo and to a distance of 1km for surface roughness in line with USEPA recommendations.
- AERMOD Prime (16181r) dispersion modelling was utilised throughout the assessment in order to provide the most reliable dispersion estimates.
- All building wake affects (e.g. buildings within the site) were assessed within the dispersion model.
- 10 m spaced topographical data was inputted into the model.

2. Materials and methods

This section will describe the materials and methods used within the study.

2.1 Emission input data

Emission input data for the existing processes on site was taken from a review of historical monitoring data and IPC licence limits which was published and sent to the Irish EPA as part of licence compliance. Existing process emission points include:

- Emission point AEP1 – Boiler
- Emission point AEP2 – Biofilter

For proposed emission points, emission data was taken from manufacturers and process suppliers, existing licences utilising such equipment and historical monitoring of similar processes on other licences facilities. Proposed process emission points include:

- Emission point AEP3 – Existing Odour control unit Materials Recovery building and Anaerobic digestion plant
- Emission point AEP4 – Combined Heat and Power gas utilisation engines emission point

All volume flow, emission concentrations and mass emission rate data for each emission point AEP1 to AEP4 is included in *Section 3* of this document.

2.2 Atmospheric dispersion modelling of air quality: What is dispersion modelling?

Any material discharged into the atmosphere is carried along by the wind and diluted by wind turbulence, which is always present in the atmosphere. This process has the effect of producing a plume of air that is roughly cone shaped with the apex towards the source and can be mathematically described by the Gaussian equation. Atmospheric dispersion modelling has been applied to the assessment and control of emissions for many years, originally using Gaussian form ISCST 3 and more recently utilising advanced boundary-layer physics models such as ADMS and AERMOD (Keddie et al. 1992). Once the compound emission rate from the source is known, (g s^{-1}), the impact on the vicinity can be estimated. These models can effectively be used in three different ways: firstly, to assess the dispersion of compounds; secondly, in a “reverse” mode, to estimate the maximum compound emissions which can be permitted from a site in order to prevent air quality impact occurring; and thirdly, to determine which process is contributing greatest to the compound impact and estimate the amount of required abatement to reduce this impact within acceptable levels (McIntyre et al. 2000). In this latter mode, models have been employed for imposing emission limits on industrial processes, control systems and proposed facilities and processes (Sheridan et al., 2002).

2.3 Atmospheric dispersion modelling of air quality: dispersion model selection

The model chosen in this study was AERMOD Prime (EPA Version 16181r). The AERMOD model was developed through a formal collaboration between the American Meteorological Society (AMS) and U.S. Environmental Protection Agency (U.S. EPA). AERMOD is a Gaussian plume model and replaced the ISC3 model in demonstrating compliance with the National Ambient Air Quality Standards (Porter et al., 2003) AERMIC (USEPA and AMS working group) is emphasizing development of a platform that includes air turbulence structure, scaling, and concepts; treatment of both surface and elevated sources; and simple and complex terrain. The modelling platform system has three main components: AERMOD, which is the air dispersion model; AERMET, a meteorological data pre-processor; and AERMAP, a terrain data pre-processor (Cora and Hung, 2003).

AERMOD is a Gaussian steady-state model which was developed with the main intention of superseding ISCST3 (NZME, 2002). The AERMOD modeling system is a significant departure from ISCST3 in that it is based on a theoretical understanding of the atmosphere rather than depend on empirical derived values. The dispersion environment is characterized by turbulence theory that defines convective (daytime) and stable (nocturnal) boundary layers instead of the stability categories in ISCST3. Dispersion coefficients derived from turbulence theories are not based on sampling data or a specific averaging period. AERMOD was especially designed to support the U.S. EPA's regulatory modeling programs (Porter at al., 2003)

Special features of AERMOD include its ability to treat the vertical in-homogeneity of the planetary boundary layer, special treatment of surface releases, irregularly-shaped area sources, a three plume model for the convective boundary layer, limitation of vertical mixing in the stable boundary layer, and fixing the reflecting surface at the stack base (Curran et al., 2006). A treatment of dispersion in the presence of intermediate and complex terrain is used that improves on that currently in use in ISCST3 and other models, yet without the complexity of the Complex Terrain Dispersion Model-Plus (CTDMPLUS) (Diosey et al., 2002). Additional utilities associated with the dispersion model allow computation of ground level concentrations of pollutants over defined statistical averaging periods, consideration of building wake/downwash effects in the vicinity of the assessed facility.

2.4 Odour and Air quality impact assessment criteria

The predicted air quality impact from the operation of the processes is compared to relevant odour and air quality objectives and limits. Air quality standards and guidelines referenced in this report include:

- SI 180 of 2011 Air Quality legislation,
- Irish EPA 2002 and Environment Agency 2002 Guideline limit of less than 1.50 Ou_E/m^3 at the 98^{th} percentile of hourly averages for high to medium risk odours.
- EPR H1 Environmental Risk Assessment Part 2 – Assessment of point source releases and cost benefit analysis, Environment Agency 2008.
- AG4, 2010. Air dispersion modelling from industrial installations guidance note (AG4), Irish EPA, 2010.

Air quality is judged relative to the relevant Air Quality Standards, which are concentrations of pollutants in the atmosphere, which achieve a certain standard of environmental quality. Air quality Standards are formulated on the basis of an assessment of the effects of the pollutant on public health and ecosystems.

In general terms, air quality standards have been framed in two categories, limit values and guideline values. Limit values are concentrations that cannot be exceeded and are based on WHO guidelines for the protection of human health. Guideline values have been established for long-term precautionary measures for the protection of human health and the environment. European legislation has also considered standards for the protection of vegetation and ecosystems.

Where ambient air quality criteria do not exist as in the case for some of the substances of interest, it is usual to use $1/100^{th}$ of the occupational exposure limit (OEL) for an eight-hour reference period to compare with the annual average predictions. The one-hour predictions are generally compared with a standard derived from $1/40^{th}$ of the Short Term Exposure Limit (STEL). Occupational exposure limits are published by the Occupational Safety and Heath Authority (i.e. EH 40).

The relevant air quality standards are presented in *Tables 2.1 and 2.2*.

2.5 Air Quality Guidelines for classical pollutants in Ireland and Europe

Table 2.1 illustrates the guideline and limit values for air quality pollutants in Ireland.

Table 2.1. EPA, EU and Irish Limit values laid out in the SI 180 of 2011.

POLLUTANT	Objective			
	Concentration[2]	**Maximum No. Of exceedences allowed[3]**	**Exceedence expressed as percentile[3]**	**Measured as**
Carbon monoxide (CO)	10 mg m^{-3}	None	100^{th} percentile	Running 8 hour mean
Nitrogen dioxide and oxides of nitrogen	200 µg m^{-3} NO_2 40 µg m^{-3} NO_2	18 times in a year --	99.79^{th} percentile --	1 hour mean Annual mean
Sulphur dioxide (SO_2)	350 µg m^{-3} 125 µg m^{-3} 20 µg m^{-3}	24 times in a year 3 times in a year --	99.73th percentile 99.18^{th} percentile --	1 hour mean 24 hour mean Annual mean and winter mean (1^{st} Oct to 31^{st} March
Particulates (PM_{10})	50 µg m^{-3} 40 µg m^{-3}	35 times in a year None	90.40^{th} percentile	24 hour mean Annual mean
Particulates ($PM_{2.5}$)	25 µg m^{-3} – Stage 1 20 µg m^{-3} – Stage 2	None None	-- --	Annual mean Annual mean

Table 2.2. Guideline and limit values for other pollutants as taken from EPR H1, Part 2, TaLuft 2002 and EH40 Notes 2005.

POLLUTANT	Objective			
	Concentration	**Maximum No. Of exceedences allowed**	**Exceedence expressed as percentile**	**Measured as**
Hydrogen chloride[1, 3]	100 µg m^{-3} 20 µg m^{-3}	175 times in a year --	98^{th} percentile --	1 hour mean Annual mean
Hydrogen fluoride[2, 3]	160 µg m^{-3} 3 µg m^{-3} 0.30 µg m^{-3}	0 times in a year 175 times in a year None	100^{th} percentile 98^{th} percentile --	1 hour mean 1 hour mean Annual mean
Total non-methane VOC (as benzene)[4]	< 5 µg m^{-3} as benzene	None	--	Annual mean
Odour[5]	<1.50 Ou_E/m^3	175 times in a year	98^{th} percentile	1 hour mean

Notes: [1, 2] denotes taken from EPR H1 Environmental Risk Assessment Part 2 – Assessment of point source releases and cost benefit analysis, Environment Agency 2008.
[3] denotes taken from TaLuft 2002.
[4] denotes taken from Directive 2000/69/EC.
[5] denotes taken from AG4, 2010. Air dispersion modelling from industrial installations guidance note (AG4), Irish EPA, 2010.

2.6 Existing Baseline classical air pollutant Air Quality

The EPA has been monitoring national Air quality from a number of sites around the country. This information is available from the EPA's website. The values presented for PM_{10}, SO_2, NO_2, and CO give an indication of expected urban / rural emissions of the compounds listed in *Table 2.1* excluding odour. *Table 2.3* illustrates the baseline data expected to be obtained from suburban area. Since Eras Eco Ltd is located in a suburban area it would be considered located in a Zone C/D area according to the EPA's classification of zones for air quality. Traffic and industrial related emissions would be medium and it would be expected that air quality in the region would be average to good.

In addition, baseline data for Hydrogen chloride and fluoride was gathered from a review of published monitoring work performed on other industrial facilities.

Table 2.3. Baseline air quality data used to assess air quality impact criterion in Zone C/D region in Ireland - 2014.

Reference air quality data-Source identity	Zone C (worst case baseline)	Zone D (worst case baseline)	Details
Particulate matter-PM_{10} Annual mean ($\mu g\ m^{-3}$)-	21	22	Measured 2014
Particulate matter-$PM_{2.5}$ Annual mean ($\mu g\ m^{-3}$)-	16	13	Measured 2014
Nitrogen dioxide-NO_2 Annual mean ($\mu g\ m^{-3}$)	16	13	Measured 2014
Sulphur dioxide-SO_2 Annual average ($\mu g\ m^{-3}$)	5	4	Measured 2014
Carbon monoxide-CO Annual mean ($\mu g\ m^{-3}$)	200	500	Measured 2014
Benzene	0.09	--	Measured 2014
Hydrogen chloride [1]	--	0.50 (Nobber, Co. Meath)	Measured 2009
Hydrogen fluoride[1]	--	0.030 (Nobber, Co. Meath)	Measured 2009

Notes: [1] denotes taken from Air quality impact assessment – College Proteins, Nobber, Co. Meath, Porter et al., 2010.

2.7 Meteorological data

Five years of hourly sequential meteorological data from Cork 2008 to 2012 inclusive was chosen for the modelling exercise. A schematic wind rose and tabular cumulative wind speed and directions of all years are presented in *Section 8*. All years of met data was screened to provide more statistical significant result output from the dispersion model. The worst case year Cork 2012 was used for data presentation. This is in keeping with national and international recommendations on quality assurance in operating dispersion models and will provide a worst case assessment of predicted ground level concentrations based on the input emission rate data. Surface roughness, Albedo and Bowen ratio were assessed and characterised around each met station for AERMET Pro processing.

2.8 Terrain data

Due to the fact that Eras Eco Ltd is located in complex terrain a terrain file was included in the dispersion modelling assessment. A 10 metre Cartesian grid spaced topographical data was obtained from Eras Eco Ltd and used to create a 10 metre Cartesian grid *.DEM file for use in Aermap software within AERMOD Prime.

2.9 Building wake effects

Building wake effects are accounted for in modelling scenarios (i.e. all existing and proposed building features located within the facility) as this can have a significant effect on the compound plume dispersion at short distances and can significantly increase GLC's in close proximity to the facility.

3. Results-Emission testing.

The historical measurement data, results and review or existing and proposed IPC licence limits for the existing and proposed emission source exhaust stacks for the site are presented in *Tables 3.1 to 3.5.*

3.1 Pollutant emission characteristics for emission points AEP1 to AEP4

Table 3.1 summarises the volume flow rate, pollutant concentration and mass emission rate of pollutant from the emission point. This data was utilised in conjunction with source characteristics contained in *Table 3.5* for the dispersion modelling exercise to assess the radius of impact of the facility.

Table 3.1. Volume flow rates, flue gas concentrations and mass emission rates of pollutants for emission point AEP1 - Boiler.

Source identity – AEP1 - boiler	Units	Value	Mass emission rate (g/s)
Carbon monoxide	mg/Nm^3	<1,000	3.22
Oxides of nitrogen	mg/Nm^3	<250	0.806
Sulphur dioxide	mg/Nm^3	<100	0.322
Total particulates	mg/Nm^3	<20	0.064
Odour	Ou_E/m^3	<1,000	3,576 Ou_E/s
Hydrogen sulphide	mg/Nm^3	<5.0	0.016
Volume flow rate	Nm^3/hr	11,600	--
Temperature	Kelvin	449	--

Notes: [1] denotes that EPA requested that SO_2 be assessed on this emission point in accordance with Medium Combustion Directive. Medium Combustion Directive stated that SO_2 limits do not apply for combustion source using biomass. AEP1 burns biomass.

Table 3.2. Volume flow rates, flue gas concentrations and mass emission rates of pollutants for emission point AEP2 – Biofilter.

Source identity – AEP2 – biofilter	Units	Value	Mass emission rate (g/s)
Odour	Ou_E/m^3	<1,500	833Ou_E/s
Hydrogen sulphide	mg/Nm^3	<5.0	0.0027
Volume flow rate	Nm^3/hr	2,000	--
Temperature	Kelvin	303	--

Table 3.4. Volume flow rates, flue gas concentrations and mass emission rates of pollutants for emission point AEP3 – Materials Recovery Building Odour control unit.

Source identity – AEP3 – MRB OCU	**Units**	**Value**	**Mass emission rate (g/s)**
Odour	Ou_E/m^3	<1,000	8,300Ou_E/s
Volume flow rate	Nm^3/hr	29,980	--
Temperature	Kelvin	303	--

Table 3.5. Volume flow rates, flue gas concentrations and mass emission rates of pollutants for emission point AEP4 – AD CHP plant.

Source identity – AEP4 – AD CHP Plant	**Units**	**Value**	**Mass emission rate (g/s)**
Carbon monoxide	mg/Nm^3	<1,400	2.411
Oxides of nitrogen	mg/Nm^3	<500	0.861
Sulphur dioxide	mg/Nm^3	<500	0.861
Total particulates	mg/Nm^3	<140	0.241
Hydrogen chloride	mg/Nm^3	<50	0.086
Hydrogen fluoride	mg/Nm^3	<5.0	0.0086
Total Organic Carbon (Methane)	mgC/Nm^3	<1,000	1.722
Total non methane VOC's	mg/Nm^3	<75	0.124
Hydrogen sulphide	mg/Nm^3	<5.0	0.00861
Volume flow rate	Nm^3/hr	6,200	--
Temperature	Kelvin	723	--

3.2. Dispersion model input data – Source characteristics

Table 3.5 illustrates the source characteristics utilised within the dispersion model. Grid reference location, stack height (A.G.L), maximum volume flow and temperature of the emission point are presented within this table for reference purposes.

Table. 3.5 Stack source characteristics for Eras Eco Ltd emission points AEP1 to AEP4.

Source identity – AEP1 to AEP4	AEP1	AEP2	AEP3	AEP4
X grid coordinate (m)	209695	209708.9	209612.2	209631.3
Y grid coordinate (m)	79800	79818.6	79761.9	79756.5
Stack height (m)	16.50	15	15	19
Temperature (Kelvin)	449	303	303	723
Stack tip diameter (m)	0.80	0.22	0.80	0.65
Efflux velocity (m/s)	10.52	16.20	16.51	18.80
Volumetric airflow rate (Nm^3/hr)	11,600	2,000	29,980	6,200
Actual volumetric airflow rate (Am^3/hr)	19,078	2,219	33,725	22,500
Elevation (m)	2.0	2.0	2.0	2.0

3.3 Emission rate calculations and mass emission rates

The contaminant concentration from a stack is best quantified by a mass emission rate. For a chimney or ventilation stack, this is equal to the compound concentration (mg m^{-3}) of the discharge air multiplied by its flow-rate (m^3 s^{-1}). It is equal to the volume of air contaminated every second to the concentration limit (mg s^{-1}). The mass emission rate (g s^{-1}) is used in conjunction with dispersion modelling in order to estimate the approximate radius of impact. All data used in the dispersion modelling exercise was obtained through in stack measurement. *Tables 3.1 to 3.4* illustrates the volume flow values and stack concentration values used to calculate mass emission rates for *each Scenario* from the exhaust stack of the emission points. All data is based on historical measured emissions.

This data was used in conjunction with the source characteristics stated in *Table 3.5* to estimate the radius of impact for the particular pollutant.

3.4 Dispersion modelling assessment

AERMOD Prime (16181r) was used to determine the overall ground level impact of emission points – AEP1 to AEP4 located in Eras Eco Ltd. These computations give the relevant GLC's at each 50-meter X Y Cartesian grid receptor location that is predicted to be exceeded for the specific air quality impact criteria. A total Cartesian + individual receptors of 961 points was established giving a total grid coverage area of 2.25 square kilometres around the emission point.

Five years of hourly sequential meteorological data from Cork Airport (Cork Airport 2008 to 2012 inclusive) and source characteristics (including emission date contained in *Tables 3.1 to 3.4*) were inputted into the dispersion model for all parameters.

In order to obtain the predicted environmental concentration (PEC), background data was added to the process emissions. In relation to the annual averages, the ambient background concentration was added directly to the process concentration. However, in relation to the short-term peak concentrations, concentrations due to emissions from elevated sources cannot be combined in the same way. Guidance from the UK Environment Agency advises that an estimate of the maximum combined pollutant concentration can be obtained by adding the maximum short-term concentration due to emissions from the source to twice the annual mean background concentration.

3.5 Dispersion model Scenarios

AERMOD Prime (USEPA ver. 16181r) was used to determine the overall odour and air quality impact of the facility operations.

Fifteen distinct scenarios were assessed within the dispersion model. The output data was analysed to calculate the following:

Ref Scenario 1: Predicted Carbon monoxide emission contribution of exhaust stacks located in Eras Eco Ltd to 8 hr average Carbon monoxide plume dispersal at the 100^{th} percentile for an Carbon monoxide concentration of less than or equal to 500 µg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.2*).

Ref Scenario 2: Predicted Oxides of nitrogen emission contribution of exhaust stacks located in Eras Eco Ltd to 1 hr average Oxides of nitrogen plume dispersal at the 99.79^{th} percentile for an Oxides of nitrogen concentration of less than or equal to 35 µg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.3*).

Ref Scenario 3: Predicted Oxides of nitrogen emission contribution of exhaust stacks located in Eras Eco Ltd to Oxides of nitrogen plume dispersal at the Annual average for an Oxides of nitrogen concentration of less than or equal to 18 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.4*).

Ref Scenario 4: Predicted Sulphur dioxide emission contribution of exhaust stacks located in Eras Eco Ltd to Sulphur dioxide plume dispersal at the 99.73th percentile of an 1 hour average for an Sulphur dioxide concentration of less than or equal to 80 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.5*).

Ref Scenario 5: Predicted Sulphur dioxide emission contribution of exhaust stacks located in Eras Eco Ltd to Sulphur dioxide plume dispersal at the 99.18th percentile of an 24 hour average for an Sulphur dioxide concentration of less than or equal to 40 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.6*).

Ref Scenario 6: Predicted Sulphur dioxide emission contribution of exhaust stacks located in Eras Eco Ltd to Sulphur dioxide plume dispersal for the Annual average for an Sulphur dioxide concentration of less than or equal to 12 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.7*).

Ref Scenario 7: Predicted Total particulates emission contribution of exhaust stacks located in Eras Eco Ltd to Total particulates as PM10 plume dispersal at the 90.40th percentile of an 24 hour average for an Total particulates concentration of less than or equal to 8.0 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.8*).

Ref Scenario 8: Predicted Total particulates emission contribution of exhaust stacks located in Eras Eco Ltd to Total particulates as PM10 plume dispersal at the Annual average for a Total particulates concentration of less than or equal to 4 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.9*).

Ref Scenario 9: Predicted Total particulates emission contribution of exhaust stacks located in Eras Eco Ltd to Total particulates as PM2.5 plume dispersal at the Annual average for a Total particulates concentration of less than or equal to 4 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.10*).

Ref Scenario 10: Predicted Hydrogen chloride emission contribution of exhaust stacks located in Eras Eco Ltd to 1 hr average Hydrogen chloride plume dispersal at the 98th percentile for an Hydrogen chloride concentration of less than or equal to 5 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.11*).

Ref Scenario 11: Predicted Hydrogen chloride emission contribution of exhaust stacks located in Eras Eco Ltd to Hydrogen chloride plume dispersal at the Annual average for a Hydrogen chloride concentration of less than or equal to 1.0 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.12*).

