Mooresfort,
Lattin,
Co. Tipperary

Tel: - 062 55385
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Environmental Protection Agency,
Licensing Department,
Johnstown Castle Estate,
Co.Wexford.

RE: Industrial Emissions Activities Licence Application for Timoleague Agri Gen Ltd., Barryshall, Timoleague, Bandon, Co. Cork. Reg. No: P0986-01.

Dear Sir/Madam,

I refer to your letter requesting clarification of further information dated 03 March 2014 in relation to the above Industrial Emissions Activities Licence Application for Timoleague Agri Gen Ltd.

We here in attach our clarification response in the same numerical order:

6. Complete the tables referenced in section E.1. of the application form with regard to the emissions to atmosphere from both biofilters, the CHP engines, the boiler and any other significant emissions to air and include as part of the EIS.

Air Dispersion Modelling in accordance with the Air Dispersion Modelling Guidance Document issued by the EPA 2010, has been prepared by Dr. Brian Sheridan of Odour Monitoring Ireland Ltd. Enclosed, please find 2 no hard copies of the final report prepared and also 2 no copies in pdf format on the accompanying CD-ROMs.

In addition to the above please also provide an updated non-technical summary to reflect the information provided in your reply.

An updated Non-technical summary is attached.

I trust that this submission meets with your requirements.

Yours Sincerely,

Julianne O' Brien
NRGE Ltd.

27th Nov 2014.

This submission is supported by:

• Dispersion Modelling Assessment of Emissions from Proposed Anaerobic Digestion Facility – prepared by Dr. Brian Sheridan of Odour Monitoring Ireland Ltd. • Revised Non-Technical Summary	2 hard copies 2 copies on CD-ROM (pdf format)

Dispersion Modelling Assessment of Emissions from Proposed Anaerobic Digestion Facility

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DISPERSION MODELLING ASSESSMENT OF EMISSIONS FROM PROPOSED ANAEROBIC DIGESTION FACILITY TO BE LOCATED IN TIMOLEAGUE AGRI GEN LTD, BARRYSHALL, TIMOLEAGUE, BANDON, CO. CORK.

PERFORMED BY ODOUR MONITORING IRELAND ON THE BEHALF OF NRGE LTD.

REPORT PREPARED BY:	Dr. Brian Sheridan
REPORT VERSION:	Document Ver.2
ATTENTION:	Mr Michael McEniry
DATE:	20th Nov 2014
REPORT NUMBER:	2014484(2)
REVIEWERS:	Mr. Michael Sweeney

TABLE OF CONTENTS

Document Amendment Record

Client: ***NRGE Ltd***

Title: Dispersion modelling assessment of emissions from proposed anaerobic digestion facility, to be located in Timoleague Agri Gen Ltd, Barryshall, Timoleague, Bandon, Co. Cork.

Project Number: 2014448(2)			**DOCUMENT REFERENCE:** Dispersion modelling assessment of emissions from proposed anaerobic digestion facility, to be located in Timoleague Agri Gen Ltd, Barryshall, Timoleague, Bandon, Co. Cork.		
2014448(1)	Document for review	B.A.S.	JMC	B.A.S	20/11/2014
2014448(2)	Document for review	B.A.S.	JMC	B.A.S	26/11/2014
Revision	**Purpose/Description**	**Originated**	**Checked**	**Authorised**	**Date**

ODOUR monitoring IRELAND

EXECUTIVE SUMMARY

Odour Monitoring Ireland was commissioned by NRGE Ltd to perform a dispersion modelling assessment of exhaust gas emissions from the proposed operation of an anaerobic digestion facility to be located in Timoleague Agri Gen Ltd, Barryshall, Timoleague, Bandon, Co. Cork. Emission limit values of specific compounds namely Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Total particulates, Total non-methane Volatile organic compounds, Hydrogen sulphide, odour and source characteristics (of emission points) were inputted into the dispersion modelling to allow for the assessment of air quality in the vicinity of the proposed emissions points when in operation.

Dispersion modelling assessment was performed utilising AERMOD Prime (12060) dispersion model. Five years of hourly sequential meteorological data from Cork (2003 to 2007 inclusive) was used within the dispersion model. The dispersion modelling assessment was performed in accordance with requirements contained in AG4 – Irish EPA Guidance for dispersion modelling. The total proposed mass limit emission rate of each pollutant was inputted with the source characteristics into the dispersion model in order to assess the maximum predicted ground level concentrations of each pollutant in the vicinity of the facility. This was then compared with statutory and guideline ground level concentration limit values for such pollutants.

The following conclusions are drawn from the study:

1. The assessment was carried out to provide information in line with standard information to be provided to the EPA and regulatory bodies for such projects.

2. Specific dispersion modelling was performed for Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Particulate matter, TNMVOC as Benzene, Hydrogen sulphide and Odour.

3. With regards to Carbon monoxide, the maximum GLC+Baseline for CO from the operation of the facility is 513 µg m^{-3} for the maximum 8-hour mean concentration at the 100th percentile. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values set out in SI 180 of 2011 and Directive 2008/50/EC, this is 5.13% of the impact criterion. In addition, the predicted ground level concentration of Carbon monoxide at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

4. With regards to Oxides of nitrogen, the maximum GLC+Baseline for NO_2 from the operation of the facility is 56 µg m^{-3} for the maximum 1-hour mean concentration at the 99.79th percentile. When combined predicted and baseline conditions are compared to SI 180 of 2011 and Directive 2008/50/EC, this is 28% of the impact criterion. An annual average was also generated to allow comparison with values contained in SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 14.40 µg/m^3. When compared the annual average NO_2 air quality impact criterion is 36% of the impact criterion. In addition, the predicted ground level concentration of Oxides of nitrogen at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

5. With regards to Sulphur dioxide, the maximum GLC+Baseline for SO_2 from the operation of the facility is 98 and 43 µg m^{-3} for the maximum 1-hour and 24 hr mean concentration at the 99.73th and 99.18th percentile respectively. When combined predicted and baseline conditions are compared to SI 180 of 2011 and Directive 2008/50/EC, this is 28 and 34.30% of the set target limits established for the 1 hour and 24 hour assessment criteria. An annual average was also generated to allow comparison with SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted

annual average ground level concentration in the vicinity of the facility was 8.0 μg/m^3. When compared the annual average SO_2 air quality impact criterion is 40% of the impact criterion. In addition, the predicted ground level concentration of Sulphur dioxide at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

6. With regards to Particulate matter, the maximum GLC+Baseline for Particulate matter 10μm from the operation of the facility is 16.90 μg m^{-3} for the maximum 24-hour mean concentration at the 90.40th percentile. When combined predicted and baseline conditions are compared to Directive 2008/50/EC, this is 33.80% of the impact criterion. An annual average was also generated to allow comparison with the SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 15.50 μg/m^3. When compared, the annual average Particulate matter air quality impact is 38.75 % of the impact criterion. An annual average was also generated for $PM_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 15.50 μg/m^3. When compared, the annual average $PM_{2.5}$ air quality impact is 62% of the impact criterion. In addition, the predicted ground level concentration of Particulate matter at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

7. With regards to the results from the assessment of TNMVOC as Benzene ground level concentrations, the results indicate that the ambient ground level maximum annual average concentrations anywhere in the vicinity of the facility could be up to 24% of the impact criterion (assuming all TNMVOC is Benzene which will not be the case). In addition, the predicted ground level concentration of TNMVOC as Benzene at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

8. With regards to Hydrogen sulphide, the results indicate that the maximum ambient 1 hour average ground level concentrations will be no greater than 1.30 μg/m^3. Typical odour recognition threshold for Hydrogen sulphide is 14 μg/m^3. Therefore the predicted ground level concentration is well below the odour recognition threshold for hydrogen sulphide.

9. With regards to odour, it is predicted that odour plume spread is radial with an approximate spread of 150 metres from the emission point with no sensitive receptors impacted by the plume. All resident locations in the vicinity of the proposed facility operations will perceive an odour concentration less than 0.87 Ou_E/m^3 at the 98th percentile of hourly averages for worst case meteorological year Cork 2007. In accordance with odour impact criterion presented in *Table 2.1*, and in keeping with currently recommended odour impact criterion in this country, no long-term odour impacts will be generated by receptors in the vicinity of the proposed facility operations. In addition, the predicted ground level concentration of Odour at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*. A number of key mitigation measures as outlined in Section 4.1.6 will need to be implemented into the design of the odour containment, capture and treatment system to ensure compliance.

10. The overall modelling indicates that the facility will not result in any significant impact on air quality in the surrounding area with all ground level concentrations of pollutants well within their respective ground level concentration limit values.

1. Introduction and scope

1.1 Introduction

Odour Monitoring Ireland was commissioned by NRGE Ltd to perform a dispersion modelling assessment of proposed emission limit values for a range of pollutants which could potentially be emitted from the proposed anaerobic digestion facility to be located in Timoleague Agri Gen Ltd, Barryshall, Timoleague, Bandon, Co. Cork.

The assessment allowed for the examination of proposed short and long term ground level concentrations (GLC's) of compounds as a result of the operation of proposed emission points – Gas utilisation engine 1 (AEP1), and Odour control unit 1 (AEP2). The main compounds assessed included Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Total particulates, Total non methane volatile organic compounds (expressed as Benzene), Hydrogen sulphide and Odour.

Predicted dispersion modelling GLC's were compared to proposed regulatory / guideline ground level limit values for each pollutant.

The materials and methods, results, discussion of results and conclusions are presented within this document.

1.2 Scope of the work

The main aims of the study included:

- Air dispersion modelling assessment in accordance with AG4 guidance of proposed mass emission limits of specified pollutants to atmosphere from the anaerobic digestion facility to be located in Timoleague Agri Gen Ltd, Barryshall, Timoleague, Bandon, Co. Cork.
- Assessment whether the predicted ground level concentrations of pollutants are in compliance with ground level concentration limit values as taken from SI 180 of 2011 – Air Quality Regulations, CAFE Directive 2008/50/EC, AG4 guidance document and Environment Agency H4 Guidance documents Parts 1 and 2.

1.3 Model assumptions

The approach adopted in this assessment is considered a worst-case investigation in respect of emissions to the atmosphere from proposed emission points. These predictions are therefore most likely to over estimate the GLC's that may actually occur for each modelled scenario. These assumptions are summarised and include:

- Emissions to the atmosphere from the emission points – AEP1 to AEP2 process operations were assumed to occur 24 hours each day / 7 days per week over a standard year at 100% output.
- Five years of hourly sequential meteorological data from Cork 2003 to 2007 inclusive was screened to assess worst case dispersion year which will provide statistical significant results in terms of the short and long term assessment. This is in keeping with current national and international recommendations. The worst case year Cork 2007 was used for data presentation.
- Maximum GLC's + Background were compared with relevant air quality objects and limits;
- All emissions were assumed to occur at maximum potential emission concentration and mass emission rates for each scenario.
- AERMOD Prime (12060) dispersion modelling was utilised throughout the assessment in order to provide the most conservative dispersion estimates.
- Five years of hourly sequential meteorological data from Cork 2003 to 2007 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 met station was 2007 and was used for contour plot presentation. This is in keeping with current national and international recommendations (EPA Guidance AG4 and EA Guidance H4). 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.

- All building wake effects on all applicable emission points were assessed within the dispersion model using the building prime algorithm (e.g. all buildings / structures / tanks were included).

2. Materials and methods

This section describes the materials and methods used throughout the dispersion modelling assessment.

2.1 Dispersion modelling assessment

2.1.1 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. 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).

Any dispersion modelling approach will exhibit variability between the predicted values and the measured or observed values due to the natural randomness of atmospheric environment. A model prediction can, at best, represent only the most likely outcome given the apparent environmental conditions at the time. Uncertainty depends on the completeness of the information used as input to the model as well as the knowledge of the atmospheric environment and the ability to represent that process mathematically. Good input information (emission rates, source parameters, meteorological data and land use characteristics) entered into a dispersion model that treats the atmospheric environment simplistically will produce equally uncertain results as poor information entered into a dispersion model that seeks to simulate the atmospheric environment in a robust manner. It is assumed in this discussion that pollutant emission rates are representative of maximum emission events, source parameters accurately define the point of release and surrounding structures, meteorological conditions define the local atmospheric environment and land use characteristics describe the surrounding natural environment. These conditions are employed within the dispersion modelling assessment therefore providing good confidence in the generated predicted exposure concentration values.

2.1.2 Atmospheric dispersion modelling of air quality: dispersion model selection

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).

Input data from stack emissions, and source characteristics will be used to construct the basis of the modelling scenarios.

2.2 Air quality impact assessment criteria

The predicted air quality impact from the operation of proposed emission points AEP1 to AEP2 for each scenario is compared to relevant air quality objectives and limits. Air quality standards and guidelines referenced in this report include:

- SI 180 of 2011 – Air Quality Standards Regulations 2011.
- EU limit values set out in the Directives on Air Quality 2008/50/EC.
- Horizontal guidance Note, IPPC H4, Parts 1 and 2, UK Environment Agency.
- AG4 guidance document on dispersion modelling, Environmental Protection Agency.

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 standard for the protection of vegetation and ecosystems.

The relevant air quality standards for proposed emission sources AEP1 to AEP2 are presented in *Table 2.1.*

2.2.1 Air Quality Guidelines value for air pollutants

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

Table 2.1. EU and Irish Limit values set out in the SI 180 of 2011, CAFÉ directive 2008/50/EC, H4 Guidance documents Parts 1 and 2 and AG4 guidance document.

POLLUTANT	Objective			
	Concentration[2]	**Maximum No. Of exceedences allowed[3]**	**Exceedence expressed as percentile[3]**	**Measured as**
Nitrogen dioxide and oxides of nitrogen	300 µg m^{-3} NO_2 200 µg m^{-3} NO_2 40 µg m^{-3} NO_2	18 times in a year 18 times in a year --	99.79th percentile 99.79th percentile --	1 hour mean 1 hour mean Annual mean
Particulates (PM_{10}) (2008/50/EC)	50 µg m^{-3} 40 µg m^{-3}	35 times in a year None	90.40th percentile	24 hour mean Annual mean
Particulates ($PM_{2.5}$) (2008/50/EC)	25 µg m^{-3} – Stage 1 20 µg m^{-3} – Stage 2	None None	-- --	Annual mean Annual mean
Carbon monoxide (CO)	10 mg m^{-3} (10,000 µg m^{-3})	None	100th percentile	Running 8 hour 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 99.18th percentile --	1 hour mean 24 hour mean Annual mean and winter mean (1st Oct to 31st March
Total non-methane VOC's (expressed as Benzene)	5 µg m^{-3}	None	--	Annual mean
Hydrogen sulphide	14 µg m^{-3} (at receptor)	None	100th percentile	1 hour mean
Odour	<1.50 Ou_E/m^3	175 times in a year	98th percentile	1 hour mean

2.3 Existing Baseline 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 rural imissions of the compounds listed in *Table 2.1*. *Table 2.2* illustrates the baseline data expected to be obtained from rural areas for classical air pollutants. Since the proposed facility is located in a rural area, it would be considered located in a Zone D area according to the EPA's classification of zones for air quality. Traffic and industrial related emissions would be low / medium.

Table 2.2. Baseline air quality data used to assess air quality impact criterion in a number of Zone D regions.