Ref Scenario 12: Predicted Hydrogen fluoride emission contribution of exhaust stacks located in Eras Eco Ltd to 1 hr average Hydrogen fluoride plume dispersal at the 98th percentile for an Hydrogen fluoride concentration of less than or equal to 0.60 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.13*).

Ref Scenario 13: Predicted Hydrogen fluoride emission contribution of exhaust stacks located in Eras Eco Ltd to Hydrogen fluoride plume dispersal at the Annual average for a Hydrogen fluoride concentration of less than or equal to 0.10 μg/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.14*).

Ref Scenario 14: Predicted TNMVOC (as benzene) emission contribution of exhaust stacks located in Eras Eco Ltd to TNMVOC (as benzene) plume dispersal at the Annual average for a TNMVOC (as benzene) concentration of less than or equal to 2.0 $\mu g/m^3$ for worst case meteorological year Cork 2012 (*see Figure 7.15*).

Ref Scenario 15: Predicted Odour emission contribution of exhaust stacks located in Eras Eco Ltd to 1 hr average Odour plume dispersal at the 98th percentile for an Odour concentration of less than or equal to 0.70, 1.0 and 1.50 Ou_E/m^3 for worst case meteorological year Cork 2012 (*see Figure 7.16*).

These computations give the odour and air quality concentration at each 50-meter x y Cartesian grid receptor location that is predicted to be exceeded for the expressed percentile for five years of screened hourly sequential meteorological data for Cork (worst case year Cork 2012) to allow for comparison with the ground level concentration limits contained in *Tables 2.1 and 2.2*.

This will allow for the predictive analysis of any potential impact on the neighbouring sensitive locations while the facility is in operation.

4. Results of Dispersion modelling exercise

This section will present the results of the dispersion modelling.

AERMOD GIS Pro Prime (Ver. 16181r) was used to determine the overall classical air pollutant odour and air quality impact of Eras Eco Ltd emission points (AEP1 to AEP4).

Various averaging intervals were chosen to allow direct comparison of predicted GLC's with the relevant the relevant air quality assessment criteria as outline in *Section 2.8*. In particular, 1-hour, 24 hour and annual average GLC's of the specified pollutants were calculated at 50 metres distances from the site over a fine and coarse grid extent of 2.25 kilometres squared. Relevant percentiles of these GLC's were also computed for comparison with the relevant pollutant Air Quality Standards to include those outlined in *Tables 2.1 and 2.2.*

In modelling air dispersion of NOx from combustion sources, the source term should be expressed as NO_2, e.g., NOx mass (expressed as NO_2). Some of the exhaust air is made up of NO while some is made up of NO_2. NO will be converted in the atmosphere to NO_2 but this will depend on a number of factors to include Ozone and VOC concentrations. In order to take account of this conversion the following screening can be performed.

Use the following phased approach for assessment:

Worse case scenario

35% for short-term and 70% for long-term average concentration should be considered. If PEC (process contribution + "relevant background concentration") exceeds the relevant air quality objective.

Table 4.1 illustrates the tabular results obtained from the assessment for Cork meteorological station 2012 for:

- Worst case scenario (for NO_X only).

Maximum predicted GLC's are presented within this table to allow for comparison with limit values.

Table 4.1 illustrates the tabular results obtained from the assessment. Maximum predicted GLC's are presented within this table to allow for comparison with limit values contained in *Tables 2.1 and 2.2*.

Table 4.1. Tabular illustration of predicted GLC's in the vicinity of Eras Eco Ltd in accordance with odour and air quality limit and guideline values contained in *Tables 2.1 and 2.2*.

Identity	Compound identity	Maximum predicted conc. - ($\mu g\ m^{-3}$)	Percentile value (%)
Scenario 1 -Maximum 8 hour concentration	CO	530	100th
Scenario 2 - Maximum 1 hour concentration	NO_X	51	99.79th
Scenario 3 - Maximum Annual average concentration	NO_X	17.50	Annual average
Scenario 4 - Maximum 1 hour concentration	SO_2	102	99.73th
Scenario 5 - Maximum 24 hr concentration	SO_2	66	99.18th
Scenario 6 - Maximum Annual average concentration	SO_2	15	Annual average
Scenario 7 - Maximum 24 hr concentration	PM_{10}	14	90.40th
Scenario 8 - Maximum Annual average concentration	PM_{10}	5	Annual average
Scenario 9 - Maximum Annual average concentration	$PM_{2.5}$	5	Annual average
Scenario 10 - Maximum 1 hr concentration	HCL	8.90	98th
Scenario 11 - Maximum Annual average concentration	HCL	1.67	Annual average
Scenario 12 - Maximum 1 hour concentration	HF	0.89	98th
Scenario 13 - Maximum annual average concentration	HF	0.167	Annual average
Scenario 14 - Maximum Annual average concentration	TNMVOC as benzene	2.4	Annual average
Scenario 15 - Maximum 1 hr concentration (at nearest sensitive receptor)	Odour	0.74	98th
Scenario 16 – Maximum Annual average concentration	H_2S	0.60	Annual average

4.1 Assessment of existing air quality impacts

Table 4.2 presents the comparison between model predictions for odour and air quality impacts, baseline air quality concentrations for the compounds and the percentage impact of the air quality criterion. As can be observed all predicted GLC's are within the odour and air quality impact criterions for all assessed compounds.

Table 4.2. Comparison between predicted GLC's + baseline national air quality data and limit values contained in Tables 2.1 and 2.2.

Identity	Compound	Maximum predicted GLC –Scenario 1 (µg m^{-3})	Baseline conc. value (µg m^{-3})[1,3]	Baseline + Maximum predicted GLC (µg m^{-3})	Impact criterion (µg m^{-3})[2]	% of Criterion
Scenario 1 -Maximum 8 hour concentration	CO	530	500	1,030.00	10,000	11.19
Scenario 2 - Maximum 1 hour concentration	NO_X	51	32	83.00	200	46.00
Scenario 3 - Maximum Annual average concentration	NO_X	17.50	16	33.50	40	90.00
Scenario 4 - Maximum 1 hour concentration	SO_2	102	10	112.00	350	26.57
Scenario 5 - Maximum 24 hr concentration	SO_2	66	5	71.00	125	44.80
Scenario 6 - Maximum Annual average concentration	SO_2	15	14	19.00	20	95.00
Scenario 7 - Maximum 24 hr concentration	PM_{10}	14	22	36.00	50	64.00
Scenario 8 - Maximum Annual average concentration	PM_{10}	5	22	27.00	40	67.50
Scenario 9 - Maximum Annual average concentration	$PM_{2.5}$	5	16	21.00	40	52.50
Scenario 10 - Maximum 1 hr concentration	HCL	8.90	1.0	9.90	100	8.20
Scenario 11 - Maximum Annual average concentration	HCL	1.67	0.50	2.17	20	10.85
Scenario 12 - Maximum 1 hour concentration	HF	0.89	0.060	0.95	3.0	26.00
Scenario 13 - Maximum annual average concentration	HF	0.167	0.030	0.20	0.30	65.67
Scenario 14 - Maximum Annual average concentration	TNMVOC as benzene	2.40	0.090	2.49	5.0	49.80
Scenario 15 - Maximum 1 hr concentration (at nearest sensitive receptor)	Odour	0.74	--	0.74	1.50	46.67
Scenario 14 - Maximum Annual average concentration	H_2S	0.60	--	0.60	--	--

<u>**Notes**</u>: [1] denotes based on data presented in *Table 2.1*
[2] denotes for impact criterion *see Table 2.1 and 2.2*
[3] denotes that the short-term concentration was added to twice the annual average as recommended by the Environment Agency.

5. Discussion of results

This section will discuss the results obtained throughout the study.

5.1 Carbon monoxide (CO) air quality impact – Scenario 1

The results for the potential air quality impact for dispersion modelling of CO based on the emission rates in *Tables 3.1 to 3.4* is presented in *Tables 4.1, 4.2* and *Figure 7.2*. As can be observed in *Table 4.2,* the maximum GLC + Baseline for CO from the operation of the facility is 1,030 $\mu g/m^3$ for the maximum 8-hour averaging period. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 2000/69/EC and 2008/50/EC, this is up to 89% lower than the set limits (*see Table 4.2*).

5.2 Oxides of nitrogen (NO_2) air quality impact – Scenario 2 and 3.

The results for the potential air quality impact for dispersion modelling of NO_X as NO_2 based on the emission rates in *Tables 3.1 to 3.4* is presented in *Tables 4.1, 4.2 and Figures 7.3 to 7.4.* As can be observed in *Table 4.2,* the maximum GLC+Baseline for NO_2 as NO_X for the 99.79th percentile for a 1-hour averaging period was 83 $\mu g/m^3$. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is up to 58% lower than the set limits.

An annual average was also generated for Scenario 3. When compared to the impact criteria, the annual average NO_2 air quality impact for Scenario 3 is up to 17% lower than the limit (*see Table 4.2*).

5.3 Sulphur dioxide (SO_2) air quality impact – Scenario 4, 5 and 6

The results for the potential air quality impact for dispersion modelling of SO_2 based on the emission rates in *Tables 3.1 to 3.4* is presented in *Tables 4.1, 4.2* and *Figures 7.5 to 7.7*. As can be observed in *Table 4.2,* the maximum GLC+Baseline for SO_2 from the operation of the facility is 112 and 71 $\mu g/m^3$ for the maximum 1-hour averaging period at the 99.73th percentile and 24-hour averaging period at the 99.18th percentile, respectively. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is from 68 and 45% lower than the set limits established for the 1 hour and 24 hour assessment criteria.

An annual average was also generated for Scenario 6 to allow comparison with the SI 180 of 2011 and 2008/50/EC. When compared the annual average SO_2 air quality impact criterion is 5% lower than the impact criterion. Please note that the biomass boiler was prescribed an SO_2 emission rate as requested by the EPA. The Medium combustion directive prescribes that biomass based systems do not have an SO_2 ELV.

5.4 Total Particulates (PM) as PM_{10} air quality impact – Scenarios 7, 8 and 9

The results for the potential air quality impact for dispersion modelling of PM as $PM_{10/2.5}$ based on the emission rates in *Tables 3.1 to 3.4* is presented in *Tables 4.1, 4.2 and Figures 7.8, 7.9 and 7.10*. As can be observed in *Table 4.2,* the maximum GLC+Baseline for PM as PM_{10} for Scenario 7 from the operation of the facility is 14 $\mu g/m^3$ for the 90.4th percentile for a 24-hour averaging period. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is from 28% lower than the set limits.

An annual average was also generated for Scenario 8 and 9 to allow comparison with the SI 180 of 2011 and 2008/50/EC for PM_{10} and $PM_{2.5}$. When compared the annual average PM_{10} and $PM_{2.5}$ air quality impact criterion is 32 and 47% lower than the impact criterion.

5.5 Hydrogen chloride air quality impact – Scenarios 10 and 11

The results for the potential air quality impact for dispersion modelling of HCL based on the emission rates in *Tables 3.1 to 3.4* is presented in *Tables 4.1, 4.2 and Figures 7.11 to 7.12.* As can be observed in *Table 4.2,* the maximum GLC+Baseline for HCL for the 98th percentile for a 1-hour averaging period was 8.9 µg/m^3. When combined predicted and baseline conditions are compared to the TaLuft S Limit values laid out in TaLuft 2002, this is up to 90% lower than the set limits.

An annual average was also generated for Scenario 11. When compared to the impact criteria contained in H1 guidance document, the annual average HCL air quality impact for Scenario 11 is up to 89% lower than the limit (*see Table 4.2*).

5.6 Hydrogen fluoride air quality impact – Scenarios 12 and 13

The results for the potential air quality impact for dispersion modelling of HF based on the emission rates in *Tables 3.1 to 3.4* is presented in *Tables 4.1, 4.2 and Figures 7.13 to 7.14.* As can be observed in *Table 4.2,* the maximum GLC+Baseline for HF for the 98th percentile for a 1-hour averaging period was 0.89 µg/m^3. When combined predicted and baseline conditions are compared to the TaLuft S Limit values laid out in TaLuft 2002, this is up to 68% lower than the set limits.

An annual average was also generated for Scenario 13. When compared to the impact criteria contained in TaLuft 2002, the annual average HF air quality impact for Scenario 13 is up to 34% lower than the limit (*see Table 4.2*).

5.7 Total non methane Volatile organic compounds (as benzene) air quality impact – Scenario 14

The results for the potential air quality impact for dispersion modelling of TNMVOC as benzene based on the emission rates in *Tables 3.1 to 3.4* is presented in *Tables 4.1, 4.2 and Figure 7.15.* As can be observed in *Table 4.2,* the maximum GLC+Baseline for TNMVOC as benzene for the annual averaging period was 2.49 µg/m^3. When combined predicted and baseline conditions are compared to the proposed Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 2008/50/EC, this is up to 50% lower than the proposed set limits.

5.8 Odour air quality impact air quality impact – Scenario 15

The plotted odour concentrations of ≤0.70, 1.0 and 1.50 Ou_E/m^3 for the 98th percentile for the facility is illustrates in *Tables 4.1, 4.2* and *Figure 7.16*. As can be observed, the odour plume spread from the facility is small and remains close to the facility. In addition the predicted ground level concentration at worst case residential / industrial receptors is approximately 65% lower (0.74 Ou_E/m^3) than the odour impact criterion presented in *Table 2.2*.

Therefore it is predicted that the proposed facility design will not lead to odour impact in the vicinity of the facility with worst case residential/industrial receptors perceiving an odour concentration less than 1.50 Ou_E/m^3 at the 98th percentile of hourly averages for worst case meteorological year Cork 2012.

6. Conclusions

The following conclusions were drawn from the dispersion modelling assessment: Greater detail can be found within the document and it is recommended that the document be read in full.

1. Process emission estimation and dispersion modeling was performed on emissions from the existing and proposed processes to be located in Eras Eco Ltd, Foxhole, Youghal, Co. Cork.
2. Dispersion modeling was performed in accordance with best international practice and AG4 guidance document on dispersion modelling with a minimum of five years of hourly sequential meteorological data from Cork 2008 to 2012 inclusive was used in the dispersion modeling assessment. AERMOD Prime 16181r was utilised for the dispersion modelling assessment.
3. With regard to Carbon monoxide, the maximum GLC + Baseline for CO from the operation of the facility is 1,030 $\mu g/m^3$ for the maximum 8-hour averaging period. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 2000/69/EC and 2008/50/EC, this is up to 89% lower than the set limits.
4. With regard to Oxides of nitrogen, the maximum GLC+Baseline for NO_2 as NO_X for the 99.79th percentile for a 1-hour averaging period was 83 $\mu g/m^3$. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is up to 58% lower than the set limits. An annual average was also generated for Scenario 3. When compared to the impact criteria, the annual average NO_2 air quality impact for Scenario 3 is up to 16% lower than the limit.
5. With regard to Sulphur dioxide, the maximum GLC+Baseline for SO_2 from the operation of the facility is 112 and 71 $\mu g/m^3$ for the maximum 1-hour averaging period at the 99.73th percentile and 24-hour averaging period at the 99.18th percentile, respectively. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is from 68 and 43% lower than the set limits established for the 1 hour and 24 hour assessment criteria. An annual average was also generated for Scenario 6 to allow comparison with the SI 180 of 2011 and 2008/50/EC. When compared the annual average SO_2 air quality impact criterion is 5% lower than the impact criterion. Please note that the biomass boiler was prescribed an SO_2 emission rate as requested by the EPA. The Medium combustion directive prescribes that biomass based systems do not have an SO_2 ELV.
6. With regard to Total Particulates as PM_{10}, the maximum GLC+Baseline for PM as PM_{10} for Scenario 7 from the operation of the facility is 14 $\mu g/m^3$ for the 90.4th percentile for a 24-hour averaging period. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 99/30/EC and 2008/50/EC, this is from 28% lower than the set limits. An annual average was also generated for Scenario 8 and 9 to allow comparison with the SI 180 of 2011 and 2008/50/EC for PM_{10} and $PM_{2.5}$. When compared the annual average PM_{10} and $PM_{2.5}$ air quality impact criterion is 32 and 47% lower than the impact criterion.
7. With regard to Hydrogen chloride, the maximum GLC+Baseline for HCL for the 98th percentile for a 1-hour averaging period was 8.90 $\mu g/m^3$. When combined predicted and baseline conditions are compared to the TaLuft S Limit values laid out in TaLuft 2002, this is up to 90% lower than the set limits. An annual average was also generated for Scenario 10. When compared to the impact criteria contained in H1 guidance document, the annual average HCL air quality impact for Scenario 10 is up to 89% lower than the limit.
8. With regard to Hydrogen fluoride, the maximum GLC+Baseline for HF for the 98th percentile for a 1-hour averaging period was 0.89 $\mu g/m^3$. When combined predicted and baseline conditions are compared to the TaLuft S Limit values laid out in TaLuft 2002, this is up to 68% lower than the set limits. An annual average was also generated for Scenario 12. When compared to the impact criteria contained in TaLuft 2002, the annual average HF air quality impact for Scenario 12 is up to 34% lower than the limit.

9. With regard to TNMVOC as benzene, the maximum GLC+Baseline for TNMVOC as benzene for the annual averaging period was 2.49 $\mu g/m^3$. When combined predicted and baseline conditions are compared to the proposed Irish guideline/limit values and EU Limit values laid out in the EU Daughter directive on Air Quality 2008/50/EC, this is up to 50% lower than the proposed set limits.
10. With regard to Odour, the odour plume spread from the facility is small and remains close to the facility. In addition the predicted ground level concentration at worst case residential / industrial receptors is approximately 65% lower (0.74 Ou_E/m^3) than the odour impact criterion. Therefore it is predicted that the proposed facility design will not lead to odour impact in the vicinity of the facility with worst case residential/ industrial receptors perceiving an odour concentration less than 1.50 Ou_E/m^3 at the 98th percentile of hourly averages for worst case meteorological year Cork 2012.
11. Based on the predicted emissions and emission limit value guarantees, the proposed operation of the Eras Eco Ltd facility located in foxhole, Youghal, Co. cork will not breach stated air quality regulations when in operation.

7. *Appendix I* - Contour plots for dispersion modelling assessment (Process contributions only)

Odour, Carbon monoxide, Oxides of nitrogen, Sulphur dioxide and Total particulates percentile and annual average contour plots are illustrated in this section. Contour plots are only supplied in this section for illustrative purposes only.

7.1. Site layout and location

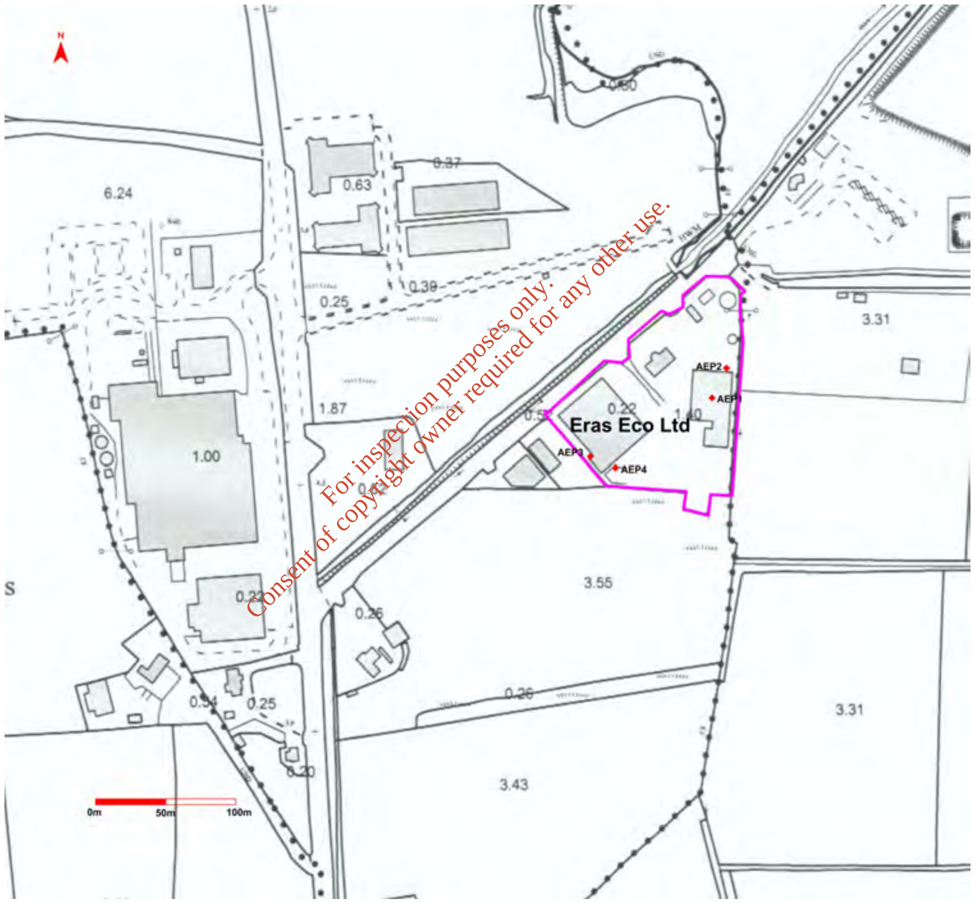

Figure 7.1. Aerial facility layout map showing Eras Eco Ltd location and boundary (▬) and relative locations of emission points AEP1 to AEP4.