Reference air quality data – Source identity	Sulphur dioxide- SO_2 (µg m^{-3})	Nitrogen dioxide- NO_x as NO_2 (µg m^{-3})	Particulate matter- PM_{10} (µg m^{-3})	Particulate matter- $PM_{2.5}$ (µg m^{-3})	Carbon monoxide – CO (mg m^{-3})	Benzene (µg m^{-3})
Emo Laois	-	4	-	-	-	-
Castlebar Mayo	-	11	15	-	-	-
Kilkitt, Monaghan	3	4	11	-	-	-
Shannon estuary	2	-	-	-	-	-
Mullingar	-	-	-	-	0.30	0.50
Coleraine St	-	-	-	-	0.30	-
Claremorris	-	-	13	8	-	-
Longford	-	-	-	17	-	-

Notes: [1] denotes taken from Air quality monitoring report 2013, www.epa.ie.

2.4 Meteorological data

Five years of hourly sequential meteorological data was chosen for the modelling exercise (i.e. Cork 2003 to 2007 inclusive). A schematic wind rose and tabular cumulative wind speed and directions of all five years are presented in *Section 7*. All five years of met data was screened to provide more statistical significant result output from the dispersion model. 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.

2.5 Terrain data

Topography effects were accounted for within the dispersion modelling assessment. Individual sensitive receptors were inputted into the model at their specific height in order to take account of any effects of elevation on GLC's at their specific locations. Topographical data was received from OS Ireland and was inputted into the model utilising the AERMAP algorithm.

2.6 Building wake effects

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

3. Results

This section describes the results obtained for the dispersion modelling exercise. All input data and source characteristics were developed in conjunction with engineering drawings and documentation supplied to OMI for the development.

3.1. Dispersion model input data – Source characteristics

Table 3.1 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 3.1. Source characteristics for proposed emission points AEP1 to AEP2**.**

Parameter	Emission point AEP1 – Gas Engine 1	Emission point AEP2–OCU 1
X coordinate	146351.6	146405.7
Y coordinate	42429.6	42394.1
Elevation (A.O.D) (m)	22.25	22.25
Stack height (m)	15	3
Orientation	Vertical	Vertical
Temperature (K)	453	293
Efflux velocity (m/s)	19.52	0.039
Max volume flow (Nm^3/hr)	4,200[1]	18,960[2]
Max volume flow (Am^3/hr)	4,968	20,349
Stack tip diameter (m)	0.30	132 m^2
Max building/structure height (m)	18.7	12.50
Building ground level (m)	20.5	20.5

Notes: [1] denotes referencing conditions for emission point AEP1 are 273.15K, 101.3KPa, dry gas, 5% O_2.
[2]denotes referencing conditions for emission point AEP2 is 293K, 101.3KPa, wet gas, 20.9% O_2.

3.2 Process emissions - Volume flow rate and flue gas concentration guarantees

The input mass emission rate data used in the dispersion model for each emission point is presented in *Tables 3.2 and 3.3* for each scenario. All source characteristics and location are reported in *Table 3.1*. These will be utilised as process guarantees for the operating process emission points so as to ensure compliance with the stated guideline limits

Table 3.2. Emission values from exhaust stack of the emission source AEP1.

Parameters – Exhaust stack AEP 1	Conc. Limit Values	Units	Volume flow (Nm^3/hr ref 5% O_2)	Mass emission rate (g/s)
Carbon monoxide (CO)	1,500	mg/Nm^3 5% O_2	4,200	1.750
Oxides of nitrogen (NOx as NO_2)	500	mg/Nm^3 5% O_2	4,200	0.583
Sulphur dioxide (SO_2)	500	mg/Nm^3 5% O_2	4,200	0.583
Total particulates	50	mg/Nm^3 5% O_2	4,200	0.058
Total non methane Volatile organic compounds	75	mg/Nm^3 5% O_2	4,200	0.088
Hydrogen sulphide	5	mg/Nm^3 5% O_2	4,200	0.006

Table 3.3. Emission values from exhaust stack of the emission source AEP2.

Parameters – Exhaust stack AEP2	Conc. Limit Values	Units	Volume flow (m^3/hr)	Mass emission rate (Ou_E/s)
Reception building extraction	1,000	Ou_E/m^3	11,960	3,322
Fibre store	1,000	Ou_E/m^3	7,000	1,944
Total extraction through OCU 1	**1,000**	**Ou_E/m^3**	**18,960**	**5,267**

3.3 Dispersion modelling assessment

AERMOD Prime (12060) was used to determine the overall ground level impact of proposed emission points AEP1 to AEP2 to be located in the anaerobic digestion facility Timoleague Agri Gen Ltd, Barryshall, Timoleague, Bandon, Co. Cork. These computations give the relevant GLC's at each 30 and 150-meter X Y Cartesian grid receptor location that is predicted to be exceeded for the specific air quality impact criteria. Individual receptor elevations were established at their specific height above ground and also included a 1.80 m normal breathing zone. A total Cartesian + individual receptors of 2,133 points was established giving a total grid coverage area of 9.0 square kilometres around the emission point (fine grid area 1.44 and course grid area of 9.0 km sq).

Five years of hourly sequential meteorological data from Cork (Cork 2003 to 2007 inclusive) and source characteristics (*see Table 3.1*), including emission date contained in *Tables 3.2 to 3.3* were inputted into the dispersion model.

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.

3.4 Dispersion model Scenarios

AERMOD Prime (USEPA ver. 12060) was used to determine the overall air quality impact of the emission points while in operation at 100% capacity for named air pollutants.

Impacts from the named emission points were assessed in accordance with the impact criterion contained in Directive 2008/50/EC, SI 180 of 2011, H4 guidance and AG4 guidance documents.

Twelve scenarios were assessed within the dispersion model examination for each of the classical air pollutants and as requested by the EPA (email correspondence).

The dispersion modelling is carried out in line with the requirements of guidance document AG4- Dispersion modelling.

The output data was analysed to calculate the following:

Ref Scenario 1: Predicted cumulative ground level concentration of Carbon monoxide emission contribution of cumulative emissions for the 100th percentile of 8 hour averages for Cork meteorological station year 2007 for a Carbon monoxide concentration of less than or equal to 160 µg/m^3 assuming 24 hr operation (*see Figure 6.2*).

Ref Scenario 2: Predicted cumulative ground level concentration of Oxides of nitrogen emission contribution of cumulative emissions for the 99.79th percentile of 1 hour averages for Cork meteorological station year 2007 for an Oxides of nitrogen concentration of less than or equal to 28 µg/m^3 assuming 24 hr operation (*see Figure 6.3*).

Ref Scenario 3: Predicted cumulative ground level concentration of Oxides of nitrogen emission contribution of cumulative emissions for the Annual average for Cork meteorological station year 2007 for an Oxides of nitrogen concentration of less than or equal to 1.75 μg/m^3 assuming 24 hr operation (*see Figure 6.4*).

Ref Scenario 4: Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the 99.73th percentile of 1 hour averages for Cork meteorological station year 2007 for an Sulphur dioxide concentration of less than or equal to 70 μg/m^3 assuming 24 hr operation (*see Figure 6.5*).

Ref Scenario 5: Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the 99.18th percentile of 24 hour averages for Cork meteorological station year 2007 for an Sulphur dioxide concentration of less than or equal to 30 μg/m^3 assuming 24 hr operation (*see Figure 6.6*).

Ref Scenario 6: Predicted cumulative ground level concentration of Sulphur dioxide emission contribution of cumulative emissions for the Annual average for Cork meteorological station year 2007 for an Sulphur dioxide concentration of less than or equal to 2.5 μg/m^3 assuming 24 hr operation (*see Figure 6.7*).

Ref Scenario 7: Predicted cumulative ground level concentration of Total particulates as PM_{10} emission contribution of cumulative emissions for the 90.40th percentile of 24 hour averages for Cork meteorological station year 2007 for an Total particulates as PM_{10} concentration of less than or equal to 1.30 μg/m^3 assuming 24 hr operation (*see Figure 6.8*).

Ref Scenario 8: Predicted cumulative ground level concentration of Total particulates as PM_{10} emission contribution of cumulative emissions for the Annual average for Cork meteorological station year 2007 for an Total particulates as PM_{10} concentration of less than or equal to 0.30 μg/m^3 assuming 24 hr operation (*see Figure 6.9*).

Ref Scenario 9: Predicted cumulative ground level concentration of Total particulates as $PM_{2.5}$ emission contribution of cumulative emissions for the Annual average for Cork meteorological station year 2007 for an Total particulates as $PM_{2.5}$ concentration of less than or equal to 0.30 μg/m^3 assuming 24 hr operation (*see Figure 6.10*).

Ref Scenario 10: Predicted cumulative ground level concentration of TNMVOC as Benzene emission contribution of cumulative emissions for the Annual average for Cork meteorological station year 2007 for an TNMVOC as Benzene concentration of less than or equal to 0.50 μg/m^3 assuming 24 hr operation (*see Figure 6.11*).

Ref Scenario 11: Predicted cumulative ground level concentration of Hydrogen sulphide emission contribution of cumulative emissions for the 100th percentile of 1 hourly averages for Cork meteorological station year 2007 for an Hydrogen sulphide concentration of less than or equal to 1.0 μg/m^3 assuming 24 hr operation (*see Figure 6.12*).

Ref Scenario 12: Predicted cumulative ground level concentration of Odour emission contribution of cumulative emissions for the 98th percentile of hourly averages for Cork meteorological station year 2007 for an Odour concentration of less than or equal to 1.50 Ou_E/m^3 assuming 24 hr operation (*see Figure 6.13*).

4. Discussion of results

This section will present the results of the dispersion modelling.

AERMOD GIS Pro Prime (Ver. 12060) was used to determine the overall named air pollutant air quality impact of the proposed emission points AEP1 to AEP2 during operation.

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 2.2.1*. In particular, 1-hour, 24 hour, percentile and annual average GLC's of the specified pollutants were calculated at 30 and 150 metres distances from the site over a fine and coarse grid extent of 9.0 kilometres squared. Relevant percentiles of these GLC's were also computed for comparison with the relevant pollutant Air Quality Standards to include SI 180 of 2011, Directive 2008/50/EC and AG4 guidance document.

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 treatment

35% for short-term and 70% for long-term average concentration should be considered to assess compliance with the relevant air quality objective.

This is in accordance with recommendations from the Environmental Agency UK for the dispersion modelling of NO_2 emissions from combustion processes, www.environmentagency.gov.uk

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

- Worse case scenario treatment as detailed above (for NO_x only).

Maximum predicted GLC's are presented within this table to allow for comparison with Directive 2008/50/EC and SI 180 of 2011. In addition, the predicted ground level concentrations at the selected residential receptors are presented in the Discussion of Results section of the document for all pollutants. A total of 11 individual sensitive receptors were included within the dispersion model and the location of same is presented in *Figure 6.1*. Illustrative contour plots for information purposes only are presented in *Section 6* of this report for each modelled scenario.

4.1 Assessment of air quality impacts for pollutants from proposed emission points AEP1 to AEP2

Predictive air dispersion modelling was used to ascertain the maximum ground level concentrations at or beyond the boundary of the facility of selected worst case pollutant concentration to allow for comparison with the ground level limit values contained in *Table 2.1*. *Table 4.1* illustrates the results of the dispersion modelling assessment for each pollutant and comparison with the air quality guideline and limit values contained in *Table 2.1* for the worst case GLC.

Table 4.1. Comparison between predicted GLC's + baseline national air quality data and limit values contained in *Table 2.1*.

Ref No	X coordinate (m)	Y coordinate (m)	Scen 1 (µg/m^3)	Scen 2 (µg/m^3)	Scen 3 (µg/m^3)	Scen 4 (µg/m^3)	Scen 5 (µg/m^3)	Scen 6 (µg/m^3)	Scen 7 (µg/m^3)	Scen 8 (µg/m^3)	Scen 9 (µg/m^3)	Scen 10 (µg/m^3)	Scen 11 (µg/m^3)	Scen 12 (Ou_E/m^3)
R1	146962	42317	54.65	8.56	0.41	22.40	4.21	0.59	0.20	0.06	0.06	0.09	0.49	0.37
R2	146684	42517	50.09	13.52	0.83	34.97	7.11	1.19	0.39	0.12	0.12	0.18	0.61	0.87
R3	146427	41847	28.82	5.73	0.29	14.41	3.97	0.42	0.15	0.04	0.04	0.06	0.39	0.10
R4	146247	41573	10.71	1.55	0.06	3.57	0.73	0.08	0.03	0.01	0.01	0.01	0.11	0.02
R5	145822	42137	33.40	4.22	0.13	11.68	3.14	0.19	0.06	0.02	0.02	0.03	0.37	0.02
R6	145833	42400	41.03	6.10	0.22	16.55	5.42	0.31	0.09	0.03	0.03	0.05	0.61	0.04
R7	146175	42435	137.97	25.96	1.17	65.68	21.81	1.66	0.53	0.17	0.17	0.25	1.25	0.38
R8	146118	42686	72.76	11.19	0.36	30.46	8.11	0.51	0.17	0.05	0.05	0.08	0.66	0.12
R9	146296	42807	70.33	12.80	0.56	34.86	12.09	0.81	0.24	0.08	0.08	0.12	0.52	0.31
R10	146035	42975	37.01	8.19	0.22	19.67	5.36	0.32	0.10	0.03	0.03	0.05	0.46	0.04
R11	146126	43022	46.15	6.71	0.27	17.49	7.00	0.39	0.11	0.04	0.04	0.06	0.38	0.12
Worst case conc. at receptor location	-	-	137.97	25.96	1.17	65.68	21.81	1.66	0.53	0.17	0.17	0.25	1.25	0.87
Worst case baseline conc. (µg/m^3)	-	-	300.00	22.00	11.00	6.00	3.00	3.00	15.00	15.00	15.00	0.50	-	-
Max predicted value	-	-	213.00	34.00	3.40	92.00	40.00	5.00	1.90	0.50	0.50	0.70	1.30	0.87
Baseline + worst case receptor prediction	-	-	437.97	47.96	12.17	71.68	24.81	4.66	15.53	15.17	15.17	0.75	1.25	0.87
Baseline + max predicted value	-	-	513.00	56.00	14.40	98.00	43.00	8.00	16.90	15.50	15.50	1.20	1.30	0.87
Limit value	-	-	10,000	200	40	350	125	20	50	40	25	5	14	2
% of impact criterion at receptor location	-	-	**4.38**	**23.98**	**30.41**	**20.48**	**19.85**	**23.32**	**31.06**	**37.91**	**60.66**	**15.03**	**8.92**	**58.30**
% of impact criterion for worst case prediction	-	-	**5.13**	**28.00**	**36.00**	**28.00**	**34.40**	**40.00**	**33.80**	**38.75**	**62.00**	**24.00**	**9.29**	**58.00**

As can be observed in *Table 4.1*, the predicted maximum averaging ground level concentration and baseline concentration are presented as a % of the impact criterion contained in *Tables 2.1*.

4.1.1 Carbon monoxide – Ref Scenario 1

The results for the potential air quality impact for dispersion modelling of CO based on process guaranteed emission rates in *Tables 3.2 to 3.3* are presented in *Table 4.1.* Results are presented for the maximum predicted percentile emission regime. As can be observed in *Table 4.1,* the maximum GLC+Baseline for CO from the operation of the facility is 513 $\mu g\ m^{-3}$ for the maximum 8-hour mean concentration at the 100th percentile. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values set out in SI 180 of 2011 and Directive 2008/50/EC, this is 5.13% of the impact criterion.