7.2. Dispersion modelling contour plots for Scenario 1

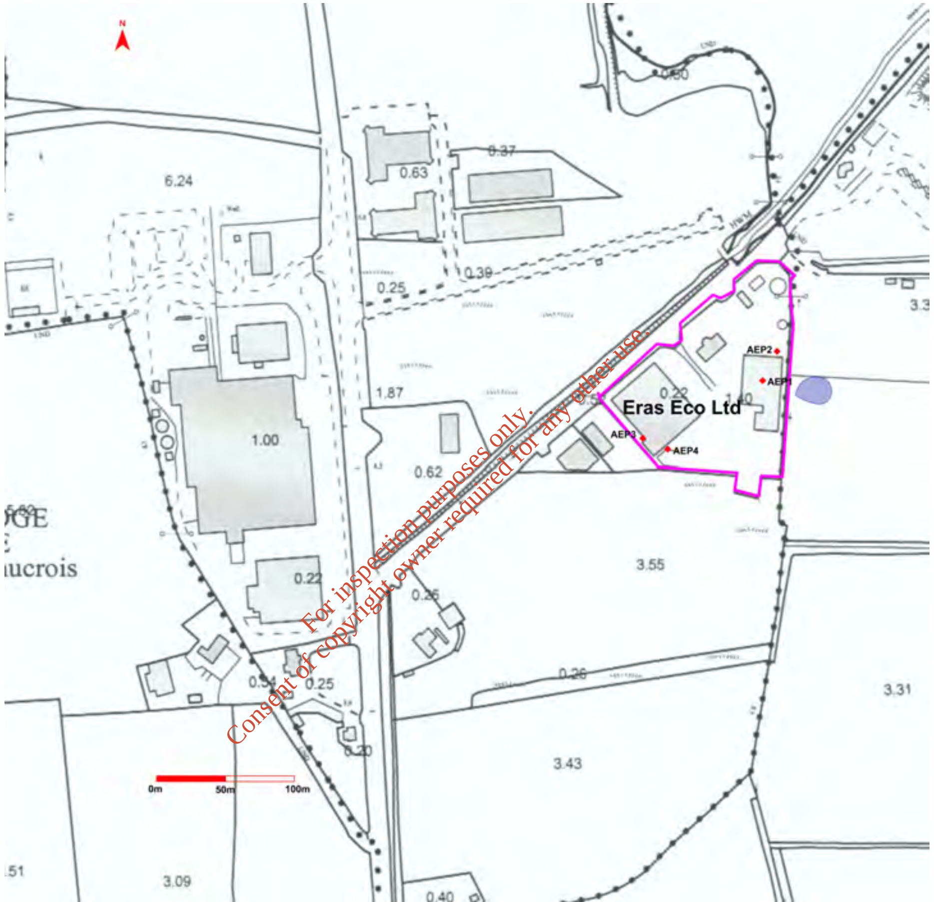

Figure 7.2. Predicted Carbon monoxide plume spread for Scenario 1 at the 100th percentile of 8 hourly averages for Carbon monoxide concentrations of ≤ 500 µg/m^3 (▬▬).

7.3. Dispersion modelling contour plots for Scenario 2

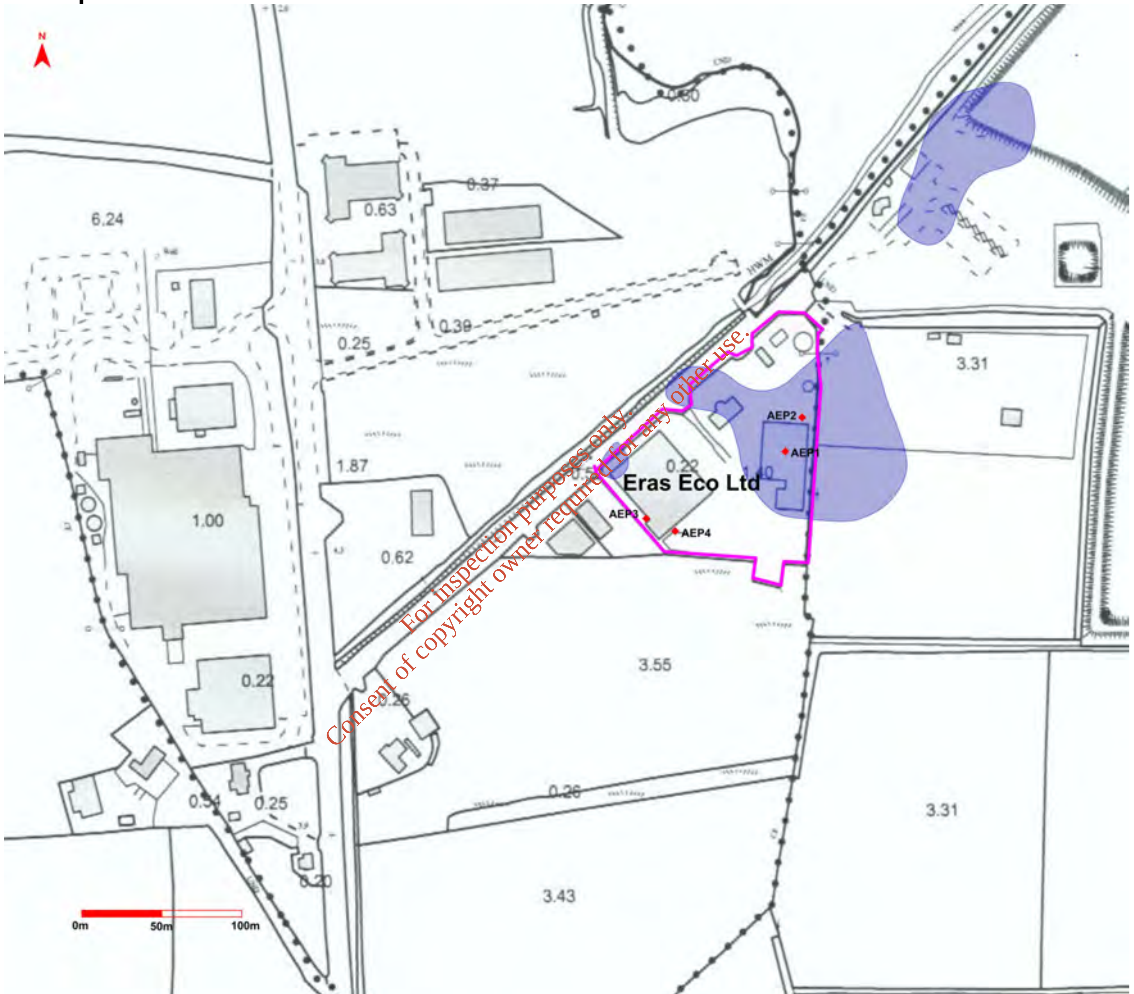

Figure 7.3. Predicted Oxides of nitrogen plume spread for Scenario 2 at the 99.79th percentile of hourly averages for Oxides of nitrogen concentrations of ≤ 35 µg/m³ ( ).

7.4. Dispersion modelling contour plots for Scenario 3

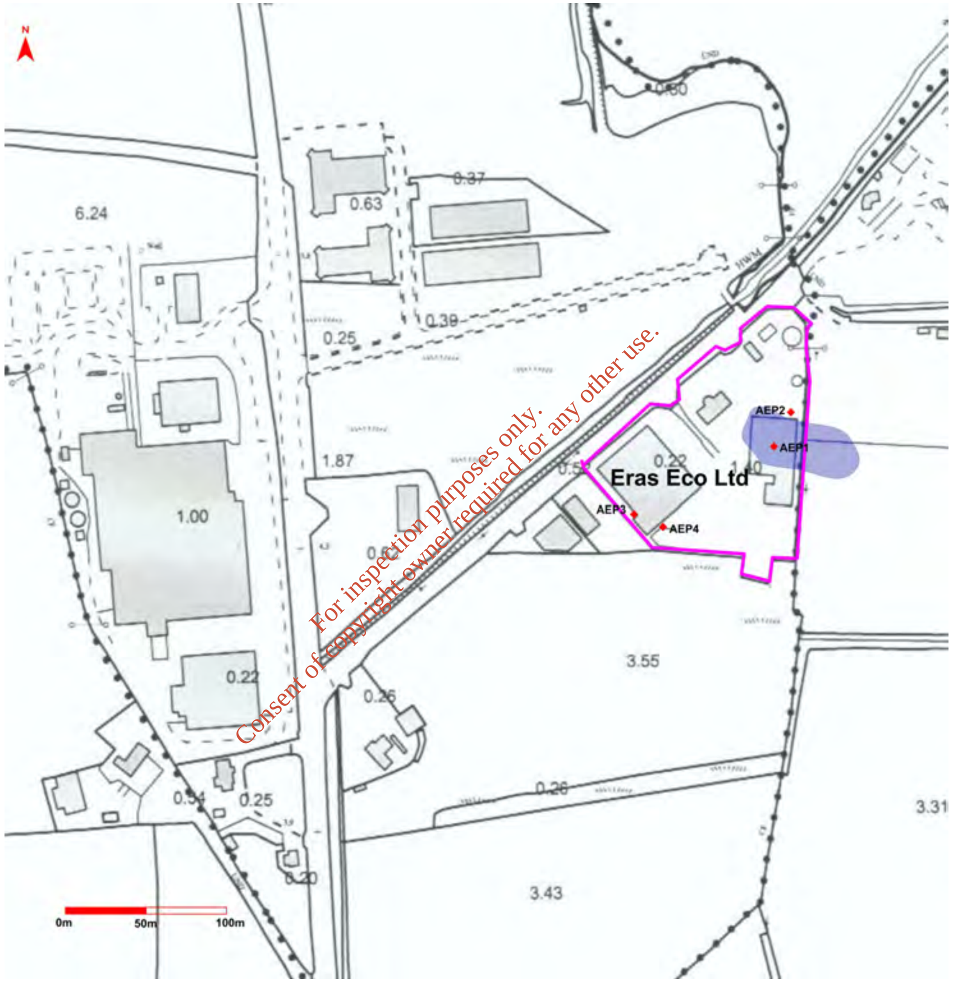

Figure 7.4. Predicted Oxides of nitrogen plume spread for Scenario 3 for the annual average for Oxides of nitrogen concentration of ≤ 15.4 µg/m³ (▬).

7.5. Dispersion modelling contour plots for Scenario 4

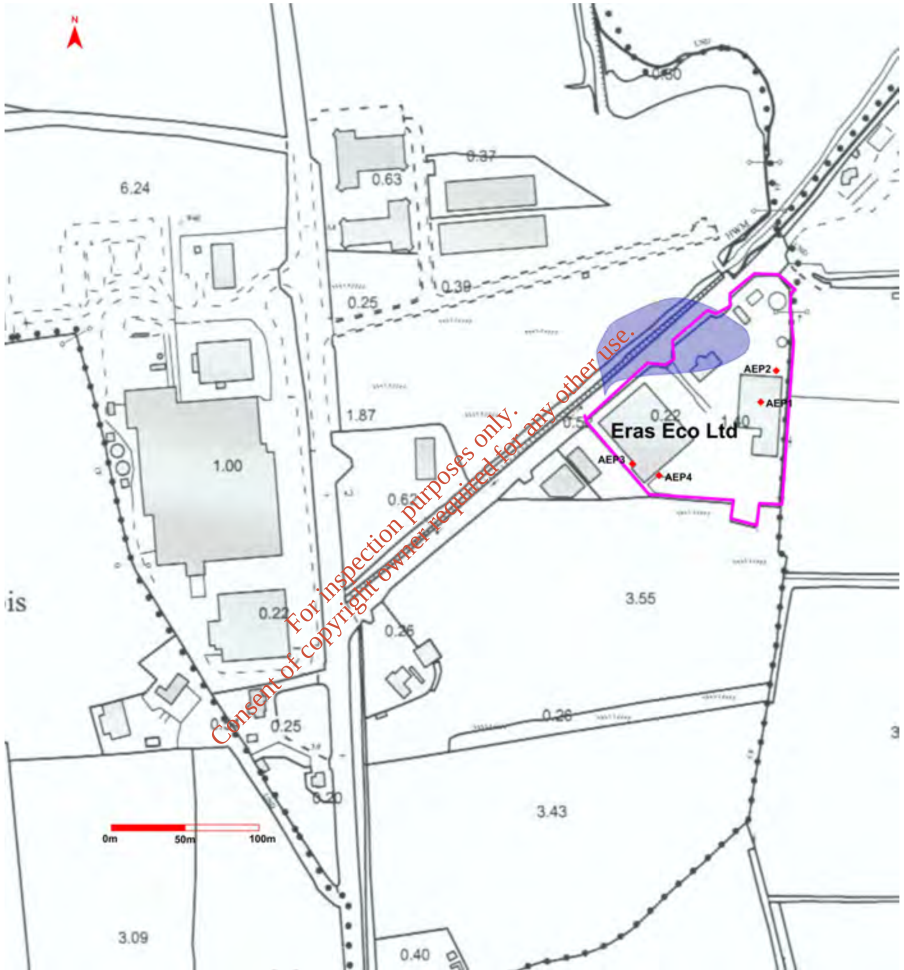

Figure 7.5. Predicted SO_2 ground level concentration of ≤80 µg/m^3 ( ) at the 99.73th percentile of 1-hour averaging period for Scenario 4.

7.6. Dispersion modelling contour plots for Scenario 5

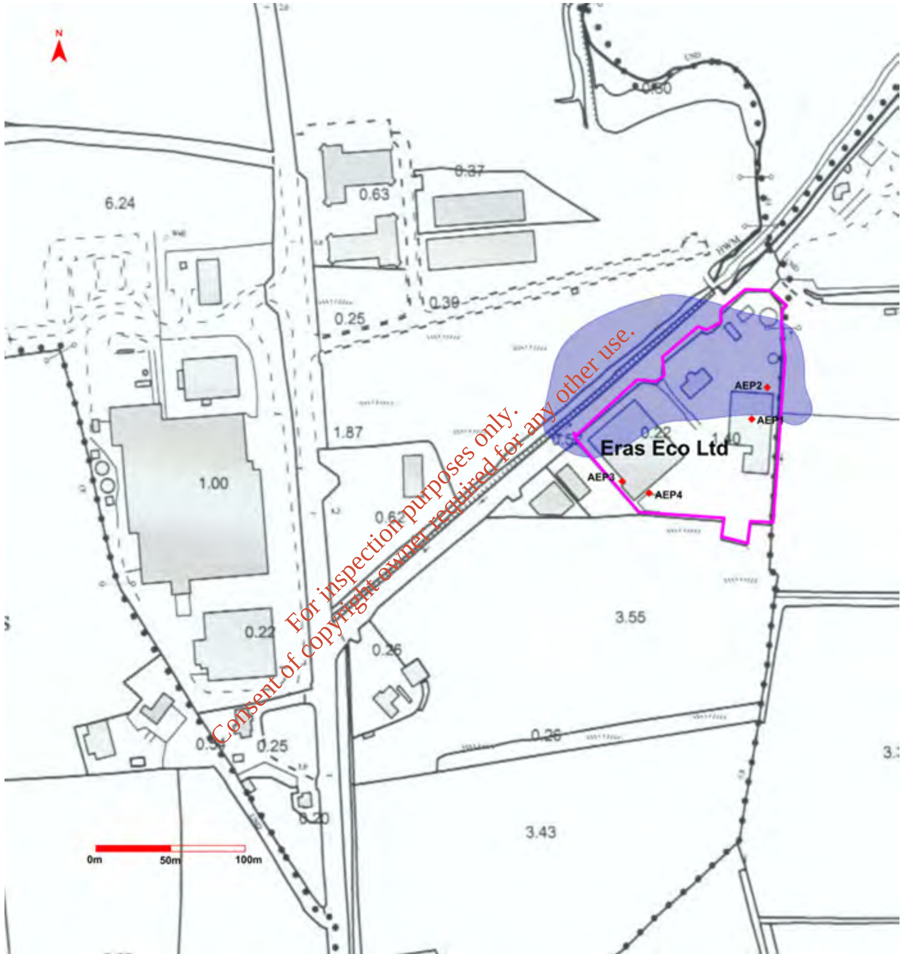

Figure 7.6. Predicted SO_2 ground level concentration of ≤40 µg m^{-3} (▬) at the 99.18th percentile of 24-hour averaging period for Scenario 5.

7.7. Dispersion modelling contour plots for Scenario 6

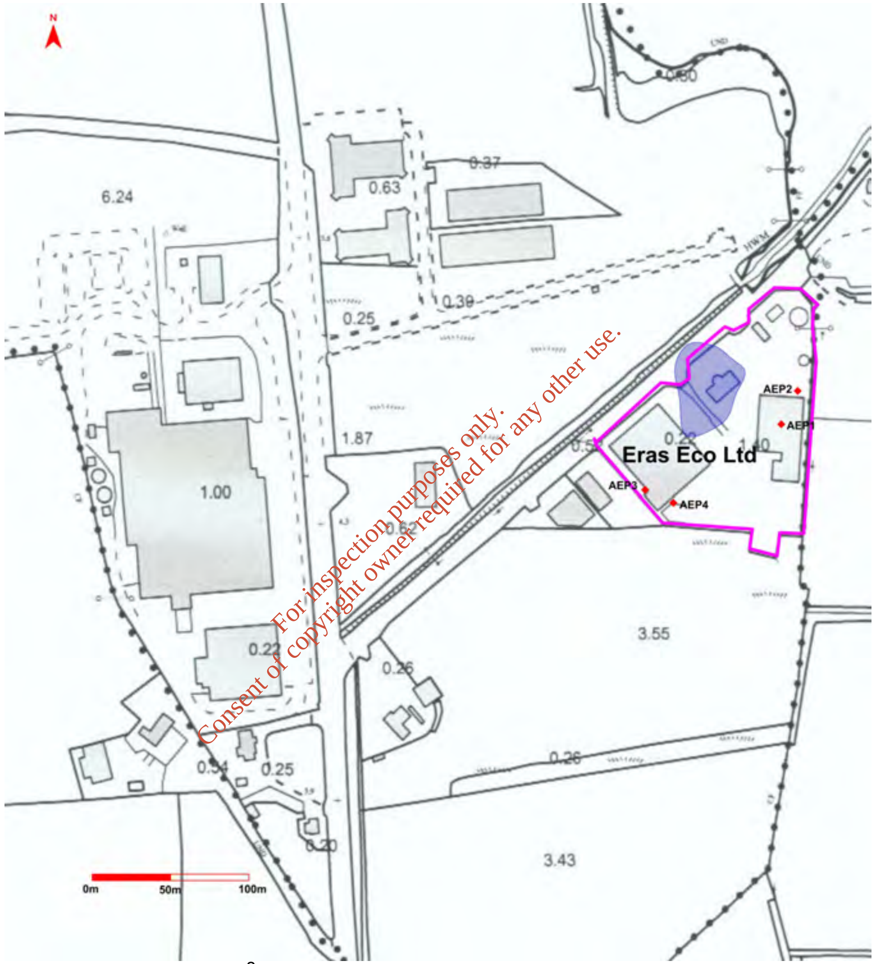

Figure 7.7. Predicted SO_2 ground level concentration of ≤12 µg/m^3 (▬) for the annual averaging period for Scenario 6.