In addition, the predicted ground level concentration of Carbon monoxide at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

4.1.2 Oxides of nitrogen – Ref Scenario 2 and 3

The results for the potential air quality impact for dispersion modelling of NO_X as NO_2 based on process guaranteed emission rates in *Tables 3.2 to 3.3* are presented in *Table 4.1.* Results are presented for the maximum predicted percentile emission regime. As can be observed in *Table 4.1,* the maximum GLC+Baseline for NO_2 from the operation of the facility is 56 $\mu g\ m^{-3}$ for the maximum 1-hour mean concentration at the 99.79th percentile. When combined predicted and baseline conditions are compared to SI 180 of 2011 and Directive 2008/50/EC, this is 28% of the impact criterion.

An annual average was also generated to allow comparison with values contained in SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 14.40 $\mu g/m^3$. When compared the annual average NO_2 air quality impact criterion is 36% of the impact criterion.

In addition, the predicted ground level concentration of Oxides of nitrogen at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

4.1.3 Sulphur dioxide – Ref Scenario 4, 5 and 6

The results for the potential air quality impact for dispersion modelling of SO_2 based on process guaranteed emission rates in *Tables 3.2 to 3.3* are presented in *Table 4.1.* Results are presented for the maximum predicted percentile emission regime. As can be observed in *Table 4.1,* the maximum GLC+Baseline for SO_2 from the operation of the facility is 98 and 43 $\mu g\ m^{-3}$ for the maximum 1-hour and 24 hr mean concentration at the 99.73th and 99.18th percentile respectively. When combined predicted and baseline conditions are compared to SI 180 of 2011 and Directive 2008/50/EC, this is 28 and 34.40% of the set target limits established for the 1 hour and 24 hour assessment criteria.

An annual average was also generated to allow comparison with SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 8.0 $\mu g/m^3$. When compared the annual average SO_2 air quality impact criterion is 40% of the impact criterion.

In addition, the predicted ground level concentration of Sulphur dioxide at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

4.1.4 Particulate matter – Ref Scenario 7, 8, and 9

The results for the potential air quality impact for dispersion modelling of Particulate matter based on process guaranteed emission rates in *Tables 3.2 to 3.3* are presented in *Table 4.1.* Results are presented for the maximum predicted percentile emission regime. As can be observed in *Table 4.1,* the maximum GLC+Baseline for Particulate matter 10µm from the operation of the facility is 16.90 µg m^{-3} for the maximum 24-hour mean concentration at the 90.40^{th} percentile, respectively. When combined predicted and baseline conditions are compared to Directive 2008/50/EC, this is 33.80% of the impact criterion.

An annual average was also generated to allow comparison with the SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 15.50 µg/m^3. When compared, the annual average Particulate matter air quality impact is 38.75 % of the impact criterion.

An annual average was also generated for $PM_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 15.50 µg/m^3. When compared, the annual average $PM_{2.5}$ air quality impact is 62% of the impact criterion.

In addition, the predicted ground level concentration of Particulate matter at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

4.1.5 TNMVOC as Benzene – Ref Scenario 10

The results for the potential air quality impact for dispersion modelling of TNMVOC as Benzene based on process guaranteed emission rates in *Tables 3.2 to 3.3* are presented in *Table 4.1*. TNMVOC as Benzene modelling results indicate that the ambient ground level annual average concentrations could be up to 24% of the impact criterion (assuming all TNMVOC is Benzene which will not be the case).

In addition, the predicted ground level concentration of TNMVOC as Benzene at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

4.1.6 Hydrogen sulphide – Ref Scenario 11

The results for the potential air quality impact for dispersion modelling of Hydrogen sulphide based on process guaranteed emission rates in *Tables 3.2 to 3.3* are presented in *Table 4.1*. Hydrogen sulphide modelling results indicate that the maximum ambient 1 hour average ground level concentrations will be no greater than 1.30 µg/m^3.

Typical odour recognition threshold for Hydrogen sulphide is 14 µg/m^3. Therefore the predicted ground level concentration is well below the odour recognition threshold for hydrogen sulphide.

4.1.7 Odour – Ref Scenario 12

The results for the potential air quality impact for dispersion modelling of Odour based on the process guaranteed emission rates in *Table 3.3* are presented in *Table 4.1 and Figure 6.13*. Odour modelling results indicate that the ambient ground level concentrations are below the relevant guideline odour air quality guideline value.

As can be observed in *Figure 6.13*, it is predicted that odour plume spread is radial with an approximate spread of 150 metres from the emission point with no sensitive receptors impacted by the plume. All resident locations in the vicinity of the proposed facility operations will perceive an odour concentration less than 0.87 Ou_E/m^3 at the 98th percentile of hourly averages for worst case meteorological year Cork 2007. In accordance with odour impact criterion presented in *Table 2.1*, and in keeping with currently recommended odour impact criterion in this country, no long-term odour impacts will be generated by receptors in the vicinity of the proposed facility operations.

In addition, the predicted ground level concentration of Odour at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

A number of key mitigation measures will need to be implemented into the design of the odour containment, capture and treatment system to include:

1. All buildings should be fitted with a high integrity building fabric with a leakage rate of no greater than 3 $m^3/m^2/hr$ at 50 Pa.
2. The facility buildings should be capable of attaining a negative pressure value of at least –ive 10 Pa when ventilation is applied and the facility is in operation – as in they should be constructed with air tightness as a key focus.
3. All sumps, tanks etc. should be sealed with tight fitting high containment efficiency covers so as to prevent the release of odours from such processes.
4. All building should be fitted with appropriate roller doors / access points of sealed nature (max leakage rate of 10 $m^3/m^2/hr$).
5. All buildings / processes holding or processing material with the potential to generate odours shall be placed under negative ventilation with all odourous air ducted to an appropriate odour control system for treatment. The odour control system shall be capable of providing treatment of odourous air to a level of less than or equal to 1,000 Ou_E/m^3 in the treated exhaust air stream.
6. All process specifications shall be independently processed proved including odour control system performance, building integrity testing (leakage rate, smoke integrity testing and applied absolute pressure testing) so as to ensure the containment, capture and treatment systems installed at the facility are functioning adequately. This shall be only carried out by personnel experienced in this method of testing.
7. An odour management plan shall be developed for the operating facility so as to ensure adequate operation of all odour management systems on a day to day basis.

5. Conclusions

Odour Monitoring Ireland was commissioned by NRGE Ltd to perform a dispersion modelling study of a new proposed anaerobic digestion facility to be located in Timoleague Agri Gen Ltd, Barryshall, Timoleague, Bandon, Co. Cork. Following a detailed impact and dispersion modelling assessment, it was demonstrated that no significant environmental impact will exist if the source characteristics and emission limit value in the waste gases are achieved.

The following conclusions are drawn from the study:

1. The assessment was carried out to provide information in line with standard information to be provided to the EPA and regulatory bodies for such projects.

2. Specific dispersion modelling was performed for Carbon monoxide, Oxides of nitrogen, Sulphur dioxide, Particulate matter, TNMVOC as Benzene, Hydrogen sulphide and Odour.