7.8. Dispersion modelling contour plots for Scenario 7

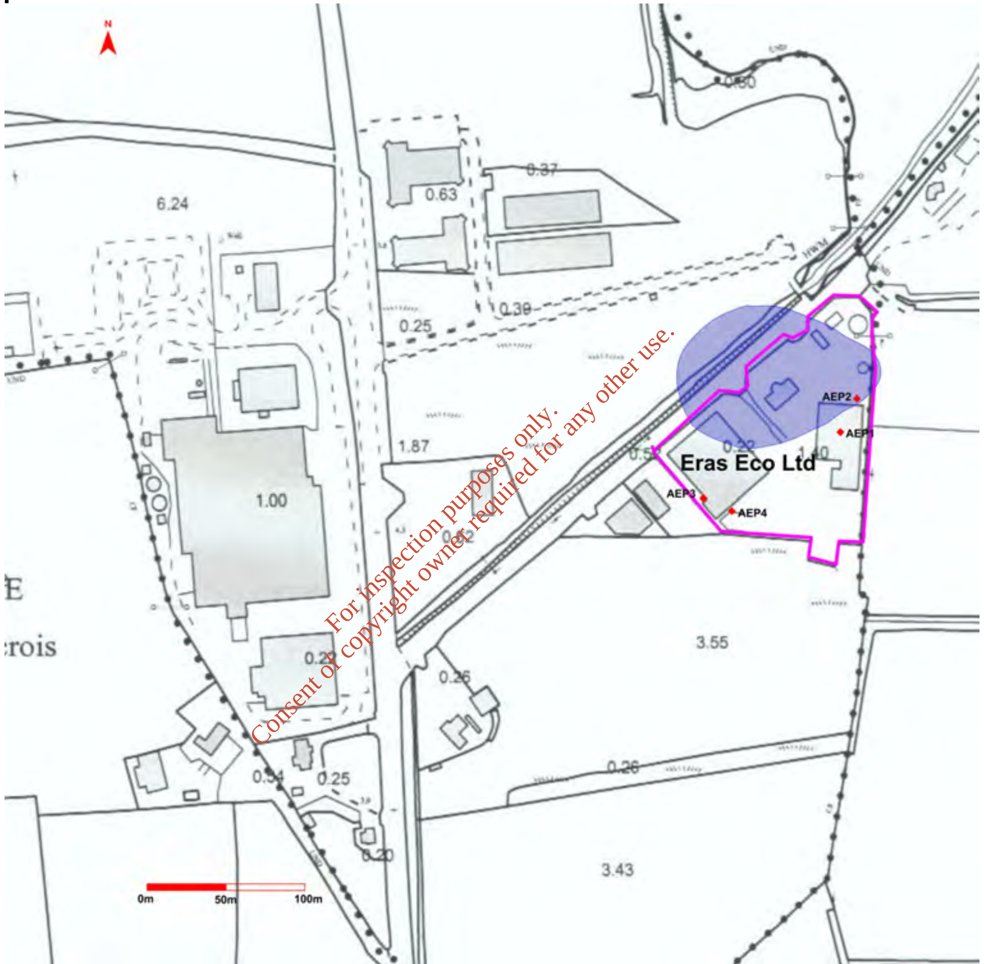

Figure 7.8. Predicted Particulate matter ground level concentration of ≤8 μg/m^3 (▬) at the 90.04th percentile of 24 hour averaging period for Scenario 7.

7.9. Dispersion modelling contour plots for Scenario 8

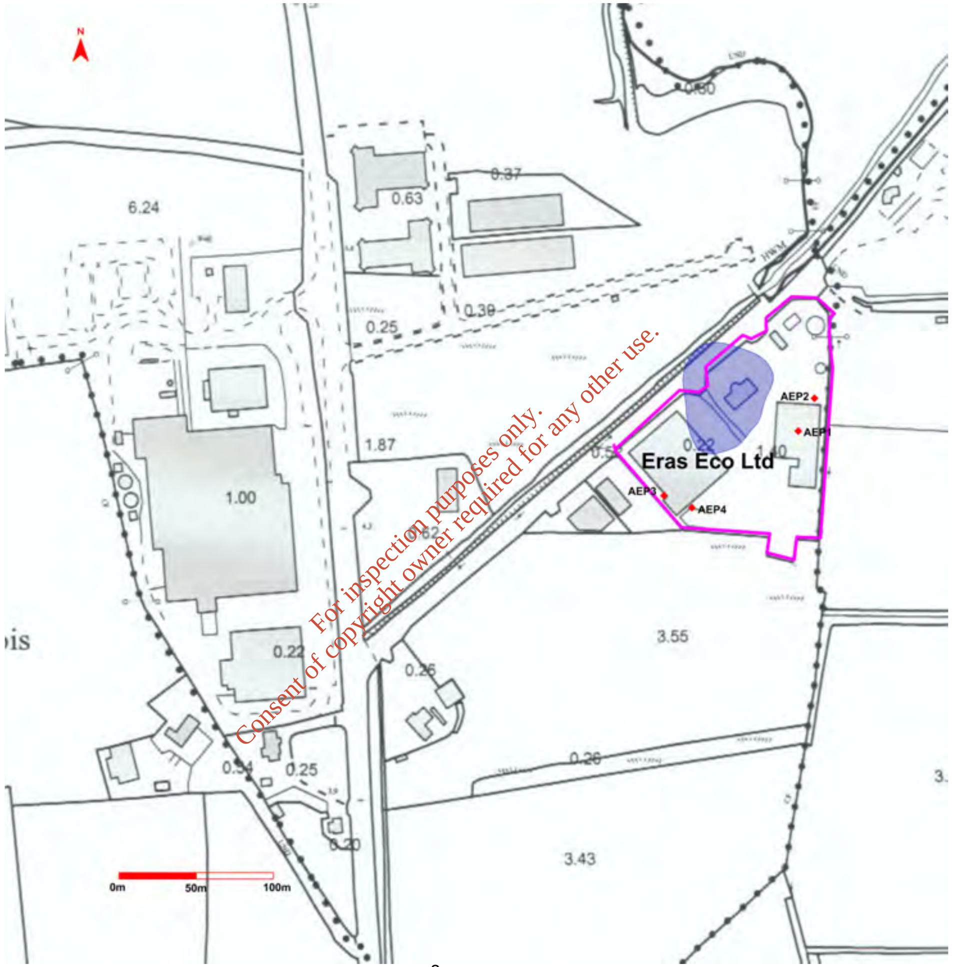

Figure 7.9. Predicted Particulate matter ground level concentration of ≤4 μg/m^3 (blue line) at the annual averaging period for Scenario 8.

7.10. Dispersion modelling contour plots for Scenario 9

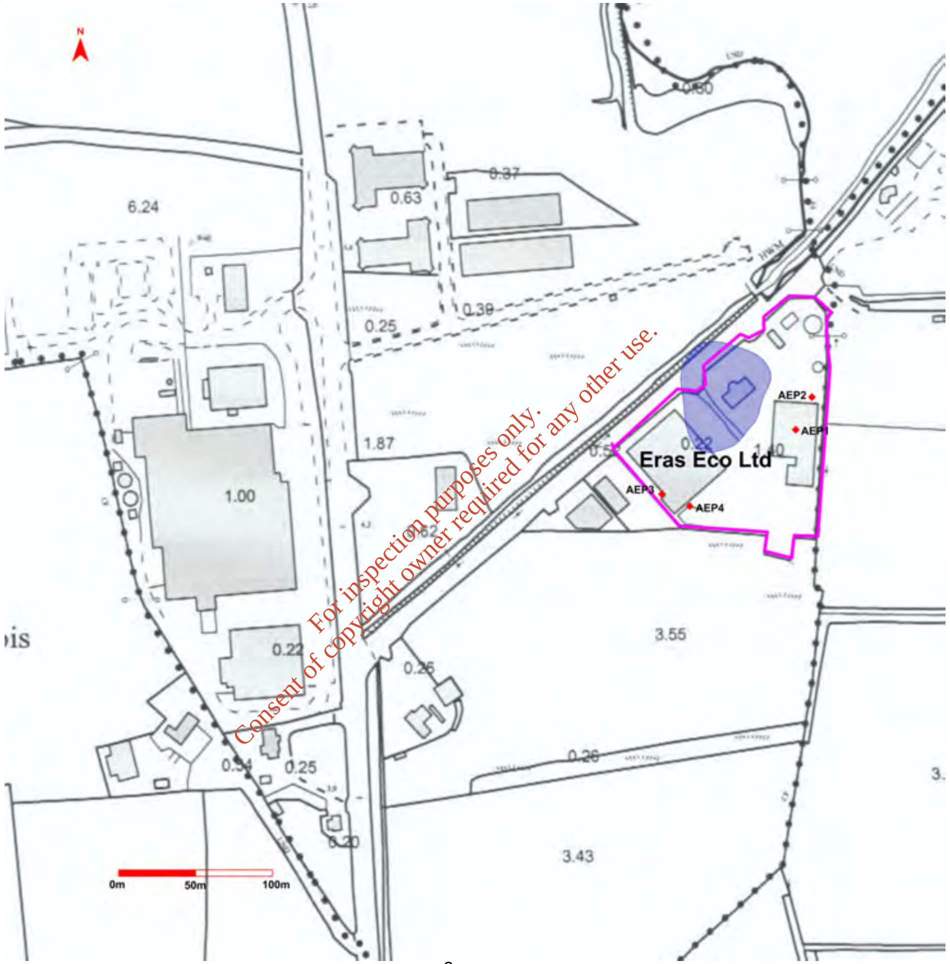

Figure 7.10. Predicted Particulate matter ground level concentration of ≤4 μg/m^3 (▬) at the annual averaging period for Scenario 9.

7.11. Dispersion modelling contour plots for Scenario 10

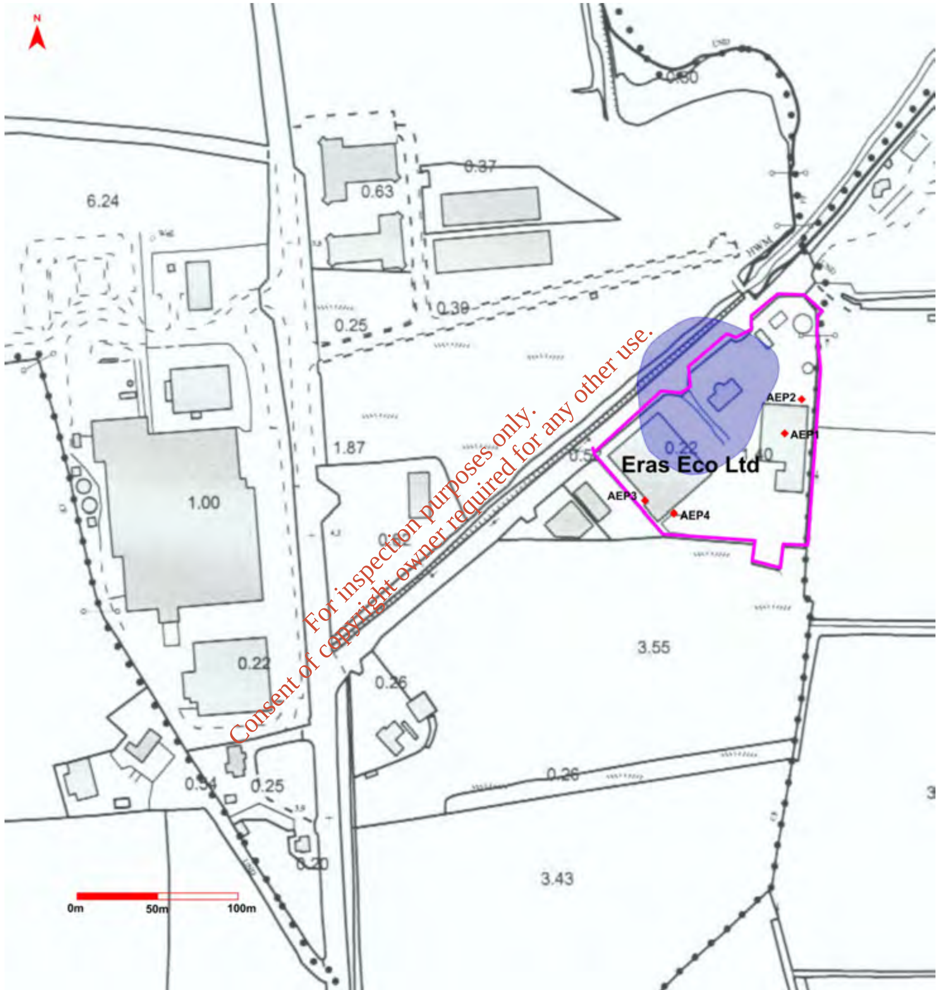

Figure 7.11. Predicted HCL ground level concentration of ≤5 µg/m^3 (▬) at the 98th percentile of 1-hour average period for Scenario 10.

7.12. Dispersion modelling contour plots for Scenario 11

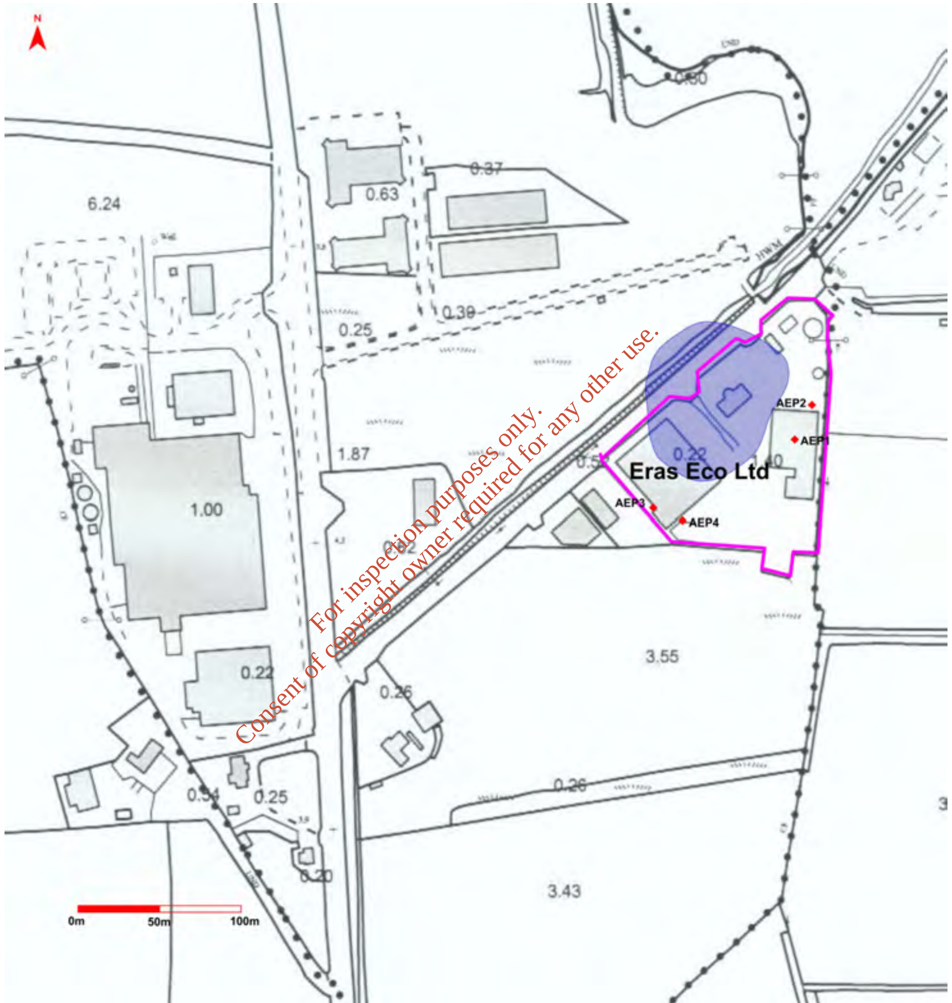

Figure 7.12. Predicted HCL ground level concentration of ≤1 μg/m^3 (▬) at the annual averaging period for Scenario 11.

7.13. Dispersion modelling contour plots for Scenario 12

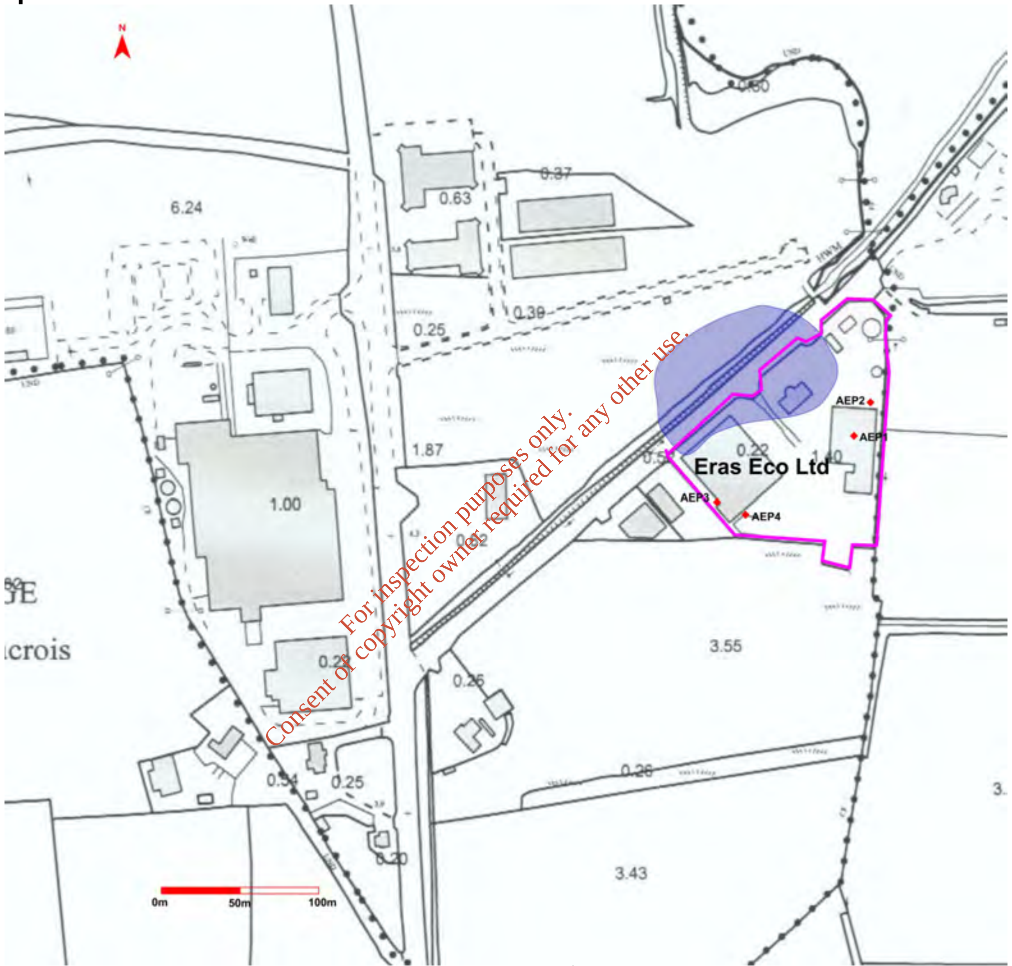

Figure 7.13. Predicted HF ground level concentration of ≤0.60 µg/m^3 (▬) at the 98th percentile of 1-hour average period for Scenario 12.

7.14. Dispersion modelling contour plots for Scenario 13

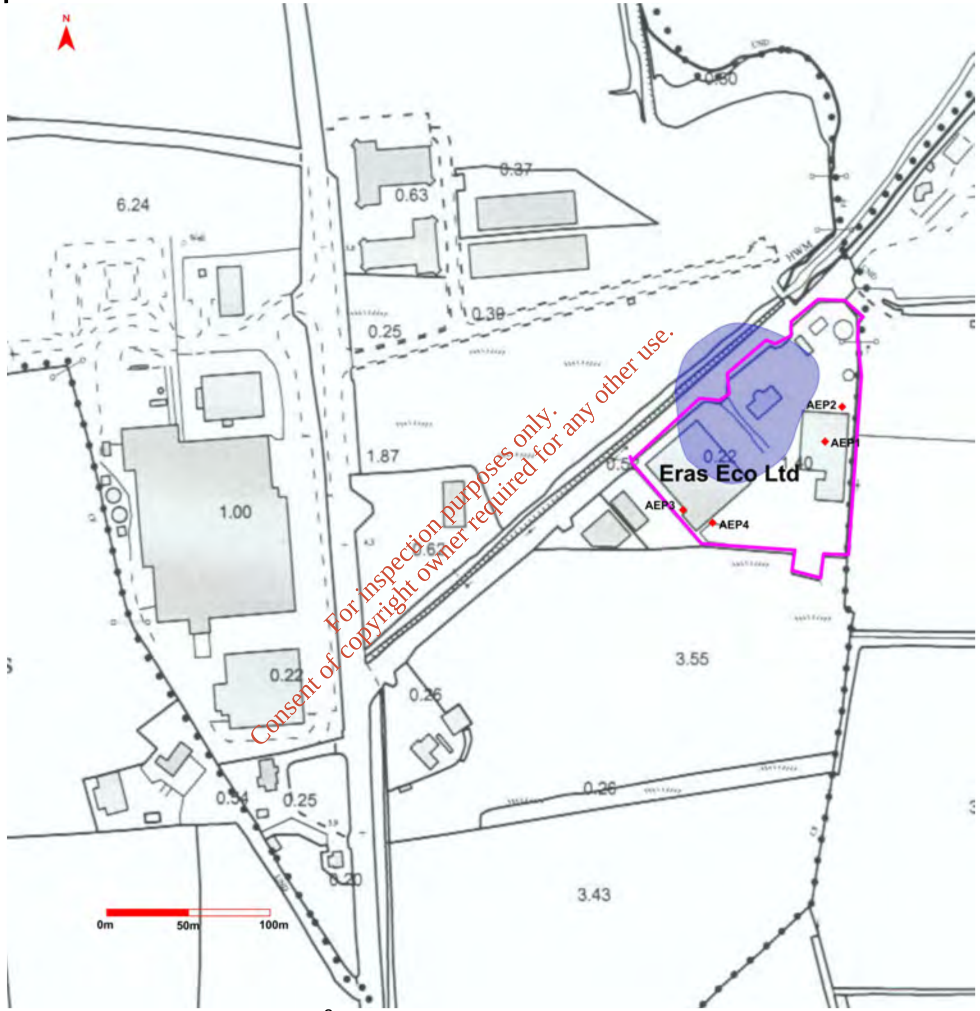

Figure 7.14. Predicted HF ground level concentration of ≤0.10 µg/m^3 (▬) at the annual averaging period for Scenario 13.