3. With regards to Carbon monoxide, the maximum GLC+Baseline for CO from the operation of the facility is 513 µg m^{-3} for the maximum 8-hour mean concentration at the 100th percentile. When combined predicted and baseline conditions are compared to the Irish guideline/limit values and EU Limit values set out in SI 180 of 2011 and Directive 2008/50/EC, this is 5.13% of the impact criterion. In addition, the predicted ground level concentration of Carbon monoxide at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

4. With regards to Oxides of nitrogen, the maximum GLC+Baseline for NO_2 from the operation of the facility is 56 µg m^{-3} for the maximum 1-hour mean concentration at the 99.79th percentile. When combined predicted and baseline conditions are compared to SI 180 of 2011 and Directive 2008/50/EC, this is 28% of the impact criterion. An annual average was also generated to allow comparison with values contained in SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 14.40 µg/m^3. When compared the annual average NO_2 air quality impact criterion is 36% of the impact criterion. In addition, the predicted ground level concentration of Oxides of nitrogen at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

5. With regards to Sulphur dioxide, the maximum GLC+Baseline for SO_2 from the operation of the facility is 98 and 43 µg m^{-3} for the maximum 1-hour and 24 hr mean concentration at the 99.73th and 99.18th percentile respectively. When combined predicted and baseline conditions are compared to SI 180 of 2011 and Directive 2008/50/EC, this is 28 and 34.30% of the set target limits established for the 1 hour and 24 hour assessment criteria. An annual average was also generated to allow comparison with SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 8.0 µg/m^3. When compared the annual average SO_2 air quality impact criterion is 40% of the impact criterion. In addition, the predicted ground level concentration of Sulphur dioxide at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

6. With regards to Particulate matter, the maximum GLC+Baseline for Particulate matter 10µm from the operation of the facility is 16.90 µg m^{-3} for the maximum 24-hour mean concentration at the 90.40th percentile. When combined predicted and baseline conditions are compared to Directive 2008/50/EC, this is 33.80% of the impact criterion. An annual average was also generated to allow comparison with the SI 180 of 2011 and Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 15.50 µg/m^3. When compared, the

annual average Particulate matter air quality impact is 38.75 % of the impact criterion. An annual average was also generated for $PM_{2.5}$ to allow comparison with Directive 2008/50/EC. The maximum predicted annual average ground level concentration in the vicinity of the facility was 15.50 $\mu g/m^3$. When compared, the annual average $PM_{2.5}$ air quality impact is 62% of the impact criterion. In addition, the predicted ground level concentration of Particulate matter at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

7. With regards to the results from the assessment of TNMVOC as Benzene ground level concentrations, the results indicate that the ambient ground level maximum annual average concentrations anywhere in the vicinity of the facility could be up to 24% of the impact criterion (assuming all TNMVOC is Benzene which will not be the case). In addition, the predicted ground level concentration of TNMVOC as Benzene at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*.

8. With regards to Hydrogen sulphide, the results indicate that the maximum ambient 1 hour average ground level concentrations will be no greater than 1.30 $\mu g/m^3$. Typical odour recognition threshold for Hydrogen sulphide is 14 $\mu g/m^3$. Therefore the predicted ground level concentration is well below the odour recognition threshold for hydrogen sulphide.

9. With regards to odour, it is predicted that odour plume spread is radial with an approximate spread of 150 metres from the emission point with no sensitive receptors impacted by the plume. All resident locations in the vicinity of the proposed facility operations will perceive an odour concentration less than 0.87 Ou_E/m^3 at the 98^{th} percentile of hourly averages for worst case meteorological year Cork 2007. In accordance with odour impact criterion presented in *Table 2.1*, and in keeping with currently recommended odour impact criterion in this country, no long-term odour impacts will be generated by receptors in the vicinity of the proposed facility operations. In addition, the predicted ground level concentration of Odour at each of the 11 sensitive receptors is presented in *Table 4.1*. As can be observed, all predicted ground level concentrations are well within the ground level concentration limit values contained in *Table 2.1*. A number of key mitigation measures as outlined in Section 4.1.6 will need to be implemented into the design of the odour containment, capture and treatment system to ensure compliance.

10. The overall modelling indicates that the facility will not result in any significant impact on air quality in the surrounding area with all ground level concentrations of pollutants well within their respective ground level concentration limit values.

6. *Appendix I* - Air dispersion modelling contour plots (Process contributions and illustrative purposes only).

These contour maps are for illustrative purposes only.

6.1 Site layout drawing and location of proposed facility and nearby residences

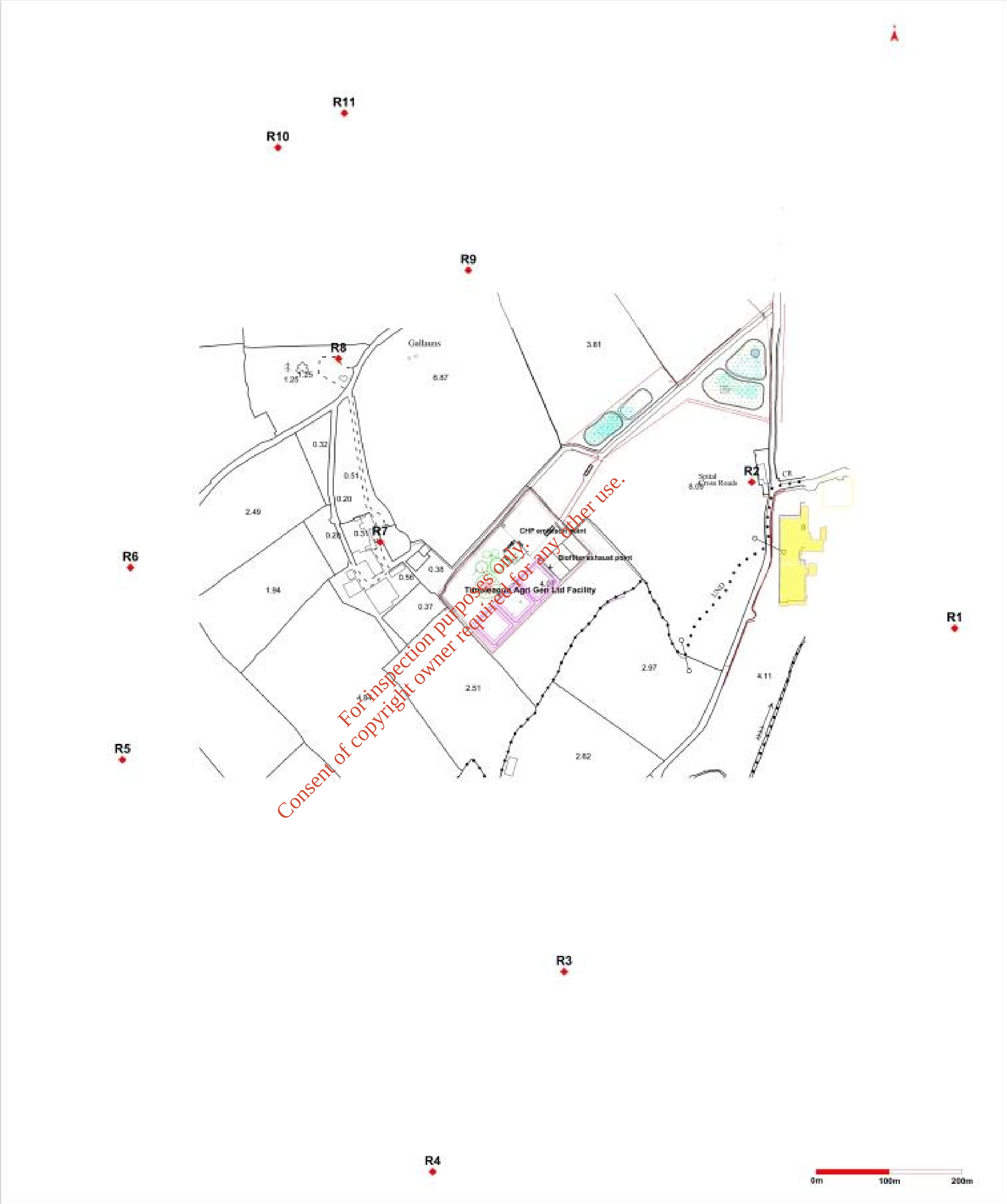

Figure 6.1. Plan view facility layout drawings for Timoleague Agri Gen Ltd anaerobic digestion facility including specific location of nearest sensitive receptors R1 to R11.