7.15. Dispersion modelling contour plots for Scenario 14

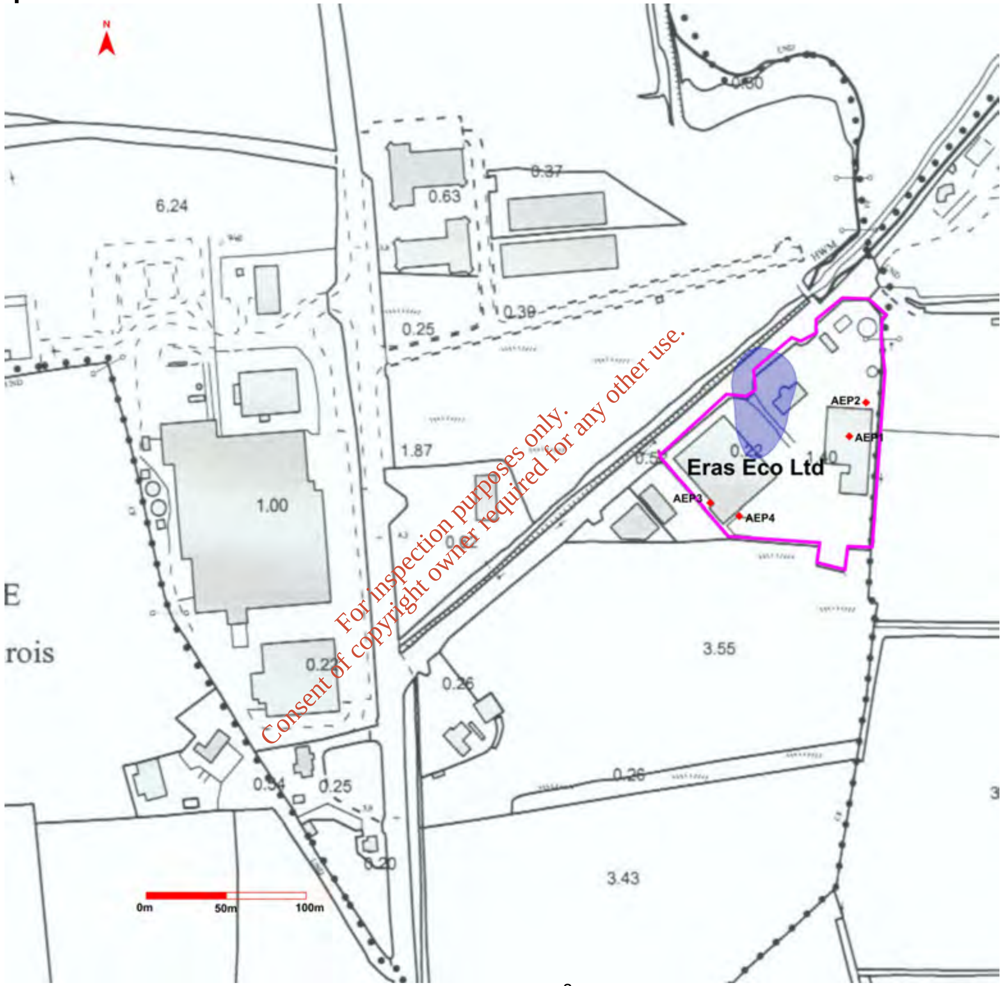

Figure 7.15. Predicted TNMVOC (as benzene) ground level concentration of ≤2.0 µg/m^3 (▬) at the annual average period for Scenario 14.

7.16. Dispersion modelling contour plots for Scenario 15

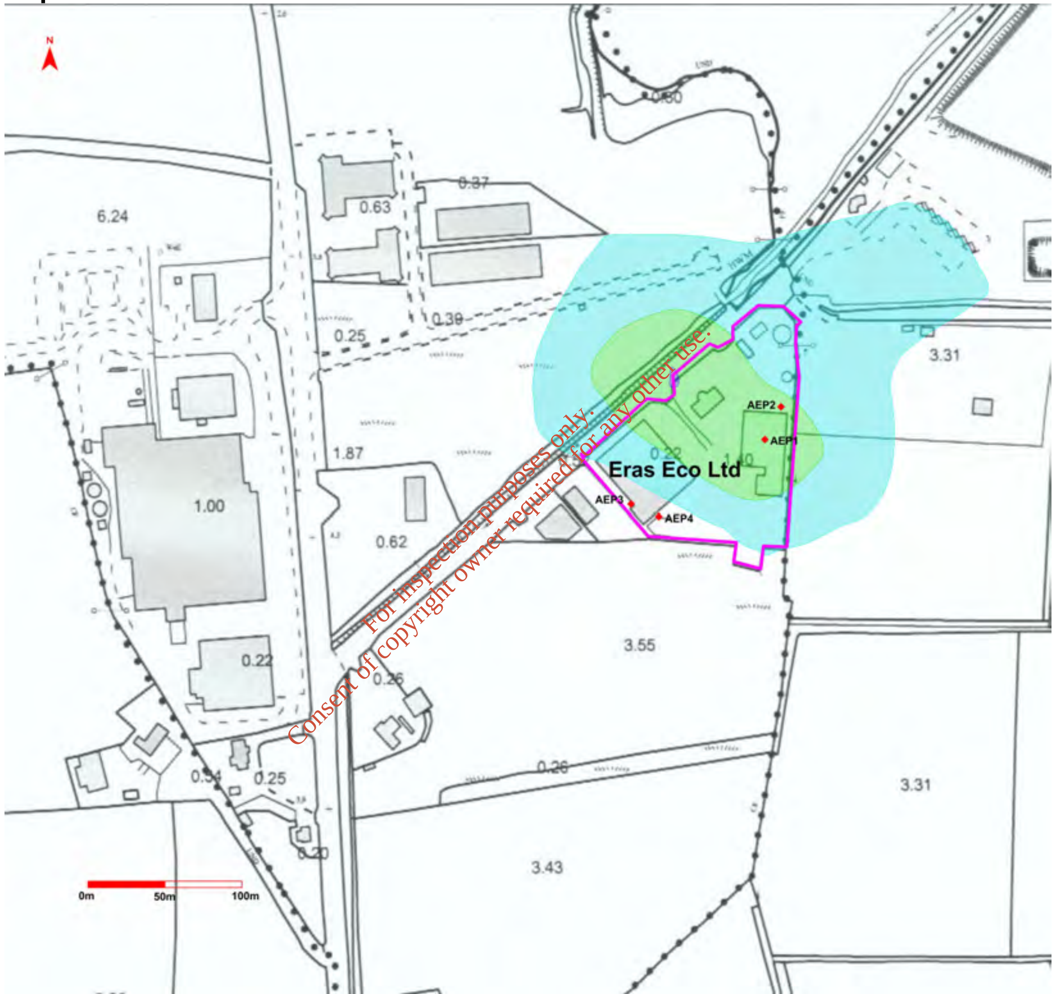

Figure 7.16. Predicted Odour ground level concentration of ≤0.70 Ou_E/m^3 ( ) , ≤1.0 Ou_E/m^3 ( ) ≤1.50 Ou_E/m^3 ( ) at the 98th percentile of 1-hour average period for Scenario 15.

7.17. Dispersion modelling contour plots for Scenario 16

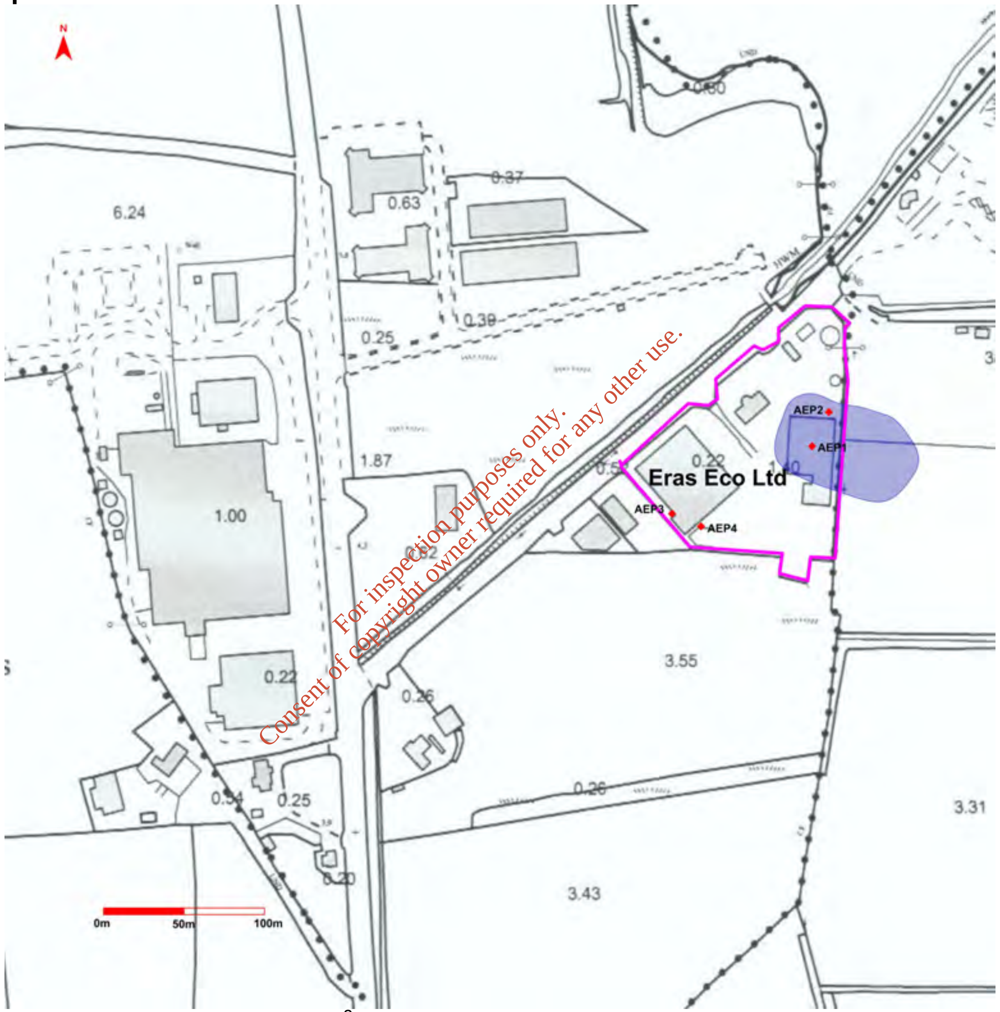

Figure 7.17. Predicted H_2S ground level concentration of ≤0.40 μg/m^3 ( ) at the annual average period for Scenario 16.

8. *Appendix II* - Meteorological data used within the Dispersion modelling study.

8.1 Meteorological file Cork airport 2008 to 2012 inclusive

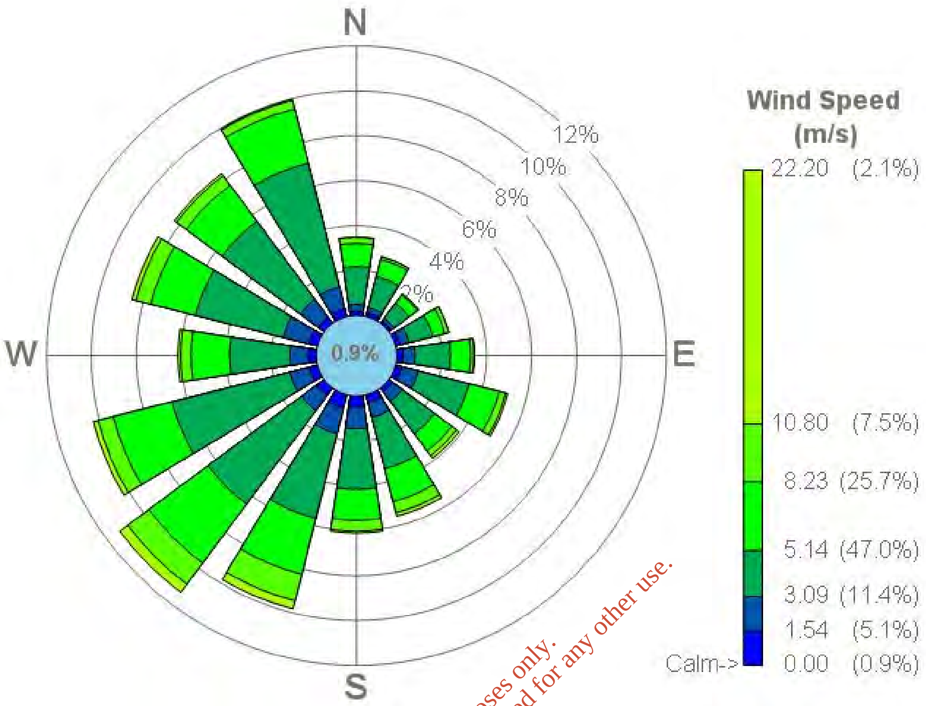

Figure 8.1. Schematic illustrating windrose for meteorological data used for atmospheric dispersion modelling, Cork 2008 to 2012 inclusive.

Table 8.1. Cumulative wind speed and direction for meteorological data used for atmospheric dispersion modelling, Cork 2008 to 2012 inclusive.

Cumulative Wind Speed Categories							
Relative Direction	**> 1.54**	**>3.09**	**>5.14**	**>8.23**	**> 10.80**	**< 10.80**	**Total**
0.0	0.18	0.31	1.68	1.03	0.26	0.01	3.48
22.5	0.18	0.22	1.44	0.78	0.12	0.00	2.75
45.0	0.12	0.17	0.83	0.46	0.05	0.00	1.64
67.5	0.20	0.41	1.09	0.55	0.18	0.00	2.45
90.0	0.28	0.53	1.58	0.89	0.15	0.03	3.45
112.5	0.28	0.76	2.33	1.38	0.30	0.10	5.15
135.0	0.20	0.52	1.81	0.96	0.26	0.15	3.89
157.5	0.34	0.69	2.36	1.50	0.51	0.16	5.57
180.0	0.51	0.95	2.69	1.38	0.49	0.08	6.10
202.5	0.60	1.18	3.88	2.56	1.22	0.37	9.83
225.0	0.42	0.83	5.19	3.28	1.17	0.45	11.33
247.5	0.37	0.89	5.40	2.70	0.70	0.22	10.28
270.0	0.35	0.81	2.68	1.72	0.47	0.12	6.15
292.5	0.40	1.16	4.04	2.05	0.68	0.18	8.50
315.0	0.33	1.00	4.32	2.00	0.53	0.11	8.29
337.5	0.38	0.99	5.69	2.48	0.39	0.05	9.98
Total	**5.13**	**11.42**	**47.02**	**25.73**	**7.47**	**2.05**	**98.82**
Calms	**-**	**-**	**-**	**-**	**-**	**-**	**0.93**
Missing	**-**	**-**	**-**	**-**	**-**	**-**	**0.24**
Total							**100.00**

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ENVIRONMENTAL MANAGEMENT FOR BUSINESS

DECOMMISSIONING MANAGEMENT PLAN

ERAS ECO LIMITED

FOXHOLE

YOUGHAL

CO. CORK

Prepared For: -

ERAS ECO Ltd.,
Foxhole,
Youghal.
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April 2017

Project	Decommissioning Management Plan			
Client	ERAS ECO Ltd.			
Report No	Date	Status	Prepared By	Reviewed By
1519301	27/03/2017	Initial Client Comment	Martina Gleeson PhD.	Jim O'Callaghan MSc, CEnv, MCIWM, IEMA
	05/04/2017	Final		

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1. INTRODUCTION

1.1 Activity Details

ERAS ECO Ltd (ERAS ECO) is Cork's leading sludge management company and has been operating its facility at Foxhole, Youghal since 2007. The facility operates under an Industrial Emissions Licence (W0211-01) issued by the Environmental Protection Agency (Agency) and treats sewage sludge from local authority sewerage treatment plants and non-hazardous sludges from industrial waste water treatment plants operating mainly in the Cork area.

ERAS ECO has applied to the Agency for a review of the Licence to allow the construction of an Anaerobic Digestion (AD) Plant and associated Combined Heat and Power (CHP) plant, and to increase the amount of waste that can be treated.

The Agency requested ERAS ECO to prepare a Decommissioning Management Plan (DMP) as part of the application for a review of the licence. ERAS ECO appointed O'Callaghan Moran & Associates (OCM) to prepare the DMP. The methodology followed the EPA Guidance on assessing and costing environmental liabilities (2014) and the document addresses both the existing and proposed operations.

1.2 Site Description

The site is located on reclaimed land in an area zoned for industrial development and encompasses approximately 1.6 hectares (ha). It comprises two waste processing buildings (Building 1 and Building 2), an administrative office building, wastewater treatment plant and open yards. It is proposed to construct an Anaerobic Digestion Plant.

1.3 Commencement of Operations

Historical reclamation work in this area has resulted in made ground with a proven thickness of up to 3m. Site investigations identified the made ground to be predominately clay with small portion of construction and demolition waste.

The site was initially used by Youghal Town Council to store diesel for vehicles operating on the adjacent Youghal Landfill. It is understood the tanks were located in the vicinity of the current site entrance.

Youghal Waste Disposal & Recycling Ltd acquired a 35-year lease the landowners Youghal Town Council, before subletting it to AVR Environmental Solutions Ltd. In 2001, planning permission was granted for the construction of a waste transfer station (Ref No. S/00/7093, 30th August 2001) and in 2005 permission was granted for the construction of a sludge treatment facility (Ref No. S/04/7531 04th February 2005).

ERAS ECO Ltd was established to compensate for the lack of recovery facilities within Ireland. In particular, its focus was the treatment of wastewater treatment plant (WWTP) sludges and the recovery of Commercial and Industrial (C&I) wastes. Eras Eco Ltd acquired the plant in 2006. The Waste Licence was granted in November 2006 and the facility was constructed and commissioned in 2007.

1.4 Closure Scenario and Scope

The facility has no defined lifetime and the risk of closure is low. The commercial viability of the facility will be kept under review and, if market conditions dictate the need to close the facility, the Agency will be notified and the DMP will be implemented. Following a planned closure ERAS ECO d may, depending, on the future plans for the facility, apply to surrender the Licence.

For the purpose of costing this DMP, it has been assumed, in accordance with the Agency's Guidance, that the plant will close unexpectedly and that the DMP will be implemented by third parties contracted by the Agency.

1.5 Restoration and Aftercare Plan

At the time of the preparation of this plan a Restoration and Aftercare Plan was not considered necessary.

1.6 Limitations

The assessment of costs associated with the implementation of the DMP is based on the information available at the time of the report preparation, including the Agency's Guidance, and may be subject to amendment based on future investigations and the annual review required under Condition 10.2 of the Licence.

2. SITE EVALUATION

2.1 Operator Performance

2.1.1 Facility Management

The Facility Manager has over 12 years' experience in Waste Management and holds a Certificate in FAS Waste Management Training Course. The Environmental, Health & Safety Manager has 7 years' experience in EHSQ and holds a BSc in environmental management, a Certificate in Safety & Health and a NEBOSH Safety Diploma. All operatives are provided with the appropriate and necessary training to complete their assigned tasks.

2.1.2 Compliance History

In 2016 ERAS ECO received any notifications of non-compliances regarding waste storage practices, dewatering of sludge, use of waste wood as a fuel, maintenance of the drainage system and stormwater diversion.

2.1.3 Enforcement History

The facility has never been the subject of any enforcement action taken by the regulatory authorities.

2.1.4 Incidents History

There have been no incidents that had the potential to result in significant soil and groundwater contamination.

2.1.5 Complaints History

In 2015 odour complaints were received and an investigation identified these were associated with the emissions from the biofilter. The duct work had become corroded and the emission point which was at a relatively low level. The corrective actions included the replacement of the ducting and extending it to and up the southern elevation of Building 2 to a level where the emission point is above the roof height. This was completed in 2015 and resulted in a reduction in the number of complaints.

In 2016 three complaints were received (15th and 16th March and 8th June) and all were investigated. The potential source of the March complaints were opening the doors of building for the acceptance of woodchip. The investigation of the June complaint did not identify any source other than the potential loss of negative air pressure in the building after the doors were opened to take a delivery of sludge.

2.2 Environmental Pathways & Sensitivities

2.2.1 Surface Water

Rainwater run-off from roofs and non-waste storage paved areas is collected in the surface water drainage system that connects to two silt/ oil interceptors (Class 1) and a storm water retention tank.

The run-off is reused on-site when possible (wheel wash, the bio-filter, cooling water for the dry product and to backwash the wastewater treatment plant filters) and the surplus water discharges to the Irish Water combined sewer via a non-return valve. The sewer outfalls to the estuary.

2.2.2 Foul Water

Wastewater generated at the installation comprises sanitary wastewater from the offices, condensate from the sludge drying unit and wash water from the vehicle wheel wash. The sanitary wastewater is treated in a proprietary treatment system (Puraflo ©) adjacent to the northern site boundary, before being discharged to the Irish Water combined sewer, that outfalls to the estuary.

The condensate and water from the wheel wash is treated in the on-site process wastewater treatment plant, with the treated effluent discharged to the Irish Water combined sewer that outfalls to the estuary. Landfill leachate will also be treated in the plant following receipt of approval as required by Condition 3.21.3 of the current licence. It is intended to divert the discharge to then Irish Water municipal wastewater treatment plant in Youghal, when this is commissioned.

2.2.3 Geology & Hydrogeology

The site is underlain by up to 3m of made ground, which overlies up to 11.6m of glacial till, which in turn overlies up to 2m of sandy gravel. The made ground is predominately clay, with small portion of construction and demolition. The bedrock underlying the site consists mainly of the Waulsortian Limestones, which consists of massive, unbedded mounds of calcareous deposits in the form of mudstones, wackestones and packstones.

2.2.4 *Neighbouring Developments*

A local road runs along its northern boundary, while south of the site is mudlands. To the east of the site is the Youghal Landfill and Civic Amenity Centre operated by Cork County Council. The adjoining lot to the west is occupied by the National Car Test (NCT). The nearest private dwelling is 250m from the site, at the junction of the site access road and the R634.

2.2.5 *Designated Sites*

The Blackwater River and estuary is designated a Special Protected Area (SPA), a proposed National Heritage Area (pNHA) and a Special Area of Conservation (SAC). The site itself is located outside the designated zone.

2.2.6 *Emissions*

There is one (1 No.) emission point to the surface water (SW-1). There is one (1 No.) emission to sewer (SE-1). There are three (3 No.) existing point emissions to air, which are the boiler stack, the biofilters and the odour control unit in Building 1. The proposed development will results in one new emission point, which will be the stack on the CHP plant.

Site operations are a source of noise and the licence specifies noise emission levels for the nearest noise sensitive locations. Operations are also a potential source of dust emissions and the licence specifies dust deposition limits.

2.3 Site Processes & Activities

<u>Sludge Treatment</u>

The treatment processes comprises reducing the moisture content and pasteurisation using either a biomass fuelled drier, or the addition of lime. The incoming sludges are weighed and samples collected for testing in the on-site laboratory. The sludge, which has a minimum Dry Solids (DS) content of 10%, is then directed either to Building 2 for treatment, or to Building 1 for temporary storage pending treatment.

At the sludge drier, the sludge is tipped into reception bins (covered with hydraulic lids and gratings) from where it is pumped to a dosing / mixing bin. From the bin, it passes into a dryer, which is heated using steam generated in a biomass (woodchip) fired boiler. The woodchip is stored in Building 1.

The building is fitted with interlocked rapid roller doors providing efficient containment of odours within the building. The steam from the drier is ducted to a crubber/separator, where it is condensed. Any fine particulate matter is returned to the dryer and the condensed effluent is sent to the on-site WWTP where it is treated before discharge.

The purged steam and volatile organics evaporating from the WWTP and odorous air from the sludge reception bin, which is fitted with a system that extracts the air from the hopper, are ducted to a biofilter odour abatement system. The extraction system provides negative ventilation to the area handling the sludge (i.e. where odours are generated). The dried sludge is then transferred to a product cooling conveyor. The product, which has a moisture content of less than 20%, is then screened to separate the fines, which are returned by the fines conveyer to the front of the dryer. The end-product is a sterilised granulated material suitable for use as a fuel. Presently this dried sludge (~ 1100 tonnes per annum) is exported to a licensed recovery facility in Germany.

The sludge drier runs on a 24 hour basis, 7 days a week including holidays. It is shut down for regular maintenance. Deliveries are between 7.00 am and 10.00 pm, Mondays to Fridays, and on Saturdays between 7.00 am and 2.00 pm.

Anaerobic Digestion

The plant will comprise six liquid storage tanks, two pasteuriser tanks and a feed hopper and conveyor located in Building, and two digester tanks and a digestate storage tank located in the south of the site. The digesters will be enclosed by an impermeable cover and heated to $37^{O}C$ and will be continuously stirred and fed with sludges. This process will produce a biogas and a digestate.

The biogas will contain approximately 65 % methane, which will then be treated and either used as a fuel in the CHP plant or exported to the national gas grid. The digestate will be pasteurised to facilitate its use as a fertiliser.

The digestate has a significant nutrient and soil enhancement value and is typically applied to agricultural lands, either as whole digestate or as a separated fibre. While it is intended to continue the land application of the digestate, it is proposed to provide the capability to dewater the digestate in a new centrifuge that will be located in Building 1. The centrifuge will not be continuously operated but will be used at times when there is pressure on digestate storage capacity.

The centrifuge will produce a fibre (typically 20% dry solids) and a separated liquor. The fibre will be a semi-solid "cake" and will be stored in a trailer inside Building 1. When full the trailer will be sent to the land application banks. The fibre is also suitable for composting and this option will be used in the periods when land application is restricted.

The liquor will be recirculated in the AD process; however following the commissioning of new Irish Water wastewater treatment plant serving Youghal, approval will be sought to discharge some liquor to the Irish Water foul sewer.

Wastewater Treatment Plant

The plant is designed to treat condensate from the sludge drier, landfill leachate and wash water from the wheel wash. It comprises a balance tank with an air diffuser, a dissolved air floatation tank, carbon and sand filters, lamella settlement unit, hypochlorite treatment and a sludge storage tank.

Treatment of Yeast Slurries and Whey Permeates

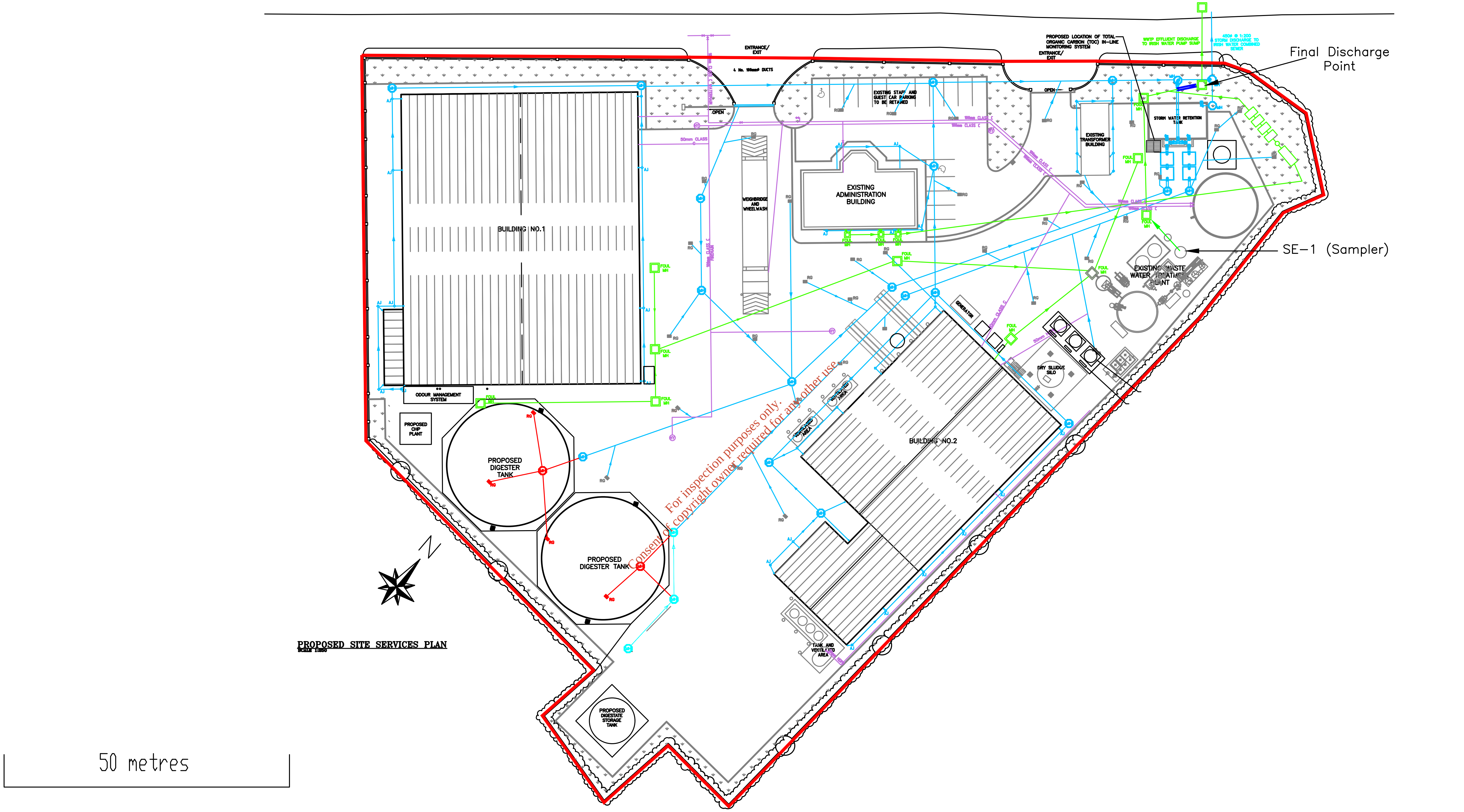
At some time in the future ERAS ECO may accept and treat yeast slurries to manufacture animal nutrition ingredients. Only whey permeates that have been accepted by the Agency as being by-products will be accepted at the installation. Given the quality control requirements the drying will be carryout in a new building, which will require planning permission. The exhaust from the new drier will be ducted to existing stack and details will be submitted to the Agency by way of an SEW.

2.4 Plant Inventory

The proposed site layout is shown on Drawing No. 15-193-02 Rev B and details of the infrastructure are presented in Table 2.1

Table 2.1 – Site Infrastructure

Infrastructure	Details
Administration Building	Two storey (106 m^2) building, houses reception, offices, canteen, toilet & changing rooms, laboratory, public information
Weighbridges	Precia molen 16M weighbridge located at entrance to access gate
Building 1	Sludge storage area, biomass/woodchip storage area, workshop
Building 2	Consists of a, sludge reception area, sludge drying area
WWTP	Consists of balance tank, culligan filters, carbon, filters, hypochlorite mixing tanks, other tanks: treated water, wash water, sludge.
Anaerobic Digesters	2 No. each 2,208m^3.
Liquid Waste Storage Tank	6.No. each 100m^3 and located inside Building 1
Pasteuriser Tanks	2 No. each 25m^3 and located inside Building 1
Transformer Building	Houses transformer
Water Storage Tanks	Above Ground Firewater Storage Tank, Underground Stormwater Retention Tank
Oil Storage Tank	Diesel Oil – Capacity 2,600 litres, double skinned tank.



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environmental management for business

CLIENT	Eras Eco
TITLE	Site Services
DRAWING No.	15–193–02
REV.	B

Facility operations require the use of a range of mobile and fixed plant, which are listed in Tables 2.2.

Table 2.3 Mobile Plant

	Item
1	CAT IT62H Loading Shovel
1	Toyota Geneo 25 Forklift
1	Porpata Scale DC Milano Vertical Hoist Platform

Table 2.4 Fixed Equipment

Items
Feed hopper and conveyor
Pumps and feed lines
Fire and intruder alarm system
Fire sprinkler system
Odour Control System
Wastewater treatment plant
Fuel pump and fuel management system
Biomass Boiler
Rotary Drier

2.5 Inventory of Raw Materials and Wastes

Diesel is stored in a plastic double skinned tank (2,600 litres) adjacent to the southern end of Building 2.

The liquid sulphuric acid, sodium hypochlorite and sodium hydroxide used in the process wastewater WWTP are stored in four Intermediate Bulk Containers (IBC) in a bunded Chemstore adjacent to the WWTP. The unit has a 1,200 litre polythene collection sump 1.

Leachate will be delivered in road tankers and pumped directly into the WWTP balance tank.

The maximum amount materials and wastes on site at any one time are shown in Table 2.5.

Table 2.5 – Materials Inventory

Wastes/Products	Quantity Stored
Untreated Sludge for Drying	250 tonnes
Untreated Liquid Waste	600 tonnes
Contents of Digesters	4,496 tonnes
Digestate	500 tonnes
Landfill Leachate (for WWTP)	25 tonnes
Quarantine Waste	1 tonne
Woodchip (for Boiler)	20 tonnes
Diesel (for Boiler)	2,600 litres
Hydraulic Oil	205 litres
Engine Oil	100 litres
Liquid Alum (for WWTP)	1 tonne
Flopam FO 4107 (for WWTP)	0.8 tonnes
Sulphuric Acid (for WWTP)	1 tonne
Soda Ash (for WWTP)	1 tonne
Sodium Hydroxide Solution (for WWTP)	1 tonne
D-10 (Detergent/Disinfectant)	60 litres

The quantities given in the table are based on the maximum amounts that can be stored on site at any one time, but in the event of the planned closure, the actual quantities should be considerably smaller, as the shutdown would be preceded by a reduction in the on-site inventory.

3. CLOSURE TASKS & PROGRAMMES

3.1 Closure Tasks

3.1.1 Materials Management

A planned shutdown of operations would be carried out after the last batches of waste received at the site had been processed and consigned. It would be preceded by a scaling down of activities, thereby reducing the quantities of materials, particularly fuel and wastes, to be dealt with when implementing the DMP.

Diesel, engine and hydraulic oil will be used to fuel plant and equipment deployed in the decommissioning works. When these are completed, it should be possible to return any remaining diesel and the WWTP chemicals to the suppliers either for resale, or reuse. The remaining materials may have to be disposed of as waste, some of which may be deemed hazardous due to their composition.

A vacuum tanker will empty the oil interceptors and the contents will be sent for disposal at a suitably licensed facility.

3.1.2 Buildings

It is not proposed to demolish any of the buildings, but they will be cleaned out and left in situ for future use. Given the nature of the waste handled at the facility, specialist decontamination of the buildings will not be required, and the cleaning will primarily involve wash down and use of road sweeper to clean the floors.

3.1.3 Plant & Equipment

In the event of a planned closure, the plant and equipment will be either be sent other biological treatment plants, sold for use, or scrapped at an approved waste recycling/recovery facility. At the time of the preparation of this DMP, it is not possible to accurately quantify every item of plant that would be suitable for resale, as this depends on their future condition. Those items of mobile plant that cannot be sold will be scrapped. The fixed plant will remain in situ. All the metal items have a scrap value, and therefore the removal of the plant and equipment should be cost neutral.

Given the nature of the wastes handled at the facility, none of the plant items will require specialist decontamination or cleaning before being scrapped.

3.1.4 Interceptors & Drains

As referred to above, the interceptors will be cleaned and the contents sent off site for treatment. All surface water and foul water drainage pipes will be flushed using water.

3.1.5 Services

The telecom, electricity and water supply services will be disconnected.

3.1.6 Environmental Monitoring

Monitoring will continue until all the decommissioning works have been completed.

3.2 Closure Programme

In the event that the entire facility is closed, all the operational areas will be decommissioned. The decommissioning will take 8 weeks (Table 3.1) and will be carried out in a number of tasks, some of which will happen concurrently.

Table 3.1 Decommissioning Plan Schedule

	START	DURATION	Week							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Tasks										
Task 1 Operate the AD plant										
Task 2 Removal of untreated and treated sludge and empty and clean the liquid waste storage tanks and consumables	1	2								
Task 3 Empty and clean digesters, digestate tank and pasteuriser tanks.	3	2								
Task 4 Clean-out Buildings 1 and 2, including AD feed hopper and Sludge Bin. Remove office equipment	3	3								
Task 5 Clean drains and storm water retention tank	5	1								
Task 6 Empty and clean interceptors	5	1								
Task 7 Decommission WWTP and Puraflow										
Task 8 Clean yards	6	1								
Task 9 Disconnecting services	6	1								
Task 10 Closure audit	7	1								

4. CRITERIA FOR SUCCESSFUL CLOSURE

Successful closure will only be complete when:

- All consumables, wastes, end of waste and residual materials have either been treated onsite, or consigned to appropriately authorised recovery/disposal facilities;
- Records of all wastes, materials and plant removed from the site have been prepared;
- All buildings have been cleaned out and services disconnected;
- A site investigation, if required, confirms that soil and groundwater conditions present no significant environmental risk;
- The environmental monitoring confirms no impact associated with the closure and decommissioning works;
- A Closure Audit has been completed and approved by the Agency.

5. CLOSURE PLAN VALIDATION

5.1 Closure Audit & Validation Report

Following the completion of the site clean out, ERAS ECO will appoint an experienced independent environmental auditor, who will be approved by the Agency, to carry out a Closure Audit, and produce a Validation Report that demonstrates the successful implementation of the Plan. The Closure Audit will address:-

1. Disposal of raw materials;
2. Disposal of wastes;
3. Decommissioning of plant and equipment;
4. Disposal of obsolete equipment;
5. Results of monitoring and testing during the decommissioning period;
6. Soil & Groundwater Assessment, and
7. The need for on-going monitoring, remedial actions or aftercare management.

The Validation Report will describe all of the activities carried out during the Closure Audit, and will contain records of the destinations of all wastes and materials consigned from the site during decommissioning. The Report will be submitted to the Agency within three months of execution of the Plan.

6. CLOSURE PLAN COSTING

The costs of a planned closure will be met in full by Ormonde Organics. The costs of implementing the DMP in an unplanned closure scenario where Ormond Organics is not is a position to meet the cost are presented in Table 6.1. The costs are based on the following assumptions:

- The closure will be unforeseen and unexpected with no advance warning that would allow an orderly wind down of activities.
- 250 tonnes of untreated sludge and 600m^3 of liquid waste will be in Building 1.
- All of the digesters, digestate storage tanks and pasteurisers are full (4,966m^3).
- A temporary site manager and operatives will be appointed to manage the plant to ensure that the sludge drying and anaerobic digestion processes are successfully completed and to implement the decommissioning and clean out.
- The cleaning of the digesters, digestate tank, pasteuriser tanks and liquid storage tanks will be carried out by specialist contractors. The washwater will be sent off site for treatment.
- Only the wastes already in the drier and the AD digesters will continue to be treated. The untreated sludge and liquid waste in Building 1 will be sent off-site for disposal/treatment.
- The diesel storage tank (2,600) litres is full and there are 4 full IBCs of sulphuric acid, sodium hydroxide, aluminium sulphate and hypochlorite on-site. The water treatment chemicals will be used in the WWTP until it is decommissioned.
- The digestate and fibre will be sent to the normal outlets, which based on the nutrient value of the materials and proximity of the land banks will be cost neutral; however an allowance is made for transport costs.
- The entire facility will be decommissioned, all buildings will be cleaned and all wastes products and consumables will be removed from the site.
- The decommissioning of the process WWTP will be carried out by third parties
- It is not proposed to demolish any of the buildings or tanks.