6.2. Dispersion modelling contour plots for Scenarios 1 to 12 – Worst case meteorological year Cork 2007

6.2.1 Scenario 1 - Carbon monoxide

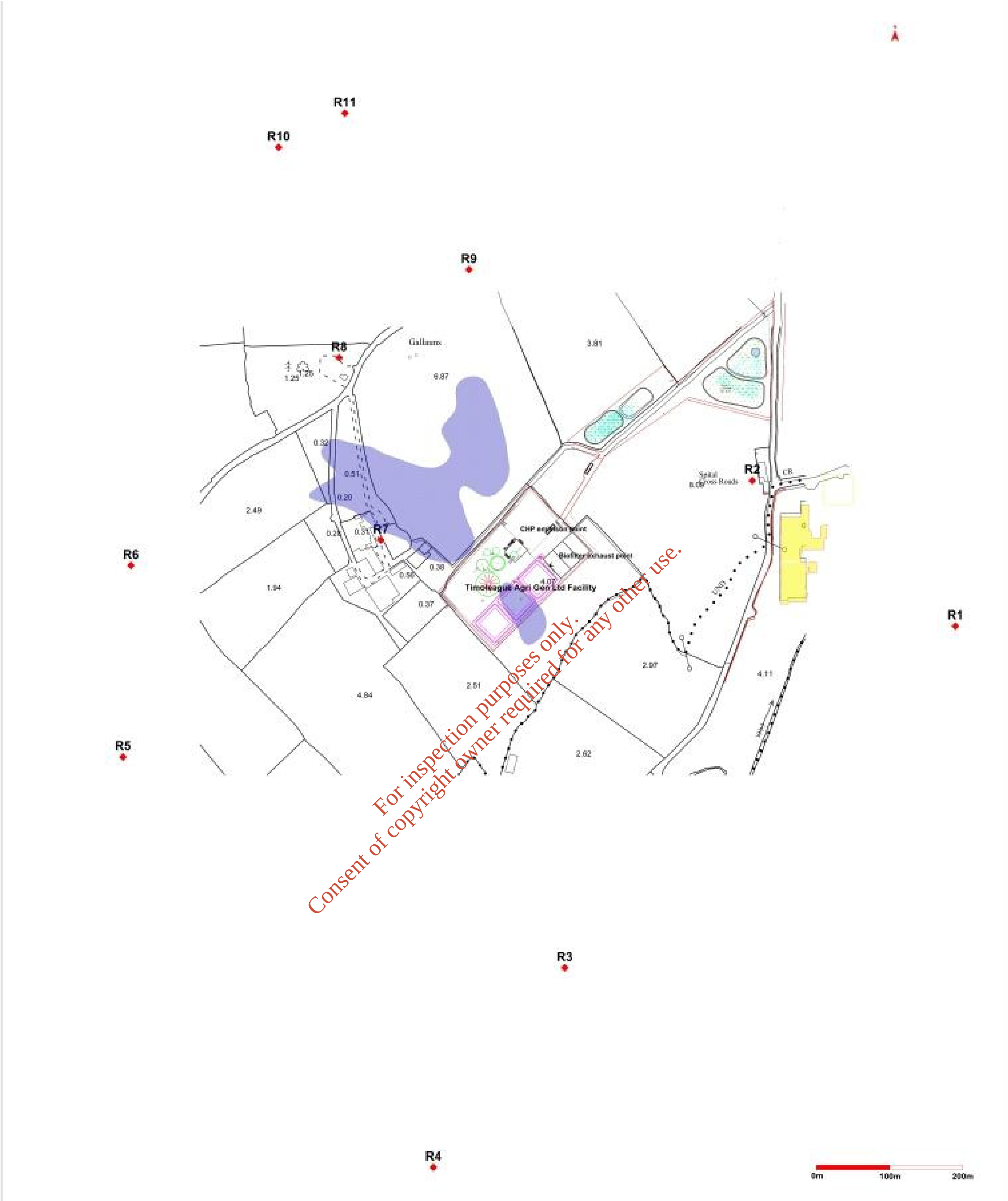

Figure 6.2. Predicted 8 hr average CO ground level concentration of 160 $\mu g/m^3$ ( ) for cumulative emissions from facility for Scenario 1 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

6.2.2 Scenario 2 and 3 - Oxides of nitrogen

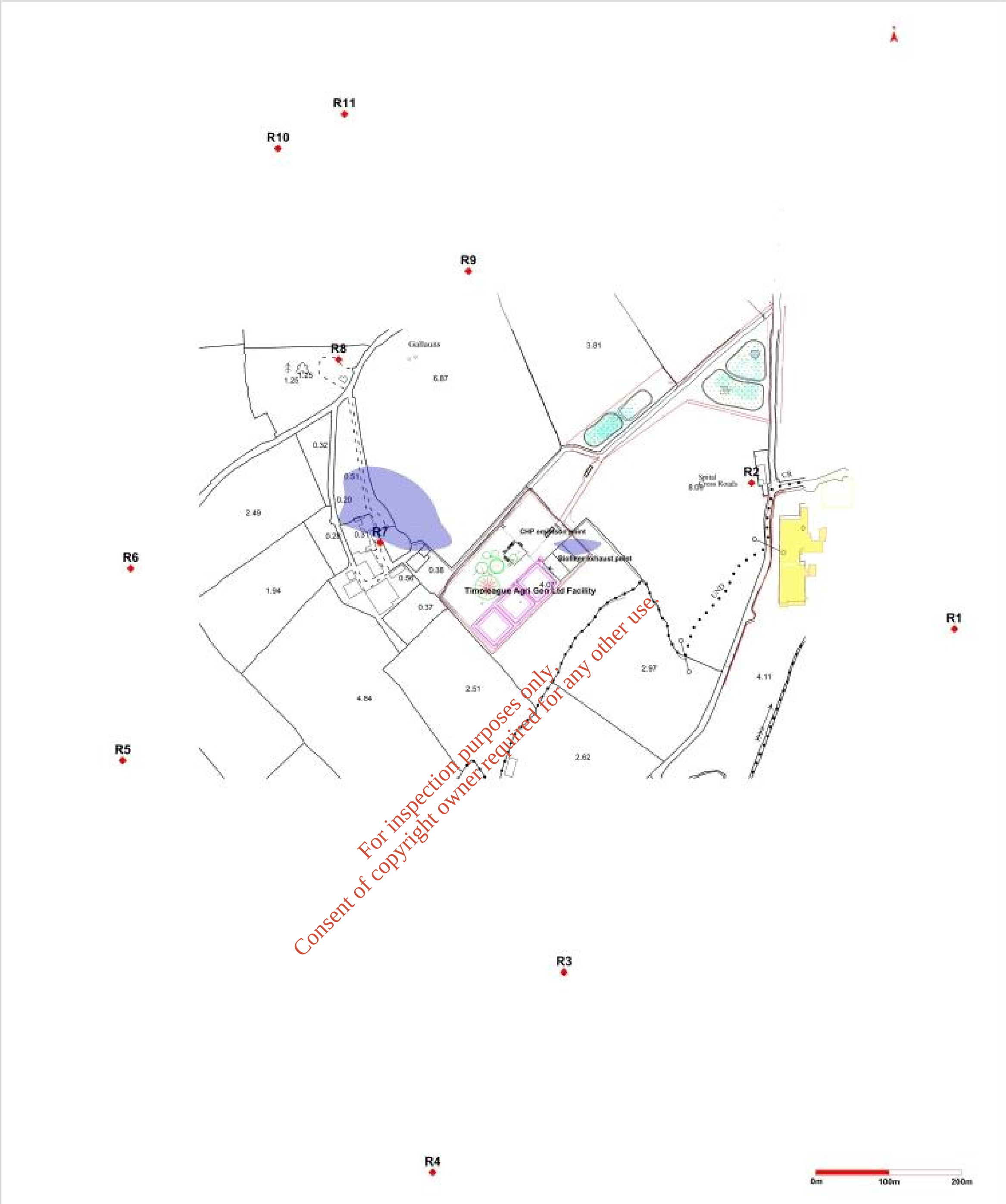

Figure 6.3. Predicted 99.79th percentile of 1 hr averages for NO_2 ground level concentration of 28 µg/m^3 ( ) for cumulative emission for Scenario 2 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