Table 6.1 Costs

Task	Description	Quantity	Unit	Rate	Cost	Source of Unit Rates
Facility Management	Site Manager (2.5 days/week for 7 weeks)	17.5	Day	€ 500	€ 8,750	Eras Eco
	1 No Operative 5 days/week for 7 weeks	35	Day	€300	€10,500	Eras Eco
	Utility Bills				€2,500	Eras Eco
Materials/Waste Disposal/Recovery	Removal, transport off-site and treatment of untreated sludge in Building 1	250	Tonnes	€30	€7,500	Eras Eco
	Removal, transport off-site and treatment of liquid waste in Building 1	600	Tonnes	€ 15	€ 9,000	Eras Eco
	Transport and off-site land spread of digestate[1]	4966	m^3	€ 6.50	€32,279	Eras Eco
	Removal and off-site disposal of leachate	25	m^3	€ 65	€ 1,625.00	Eras Eco
	Removal and off-site disposal of diesel and waste oils	1000	litres	€ 0.70	€700.00	EPA Guidance
Building Plant & Equipment Clean Out	Clean out of Building 1 and 2 (Included in Management Cost)		Day Rate		€ -	
	Cleaning plant and equipment (Included in Management Cost)		Day Rate		€ -	
	Removal of plant and equipment[2]				€ -	
	Cleaning digesters, digestate tank ,pasteurisers, liquid waste storage tanks (High powered jetting +confined space equipment +trained operatives)	2	Day Rate	€ 1,500	€3,000	Eras Eco
	Removal and off-site treatment of wash water from tanks	40	m^3	€50.00	€ 2,000	Eras Eco
	Cleaning of drains, interceptors and storm water retention tank	1	Day Rate	€700.00	€700.00	Eras Eco
	Decommissioning process WWTP	1	Item	€5,000.00	€5,000.	OCM
Yard Cleaning	Cleaning open yard (Roadsweeper)	1	Daily Hire	€ 400.00	€ 400	Eras Eco
Environmental Monitoring	Air emission and surface water quality monitoring	1	Quarter	€ 5,000.00	€ 5,000	OCM
Validation Audit	Validation Report (Consultant)	1		€ 2,500.00	€ 2,500	OCM
Security Costs	Netwatch	7	Week	€100	€ 700	Eras Eco

[1] Cost is for transport only as digestate has a nutrient value

[2] Cost neutral

Services Disconnection	Disconnect electricity and telecoms	1	Day	€ 400.00	€ 400	Eras Eco
Total Liability €)					€ 92,554	
Contingency (10%)					€ 9,255	
Total					€101,809	

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ENVIRONMENTAL LIABILITY RISK ASSESSMENT

ERAS ECO LIMITED

FOXHOLE

YOUGHAL

CO. CORK

INDUSTRIAL EMISSIONS LICENCE NO. W0211-01

Prepared For: -

ERAS ECO Ltd.,
Foxhole,
Youghal.
Co. Cork

Prepared By: -

O' Callaghan Moran & Associates
Unit 15,
Melbourne Business Park,
Model Farm Road,
Cork

April 2017

Project	Environmental Liability Risk Assessment			
Client	ERAS ECO Limited			
Report No	Date	Status	Prepared By	Reviewed By
1519301	27/03/2017	Draft	Martina Gleeson PhD.	Jim O'Callaghan MSc, CEnv, MCIWM, IEMA
	06/04/2017	Final		

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1. INTRODUCTION

1.1 Activity Details

ERAS ECO Ltd (ERAS ECO) is Cork's leading sludge management company and has been operating its facility at Foxhole, Youghal since 2007. The facility operates under an Industrial Emissions Licence (W0211-01) issued by the Environmental Protection Agency (Agency) and treats sewage sludge from local authority sewerage treatment plants and non-hazardous sludges from industrial waste water treatment plants operating mainly in the Cork area.

ERAS ECO has applied to the Agency for a review of the Licence to allow the construction of an Anaerobic Digestion (AD) Plant and associated Combined Heat and Power (CHP) plant, and to increase the amount of waste that can be treated.

The Agency requested ERAS ECO to prepare an Environmental Liabilities Risk Assessment (ELRA) as part of the application for a review of the licence. ERAS ECO appointed O'Callaghan Moran & Associates (OCM) to prepare the ELRA.

1.2 Methodology

The assessment was based on the Agency's '*Guidance on assessing and costing environmental liabilities' (March 2014).* The ELRA has been prepared to accurately reflect the risks of unplanned, but plausible incidents occurring.

The assessment included:

- An assessment of site operations, including materials and product handling and storage practices; production processes; process waste management; emission control and management (infrastructural and procedural); accident prevention policy and emergency response procedures
- Determining the environmental setting and the identification of any particular sensitive receptors that could be impacted in the short, medium and long term by the site operations;
- Establishment of the site history and regulatory compliance performance.

2. SCOPING

The ELRA addresses the liabilities from past and present activities. In this regard, all aspects of the historic and the licensable activities licence that pose a plausible risk to the environment are described and evaluated.

3. RISK IDENTIFICATION

3.1 Site Operation

3.1.1 Size and Nature of the Activity

The installation occupies almost 1.6 hectares and is approximately 2km from Youghal, adjacent to the former Youghal Landfill. The current Licence authorises the acceptance of 110,000 tonnes of waste per year, which includes:

Commercial & Industrial Waste	70,000 tonnes
Non-Hazardous Sludge	30,000 tonnes
Leachate from Landfills	10,000 tonnes

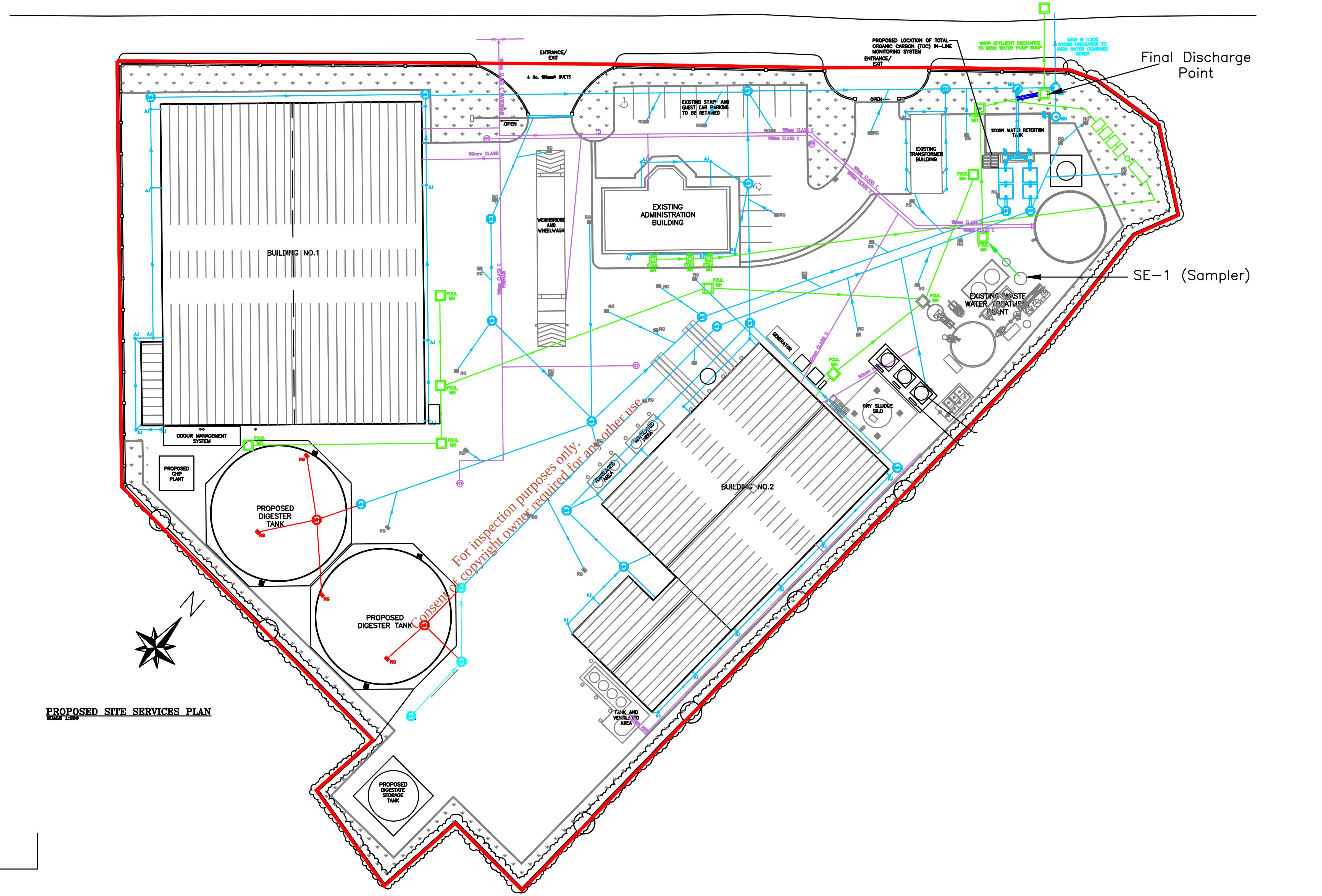
The proposed changes will reduce the overall quantities of waste to 65,000 tonnes/year, which will include:

Commercial & Industrial and Household Waste	20,000 tonnes
Non-Hazardous Sludge	40,000 tonnes
Leachate from Landfills	5,000 tonnes

The proposed site layout is shown on Drawing No. 15-193-02 Rev B and details of the infrastructure are presented in Table 2.1.

Table 3.1 – Site Infrastructure

Infrastructure	Details
Administration Building	Two storey (106 m^2) building, houses reception, offices, canteen, toilet & changing rooms, laboratory, public information room
Weighbridges	Precia molen 16M weighbridge located at entrance to access gate.
Building 1	Sludge storage area, biomass/woodchip storage area, workshop
Building 2	Consists of a, sludge reception area, sludge drying area
WWTP	Consists of balance tank, culligan filters, carbon, filters, hypochlorite mixing tanks, other tanks: treated water, wash water, sludge.
Anaerobic Digesters	2 No. each 2,208m^3.
Liquid Waste Storage Tank	6.No. each 100m^3 and located inside Building 1
Pasteuriser Tanks	2 No. each 25m^3 and located inside Building 1
Transformer Building	Houses transformer
Water Storage Tanks	Above Ground Firewater Storage Tank, Underground Stormwater Retention Tank
Oil Storage Tank	Diesel Oil – Capacity 2,600 litres, double skinned tank.



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environmental management for business

CLIENT	Eras Eco
TITLE	Site Services
DRAWING No.	15-193-02
REV.	B

3.1.2 *Site History*

Historical reclamation work in this area has resulted in made ground with a proven thickness of up to 3m. Site investigations identified the made ground to be predominately clay with small portion of construction and demolition waste.

The site was initially used by Youghal Town Council to store diesel for vehicles operating on the adjacent Youghal Landfill. It is understood the tanks were located in the vicinity of the current site entrance.

Youghal Waste Disposal & Recycling Ltd acquired a 35-year lease the landowners Youghal Town Council, before subletting it to AVR Environmental Solutions Ltd. In 2001, planning permission was granted for the construction of a waste transfer station (Ref No. S/00/7093, 30th August 2001) and in 2005 permission was granted for the construction of a sludge treatment facility (Ref No. S/04/7531 04th February 2005).

ERAS ECO Ltd was established to compensate for the lack of recovery facilities within Ireland at the time. In particular, its focus was the treatment of wastewater treatment plant (WWTP) sludges and the recovery of Commercial and Industrial (C&I) wastes. Eras Eco Ltd acquired the plant in 2006. The Waste Licence was granted in November 2006 and the facility was constructed and commissioned in 2007.

3.1.3 *Site Processes*

<u>Sludge Treatment</u>

The treatment processes comprises reducing the moisture content and pasteurisation using either a biomass fuelled drier, or the addition of lime. The incoming sludges are weighed and samples collected for testing in the on-site laboratory. The sludge, which has a minimum Dry Solids (DS) content of 10%, is then directed either to Building 2 for treatment, or to Building 1 for temporary storage pending treatment.

At the sludge drier, the sludge is tipped into reception bins (covered with hydraulic lids and gratings) from where it is pumped to a dosing / mixing bin. From the bin, it passes into a dryer, which is heated using steam generated in a biomass (woodchip) fired boiler. The woodchip is stored in Building 2.

The building is fitted with interlocked rapid roller doors providing efficient containment of odours within the building. The steam from the drier is ducted to a scrubber/separator, where it is condensed. Any fine particulate matter is returned to the dryer and the condensed effluent is sent to the on-site WWTP where it is treated before discharge.

The purged steam and volatile organics evaporating from the WWTP and odorous air from the sludge reception bin, which is fitted with a system that extracts the air from the hopper, are ducted to a biofilter odour abatement system. The extraction system provides negative ventilation to the area handling the sludge (i.e. where odours are generated).

The dried sludge is then transferred to a product cooling conveyor. The product, which has a moisture content of less than 20%, is then screened to separate the fines, which are returned by the fines conveyer to the front of the dryer. The end-product is a sterilised granulated material suitable for use as a fuel. Presently this dried sludge (~ 1100 tonnes per annum) is exported to a licensed recovery facility in Germany.

The sludge drier runs on a 24 hour basis, 7 days a week including holidays. It is shut down for regular maintenance. Deliveries are between 7.00 am and 10.00 pm, Mondays to Fridays, and on Saturdays between 7.00 am and 2.00 pm.

Anaerobic Digestion

The plant will comprise six liquid storage tanks, two pasteuriser tanks and a feed hopper and conveyor located in Building, and two digester tanks and a digestate storage tank located in the south of the site. The digesters will be enclosed by an impermeable cover and heated to 37^{O}C and will be continuously stirred and fed with sludges. This process will produce a biogas and a digestate.

The biogas will contain approximately 65 % methane, which will then be treated and either used as a fuel in the CHP plant or exported to the national gas grid. The digestate will be pasteurised to facilitate its use as a fertiliser.

The digestate has a significant nutrient and soil enhancement value and is typically applied to agricultural lands, either as whole digestate or as a separated fibre. While it is intended to continue the land application of the digestate, it is proposed to provide the capability to dewater the digestate in a new centrifuge that will be located in Building 1. The centrifuge will not be continuously operated but will be used at times when there is pressure on digestate storage capacity.

The centrifuge will produce a fibre (typically 20% dry solids) and a separated liquor. The fibre will be a semi-solid "cake" and will be stored in a trailer inside Building 1. When full the trailer will be sent to the land application banks. The fibre is also suitable for composting and this option will be used in the periods when land application is restricted.

The liquor will be recirculated in the AD process; however following the commissioning of new Irish Water wastewater treatment plant serving Youghal, approval will be sought to discharge some liquor to the Irish Water foul sewer.

Wastewater Treatment Plant

The plant is designed to treat condensate from the sludge drier, landfill leachate and wash water from the wheel wash. It comprises a balance tank with an air diffuser, a dissolved air floatation tank, carbon and sand filters, lamella settlement unit, hypochlorite treatment and a sludge storage tank.

Treatment of Yeast Slurries and Whey Permeates

At some time in the future ERAS ECO may accept and treat yeast slurries to manufacture animal nutrition ingredients. Only whey permeates that have been accepted by the Agency as being by-products will be accepted at the installation. Given the quality control requirements the drying will be carryout in a new building, which will require planning permission. The exhaust from the new drier will be ducted to existing stack and details will be submitted to the Agency by way of an SEW.

3.2 Site Security

There is a concrete block wall along part of the eastern boundary and the remainder of the site is surround by a fence. The fence is inspected regularly and any damage observed is repaired promptly. The site is accessed via electric security gates. There is a security alarm on the administration building.

3.3 Services

The installation obtains water from the mains supply provided by Irish Water. Sanitary wastewater is treated in the on-site waste water treatment system and discharged to a combined Irish Water sewer that outfalls to the Blackwater River Estuary.

3.4 Foul Water Drainage System

Wastewater generated at the installation includes sanitary wastewater from the offices and process waste water. The sanitary wastewater is treated in a proprietary treatment system (Puraflo ©) adjacent to the northern site boundary, before being discharged to the Irish Water combined sewer, that outfalls to the estuary.

Process wastewater comprising condensate from the rotary sludge drier and wash water from the wheel wash is treated in an on-site process waste water treatment plant (WWTP) comprising, pH adjustment, a balance tank, dissolved air floatation unit, carbon and sand filters, lamella settlement unit, hypochlorite treatment and a sludge storage tank. Currently the treated effluent is discharged to the Irish Water combined sewer that outfalls to the estuary.

3.5 Surface Water Drainage System

The operational yards are paved with concrete and surrounded by a kerb. There is a concrete block wall along part of the eastern boundary. Rainwater run-off from roofs and non-waste storage paved areas is collected in the surface water drainage system that connects to two silt/ oil interceptors (Class 1) and a storm water retention tank.

The run-off is reused on-site when possible (wheel wash, the bio-filter, cooling water for the dry product and to backwash the wastewater treatment plant filters) and the surplus water discharges to the Irish Water combined sewer via a retention tank and a non-return valve. The sewer outfalls to the estuary.

3.6 Inventory of Raw Materials and Wastes

Diesel is stored in a plastic double skinned tank (2,600 litres) adjacent to the southern end of Building 2. The liquid sulphuric acid, sodium hypochlorite and sodium hydroxide used in the process wastewater WWTP are stored in four Intermediate Bulk Containers (IBC) in a bunded Chemstore adjacent to the WWTP. The unit has a 1,200 litre polythene collection sump. Leachate will be delivered in road tankers and pumped directly into the WWTP balance tank. The maximum amount materials and wastes on site at any one time are shown in Table 3.1.

Table 3.1 – Materials Inventory

Wastes/Products	Quantity Stored
Untreated Sludge for Drying	250 tonnes
Untreated Liquid Waste	600 tonnes
Contents of Digesters	4496 tonnes
Digestate	500 tonnes
Landfill Leachate (for WWTP)	25 tonnes
Quarantine Waste	1 tonne
Woodchip (for Boiler)	20 tonnes
Diesel (for Boiler)	2,600 litres
Hydraulic Oil	205 litres
Engine Oil	100 litres
Liquid Alum (for WWTP)	1 tonne
Flopam FO 4107 (for WWTP)	0.8 tonnes
Sulphuric Acid (for WWTP)	1 tonne
Soda Ash (for WWTP)	1 tonne
Sodium Hydroxide Solution (for WWTP)	1 tonne
D-10 (Detergent/Disinfectant)	60 litres

3.7 Environmental Emissions

There is one (1 No.) emission point to the surface water (SW-1). There is one (1 No.) emission to sewer (SE-1). There are three (3 No.) existing point emissions to air, which are the boiler stack, the biofilters and the odour control unit in Building 1. The proposed development will result in one new emission point to air, which will be the stack on the CHP plant.

Site operations are a source of noise and the licence specifies noise emission levels for the nearest noise sensitive locations. Operations are also a potential source of dust emissions and the licence specifies dust deposition limits.

3.8 Emergency Response

Eras Eco has adopted an Emergency Response Procedure (ERP) that identifies potential hazards at the site that may cause damage to the environment and also specifies the roles, responsibilities and actions required to deal quickly and efficiently with all foreseeable major incidents and to minimise environmental impacts.

3.9 Operator Performance

3.9.1 Facility Management & Staffing Structure

The Facility Manager has over 12 years' experience in Waste Management and holds a Certificate in FAS Waste Management Training Course. The Environmental, Health & Safety Manager has 7 years' experience in EHSQ and holds a BSc in environmental management, a Certificate in Safety & Health and a NEBOSH Safety Diploma. All operatives are provided with the appropriate and necessary training to complete their assigned tasks.

3.9.1 Compliance History

In 2016 ERAS ECO received notifications of non-compliances regarding waste storage practices, dewatering of sludge, use of waste wood as a fuel, maintenance of the drainage system and stormwater diversion.

3.9.2 Enforcement History

The facility has never been the subject of any enforcement action taken by the regulatory authorities.

3.9.3 Incidents History

There have been no incidents that had the potential to result in significant soil and groundwater contamination.

3.9.4 Complaints History

In 2015 odour complaints were received and an investigation identified these were associated with the emissions from the biofilter. The duct work had become corroded and the emission point which was at a relatively low level. The corrective actions included the replacement of the ducting and extending it to and up the southern elevation of Building 2 to a level where the emission point is above the roof height. This was completed in 2015 and resulted in a reduction in the number of complaints.

In 2016 three complaints were received (15th and 16th March and 8th June) and all were investigated. The potential source of the March complaints were opening the doors of building for the acceptance of woodchip. The investigation of the June complaint did not identify any source other than the potential loss of negative air pressure in the building after the doors were opened to take a delivery of sludge.

3.10 Environmental Sensitivity

3.10.1 Surrounding Land Use

The installation is approximately 2km from Youghal, adjacent to the former Youghal Landfill. The site and the surrounding area are situated on low lying land reclaimed from the Blackwater Estuary which is known locally as Youghal Mudlands. The northern and western boundaries of the site are defined by a public access road and an adjacent development respectively. The lands to the south and west are undeveloped.

3.10.2 Hydrology

The site is located on reclaimed land to the west of the estuary of the Blackwater River. The Tourig River enters the Blackwater to the north of the site. A drainage ditch, which runs adjacent to the access road to the north-west of the site, receives run-off from the access road and from reclaimed land to the north-west. There are a number of other drains to the east and south-east of the site, all of which enter the estuary.

Rainwater run-off from roofs and non-waste storage paved areas is collected in the surface water drainage system that connects to two silt/ oil interceptors (Class 1) and a storm water retention tank.

The run-off is reused on-site when possible (wheel wash, the bio-filter, cooling water for the dry product and to backwash the wastewater treatment plant filters) and the surplus water discharges to the Irish Water combined sewer via a non-return valve. The sewer outfalls to the estuary.

3.10.3 Geology & Hydrogeology.

The soils comprise up to 3m of made ground, comprising gravelly clay soils with fragments of plastic (4-5%), wood (1%), glass (2%) and ceramics (2-3%). It is underlain by a stiff gravelly clay that is more than 14m thick. The bedrock underlying the site is Waulsortian Limestone, which consists of massive, unbedded mounds of calcareous deposits in the form of mudstones, wackestones and packstones.

The Geological Survey of Ireland (GSI) has classified the bedrock that underlies the site as a Locally Important Karstified Aquifer. A search of the GSI well database identified one well used for water supply located approximately 5km west of the site (i.e. up-gradient) and has a reported yield of 979m^3/d .

The aquifer vulnerability rating shown on the GSI Vulnerability Map is “High”; however, a site investigation completed in 2007 encountered up to 14m of gravelly clays beneath the site, giving a site specific vulnerability rating of Moderate.

The groundwater flow direction is to the south-east towards the estuary at low tide, but the direction could vary during high tide.

3.10.4 Designated Sites

The Blackwater River and estuary is designated a Special Protected Area (SPA), a Special Area of Conservation (SAC) and a proposed Natural Heritage Area (pNHA). The installation is located outside the designated areas; however, surface water run-off and treated effluent from the installation discharges to the estuary via the Irish Water combined sewer.

4. RISK ANALYSIS

4.1 Installation Design and Operation

The licence conditions require the provision of mitigation measures, both infrastructural and procedural, that effectively minimise the risk of environmental liabilities associated with unplanned events. Such measures, which are subject to regular review by Eras Eco include:

- Provision of an appropriately experienced Facility Management Team and implementation of appropriate staff training programmes;
- Implementation of a site specific Environmental Management System (EMS), including an Environmental Management Programme (EMP);
- Adoption of site specific Accident Prevention Policy and Emergency Response Procedures (ERPs), which will be reviewed annually;
- Provision of impermeable concrete surfaces in areas where wastes are stored and handled;
- Provision of separate surface water drainage system for areas of the site where there is the potential for contamination of the run-off to occur. Run-off from these areas passes through an oil interceptor before discharge to the Irish Water storm sewer;
- Collection and on-site treatment of condensate from the sludge dyer and water from the wheel wash;
- Provision of appropriate secondary containment for the diesel, engine and hydraulic oil and the WWTP treatment chemicals and routine integrity testing of these to ensure that they are fit for purpose;
- Provision and maintenance of appropriate spill response and clean-up equipment in areas where there is a risk of spills occurring;
- Regular site inspections.

4.2 Risk Identification

Environmental liabilities arise from contamination or damage to environmental media (air, surface water, soils and groundwater), which can act as pathways to sensitive receptors. The Agency, in reaching a decision to grant the current licence, concluded that the installation, if designed and operated in accordance with the licence conditions, will not give rise to environmental liabilities.

Therefore, for the purposes of this ELRA, future environmental liabilities are confined to incidents such as fires, explosions, spills and leaks. The receptors that are potentially susceptible to adverse impacts associated with such incidents include, air, soils, groundwater, surface water and nearby commercial activities and residences.

4.3 Plausible Risks

The plausible risks identified at the site are presented in Table 4.1. These take into account the facility history, the controls and mitigating measures that are already in place, with due regard for those controls to contain incidents and for the potential failure of the controls.

Table 4.1 Risks

Risk ID	Process	Potential Hazards/Risks
1	Diesel Storage	Accidental release of diesel from storage tanks - surface water, groundwater and soil contamination
2		Accidental release of diesel during deliveries and dispensing -surface water contamination.
3	WWTP Chemicals Storage	Accidental spill when filling and emptying the IBC - surface water contamination.
4		Accidental spill when filling and emptying the IBC - soil and groundwater contamination.
5	Fire in Building 1 and Building 2	Contaminated firewater generated and released to estuary – surface water contamination
		Contaminated firewater generated and released to estuary – soil and groundwater contamination
6	AD Digesters/Digestate Tanks	Accidental release of liquor to surface water drains
7		Accidental release of liquor to ground
8	Leachate Treatment	Accidental spill when feeding into WWTP-surface water contamination
		Accidental spill when feeding into WWTP-surface water contamination.
9	WWTP	Leaks/overtopping of treatment tanks and pipework-surface water contamination.
		Leaks /overtopping of treatment tanks and pipework-soil and groundwater contamination.

4.4 Risk Analysis

An assessment of the risks presented by the facility operations was completed taking consideration of site specific characteristics and the Classification Tables for Likelihood and Consequence in the Agency Guidance Document (Ref Table 4.2a and 4.2b).

Table 4.5a – Risk Classification Table (Likelihood)

Risk	Category	Description
1	Very Low	Very low chance of hazard occurring
2	Low	Low chance of hazard occurring
3	Medium	Medium chance of hazard occurring
4	High	High chance of hazard occurring
5	Very High	Very high chance of hazard occurring

Table 4.5b– Risk Classification Table (Consequence)

Risk	Category	Description
1	Trivial	No damage or negligible change to the environment
2	Minor	Minor/localised impact or nuisance
3	Moderate	Moderate damage to the environment
4	Major	Severe damage to the environment
5	Massive	Massive damage to a large area, irreversible in the medium term

The Risk Analysis Form is presented in Table 4.3. The assignation of the severity rating scores takes into consideration the mitigation measures that are already in place. OCM does not consider it plausible that all of the containment and control measures already in place would fail at the time of an incident, as this would require:

a) ERAS ECO to wilfully disregard the licence conditions regarding bund integrity testing; accident prevention and emergency response provisions; inspection and repair of paved areas; maintenance of plant and equipment; staff levels and training, and

b) a failure by the Agency to properly regulate the facility to such an extent that allowed all the control and containment measures to fail.

Table 4.3 Risk Analysis Form

Risk ID	Process*	Potential Risks	Environmental Effect	Likelihood	Basis of Likelihood	Consequence	Basis of Severity
1	Diesel Storage	Uncontrolled release from above ground storage tank that escapes the bund and enters the surface water drains.	Contamination of the surface water drains and the Blackwater Estuary	2	The diesel tank The bund design and construction complies with licence requirements and has more than 110% capacity of the tank. The bund is subject to regular visual inspection and routine integrity testing and repaired as required. Oil interceptor and shut off-valve on storm water system discharging at SW1. ERP will ensure rapid response to incident, including closing of shut off valves on storm water outlet. The risk is **Low.**	2	Surface water run-off from facility passes through an oil interceptor. In addition, the activation of the shut off valve will contain oil contaminated runoff within the site. Given the limited amount of oil stored on site, the rapid response to an incident and presence of the interceptor, the amount of oil that would enter the storm sewer and consequently the estuary would be negligible. The severity of the impact would be **Trivial**
2	Diesel Storage	Escape of diesel to surface water drainage system during filling/dispensing	Surface water contamination of the sewer and the Blackwater Estuary	2	Oil stored in bunded areas. Documented procedure on refuelling tanks, staff fully trained in spill prevention and clean-up. Oil interceptor and shut off-valve on system discharging at SW1. ERP will ensure rapid response to incident, The risk is **Low.**	1	Surface water run-off from the facility passes through an oil interceptor. Given the rapid response to an incident and presence of the interceptor the amount of oil that would enter the storm sewer and consequently the estuary would be negligible. The severity of the impact would be **Trivial**
3	WWTP Treatment Chemicals	Escape of chemicals to surface water drainage system during filling/emptying the IBC	Contamination of the drainage system and the Blackwater Estuary	2	Chemicals stored in bunded area. . Site staff fully trained in spill prevention and clean-up. Shut-off valve on system discharging at SW1. ERP will ensure rapid response to incident. The risk is **Low.**	1	Maximum of 1000 litres of chemicals stored in each IBC. Given the rapid response to an incident and presence of the shut-off valve the amount of oil that would enter the storm sewer and consequently the estuary would be negligible. The severity of the impact would be **Trivial**

Risk ID	Process*	Potential Risks	Environmental Effect	Likelihood	Basis of Likelihood	Consequence	Basis of Severity
4	WWTP Treatment Chemicals	Escape of chemicals to ground during filling/emptying the tank	Soil / groundwater contamination.	2	The area around the storage unit is paved. Site staff fully trained in spill prevention and clean-up. ERP will ensure rapid response to incident, The risk is **Low.**	1	Subsoils are made ground and not water bearing. Aquifer vulnerability is moderate to low. Bedrock aquifer is Locally Important. Given the rapid response to an incident, the condition of the paving, the amount of oil that would infiltrate to ground would be small. The severity of the impact would be **Trivial**
5	Fire	Smoke emission	Air pollution	5	The ERP ensures rapid response to incident. Staff trained in emergency response measures. However if it occurs the risk of smoke emissions is **Very High.**	1	Smoke presents a potential health risk. Surrounding land use primarily commercial. Emergency Service Co-ordinator will make decision on the need to evacuate nearby commercial premises. Could be significant disruption during incident, but no long term effect. The severity of the impact would be **Trivial.**
6	Fire	Escape of firewater to surface water and foul water drainage systems.	Contamination of the Blackwater Estuary	2	The ERP ensures rapid response to incident. Staff trained in emergency response measures. Shut off valve on the surface water lines. The risk is **Low.**	3	The shut off valve on the surface water drain will contain runoff within the site. The amount of firewater entering the combined sewer would be low and would receive significant dilution before it reached the Blackwater Estuary. The severity of the impact would be **Moderate.**
7	Fire	Infiltration of firewater to ground.	Soil / groundwater contamination.	1	The operational area is paved. Site staff fully trained in spill prevention and clean-up. ERP will ensure rapid response to incident, The risk is **Very Low.**	2	Subsoils are made ground and not water bearing. Aquifer vulnerability is moderate to low. Bedrock aquifer is Locally Important. Given the rapid response to an incident, the condition of the paving, the amount of firewater that would infiltrate to ground would be small. The severity of the impact would be **Minor**

Risk ID	Process*	Potential Risks	Environmental Effect	Likelihood	Basis of Likelihood	Consequence	Basis of Severity
8	AD Tanks/ Digestate tanks	Seepage of liquid leak from tanks to ground due to rupture of tanks or damage as a result of structural failure or explosion	Soil/ Groundwater contamination	1	All operational areas are paved with concrete and surrounded by a perimeter kerb. Routine inspection and repair of damaged paved areas. The tanks will be constructed in 2017. The tanks and pipework will be subject to regular inspection and integrity testing, which will identify any damage and facilitate quick repair. Tanks fitted with a blast release roof to minimise damage in event of explosion. The risk is **Very Low**	2	Subsoils are made ground and not water bearing. Aquifer vulnerability is moderate to low. Bedrock aquifer is Locally Important. Given the rapid response to an incident, the condition of the paving, the amount of liquid that would infiltrate to ground would be small. The severity of the impact would be **Minor**
9	AD Tanks & Digestate Storage Tanks	Entry of liquid to surface water drains due to rupture of tank or damage to pipework as result of structural failure or explosion	Surface water contamination	1	The tanks will be constructed in 2017. The tanks and pipework will be subject to regular inspection and integrity testing, which will identify any damage and facilitate quick repair. All drainage passes through a retention tank that limits flow to the river and a shut off valve is provided. Tanks fitted with a blast release roof to minimise damage in event of explosion The risk is **Very Low**.	3	Surface water run-off is discharged to the Blackwater Estuary. Given the restricted flow from the retention tank, the presence of the shut off valve and the dilution available in the river, the severity of impact, including cost of remediation would be **Moderate.**

5. RISK EVALUATION

The risks associated with the operation of the facility fall into four categories:

1 Risk of surface water and/ or soil and groundwater contamination associated with diesel storage and handling.

2 Risk of surface water and/or soil and groundwater contamination associated with waste oil handling.

3 Risk of surface water and/or soil and groundwater contamination associated with a fire.

4 Risk of surface water and/or soil and groundwater contamination associated with a failure of the digester tanks.

Each of the risks have been ranked to assist in the prioritisation of treatment and these are presented in Table 5.1. Only those risks with a risk score greater than 2 have been included.

Table 5.1 Risk Ranking

Risk ID	Process	Potential Risk	Consequence	Likelihood	Risk Score
5	Fire	Air Pollution	1	5	5
6	Fire	Firewater run-off contamination of the Blackwater Estuary	3	2	6
9	AD Tank/Digestate Tanks	Seepage of liquid leaked to surface water system and Blackwater Estuary due to rupture or damage	3	1	3

A colour coded risk matrix (Table 5.2) has been prepared to provide a broad indication of the critical nature of each risk and is a visual tool for regular risk reviews since the success of mitigation can be easily identified.

Table 5.2 Risk Matrix

Likelihood

V. High	5	**5**				
High	4					
Medium	3					
Low	2			**6**		
V. Low	1			**9**		
Consequence		Trivial	Minor	Moderate	Major	Massive
		1	2	3	4	5

Red – High-level risks requiring priority attention.

Amber – Medium-level risks requiring treatment, but not as critical as a High risk.

Green – Lowest-level risks that do not need immediate attention but there is a need for continuing awareness and monitoring on a regular basis.

There are no risks in the red and amber zones that require either priority attention or treatment. The remaining risks are in the green zone indicating a need for continuing awareness and monitoring on a regular basis. A risk treatment programme has been prepared and is presented in Section 6.

6. RISK TREATMENT

The risk management programme for the installation is set out in Table 6.1

Table 6.1 –Risk Management Plan

Risk ID	Potential Risk	Risk Score	Mitigation Measures	Outcome	Action	Person Responsible
6	Firewater run-off contamination of the Blackwater Estuary	6	Shut off valves on both the storm water and drain. Operational area contained by a combination of perimeter kerb and block wall ERP prepared and staff trained in emergency response.	Firewater Retention Assessment to be carried out.	Carry out firewater retention assessment within 6 months and implement any recommendations within 12 months. Staff training on ERP	Facility Manager
9	Seepage of liquid leaked to surface water and Blackwater Estuary due to rupture or damage to digesters and digestate storage tanks	6	Shut off valve on surface water drain. Operational area contained by a combination of perimeter kerb and block wall ERP to be prepared	No further physical mitigation measures required.	Carry out firewater retention assessment within 6 months and implement any recommendations within 12 months Staff training on ERP	Facility Manager

7. IDENTIFICATION OF PLAUSIBLE WORST CASE SCENARIO

The risk analysis identified two (Risk ID 6 and 9) with a moderate consequence and these considered to be the 'worst case' scenario for the facility. It is considered that a fire in Building 2 (ID 6) is the worst possible case as it could have the 'knock on effect' of damage to the diesel storage tank (ID 1) smoke emissions (ID 5). Given the distance between the building and the digesters the fire will not have any effect on the tank.

7.1 Source-Pathway-Receptor

7.1.1 Sources

The source of firewater run-off is a fire at the sludge drying building, which damages the diesel storage tank.

7.1.2 Pathways

Potential pathways for the fumes is the atmosphere. The pathway for the contaminated firewater is the stormwater lines. The pathway for contaminated firewater and digestate to soil/groundwater is damaged paving and underlying subsoil.

7.1.3 Receptors

Potential receptors that could be affected by the fumes are facility staff and the occupants of the adjoining landfill. Given the distance to the nearest private residence it is possible it would have to be evacuated, depending on the wind direction. The potential receptors for the contaminated run-off are the storm sewer and the Blackwater Estuary.

<u>Surface Water</u>

The activation of shut-off valve on the discharge point from the facility will retain firewater and digestate within the drainage system and the site boundary. The kerbs and block wall around the paved areas provide retention capacity, however the volume has not been established.

Foul Water Sewer

The activation of the shut-off valve on the foul sewer will prevent the discharge to the Irish Water foul sewer and onwards to the Blackwater Estuary.

Soil & Groundwater

Contaminated run-off and digestate could infiltrate to ground via damaged paving. The subsoils above the bedrock are made ground, clay and gravel up to 14 m below ground level. The aquifer is classified as Locally Important however the vulnerability at the site is considered to be Moderate to Low. There is only one well within the aquifer, which is located approximately 5 km upgradient of the facility.

7.2 Impacts and Remedial Measures

The potential impacts are on human health, surface water, groundwater or soils. The potential remedial measures include spill containment; demolition and removal of damage buildings or tanks, surface water quality monitoring and ecological compensatory measures, excavation and removal of contaminated soils and reinstatement, monitoring and possible installation and monitoring of groundwater quality and/or possibly groundwater remediation.

8. QUANTIFICATION & COSTING

The costs, which are presented in Table 8.1, are based on the following assumptions:

- The fire service will be on site within 20 minutes of the alarm being raised. The fire will be fought over one day by four fire crews, with one crew remaining on site for 12 hours after the fire has been extinguished.
- The surface water shut-off valve will be closed before the emergency services arrive at the site.
- The rates applied for the removal and off-site disposal of wastes and the contaminated firewater run-off are those currently charged by hazardous waste contractors and include transport and treatment costs.
- Following the incident a soils and groundwater assessment will be carried out. It is assumed that groundwater monitoring wells will be required to determine the nature and extent of the impacts. Provision is made for the remediation of impacted soils.
- Provision is made for surface water quality monitoring and an ecological assessment of the Blackwater Estuary and the implementation of compensatory measures.
- It is not possible to quantify the losses to the atmosphere, but an air quality impact assessment will be carried out following the incident to determine the likely extent, if any, of the impacts associated with emissions to air.
- Given the environmental sensitivity of the site, it is considered that a contingency of 30% is appropriate.

Table 8.1 Worst Case Costs

Task	Description	Quantity (No.)	Measurement Unit	Unit Rate (€)	Cost (€)	Source of unit rates
Response to **Risk ID 9-** Fire and knock-on Risk ID 1, and ID 5	Facility Management and Security.	6	Week	6,000	36,000	ERAS ECO
	Fire Services Attendance on Site[1].	1.5	Day	60,000	90,000	OCM
	Spill containment consumables (extinguishers, booms).	1	Incident	5,000	5,000	ERAS ECO
	Testing of contaminated firewater[2]	4	Sample	250	1,000	OCM
	Transport of contaminated firewater	1,055	m^3	12	12,660	OCM
	Off-site treatment of fire water.[3]	1,055	m^3	23	24,265	OCM
	Demolition of Building[4]	21,175	m^3	20	423,500	OCM
	Removal and off-site disposal of fire damaged materials[5]	300	Tonnes	150	45,000	OCM
	Plant and Equipment Hire	3	Day Rate	5,000	15,000	ERAS ECO
	Removal and disposal non-hazardous building debris[6]	800	Tonne	100	80,000	OCM
	Cleaning yards	2	Day Rate	1,000	2,000	ERAS ECO
	Cleaning drains.[7]	Item	Jet Vac	9,750	9,750	OCM
	Drain integrity survey.	Item		3,500	3,500	OCM
	Air quality assessment.	1	Fees	3,000	3,000	OCM
	Surface water quality monitoring in storm sewer and Blackwater Estuary	12	Sample	250	3,000	OCM
	Remediation of the Blackwater Estuary Remediation of the Carrowmonesh and Galway Bay • Sediment monitoring • Modelling extent of impact • Developing remedial programme • Implementing programme Monitoring effectiveness of programme	Item		300,000	300,000	OCM
	Monitoring in foul sewer	12	Sample	250	3,000	OCM

[1] The day rate of €60,000 is very significantly higher than that set in the EPA's ELRA guidance on fires at landfills, which in approximately €18,000
[2] Includes for laboratory analysis, consultants fees itemised separately
[3] Includes transport and treatment cost
[4] Building 2
[5] Based on tonnage in Building 2 listed in the DMP and assumes all is fire damaged, but none consumed by the fire
[6] Based on the non-hazardous nature of the waste in the Shed, the debris will be classified as non-hazardous
[7] Includes use of Jet Vac tankers and transport and off-site treatment costs.

	Remedial works on Irish Water foul sewer/WWTP	Item		50,000	50,000	PC<
	Soil borings.	10	Boring	100	1,000	OCM
	Soil monitoring.	20	Sample	200	4,000	OCM
	Soil excavation, transport and disposal[8].	120	Tonnes	250	30,000	EPA Guidance
	Reinstatement of excavated area, including repaving.	120	Tonnes	20	2,400	OCM
	Groundwater wells.	3	Borehole	2,500	7,500	OCM
	Groundwater samples[9]	36	Sample	250	9,000	OCM
	Consultancy Services[10].	40	Day	500	20,000	OCM
Total (€)					**980,575**	
Contingency (30%[11])					**294,172**	
Total Including Contingency (€)					**1,274,748**	

[8] Site is paved and subject to regular inspection and repair. Only pathway to soil is damaged paving and leaking drains. Quantity based on and estimated impacted area of $800m^2$ to a depth of 0.1m
[9] Includes for three years post incident monitoring at quarterly intervals
[10] Includes for Structural Engineer and Environmental Consultant
[11] Bases on environmental sensitivity of the site

9. CONCLUSION

This ELRA was carried out in accordance with Agency's Guidance (March 2014). The cost associated with the 'worst case' scenario, is €1,274,748. These costs will be recouped from the Eras Eco's insurance policy.