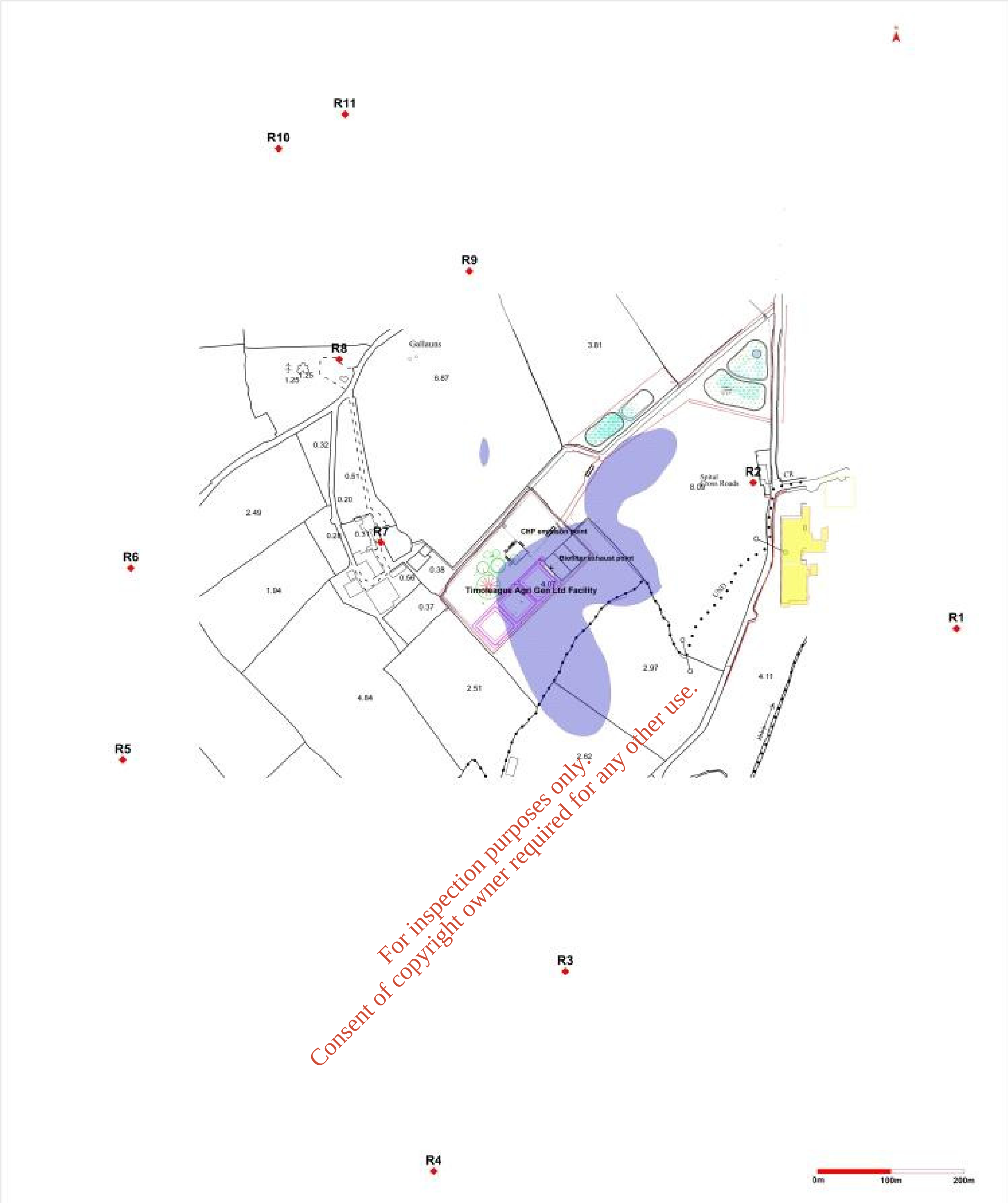

Figure 6.4. Predicted annual average NO_2 ground level concentration of 1.75 µg/m^3 ( ) for cumulative emissions for Scenario 3 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

6.2.3 Scenario 4, 5 and 6 - Sulphur dioxide

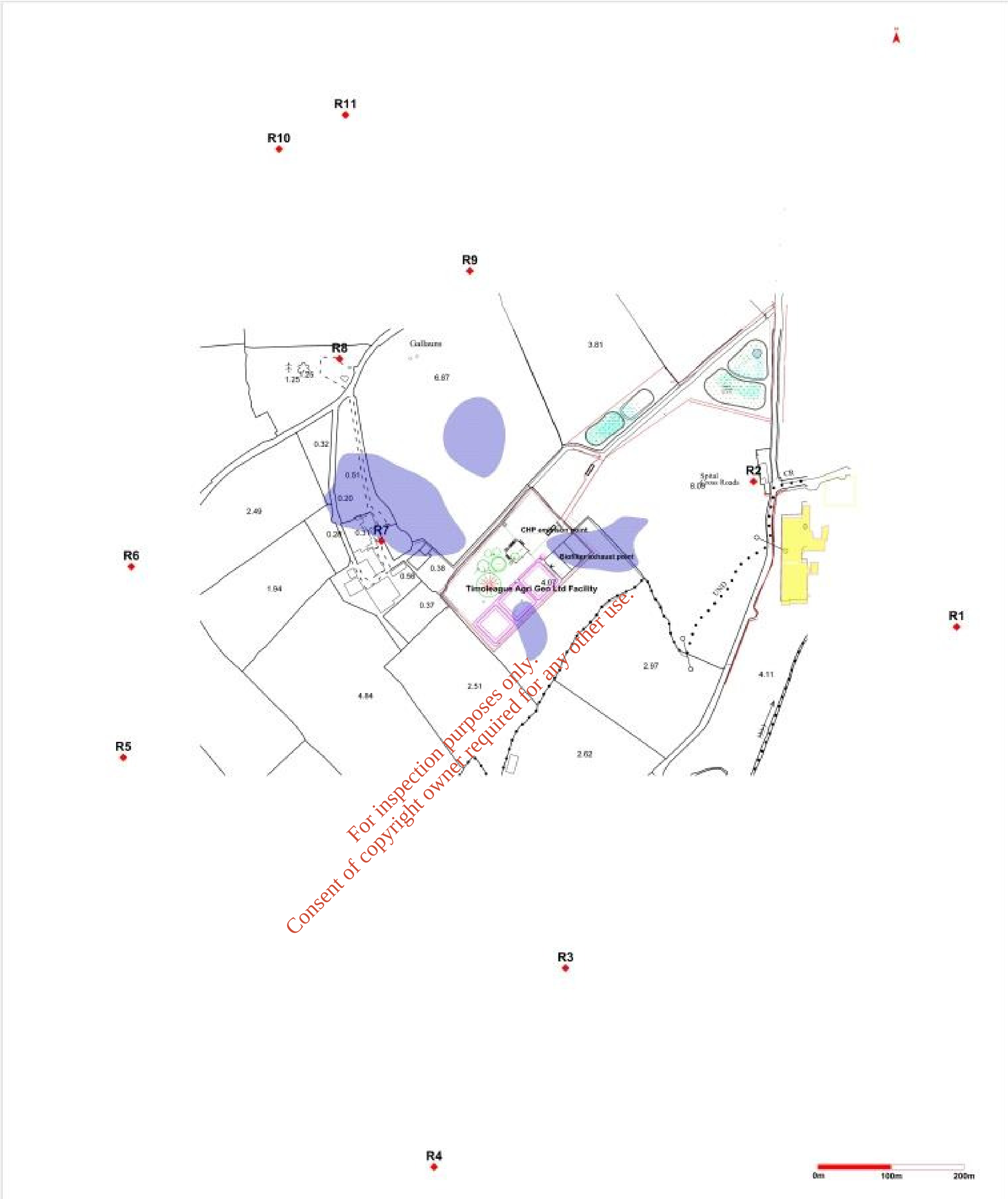

Figure 6.5. Predicted 99.73th percentile of 1 hr averages for SO_2 ground level concentration of 70 µg/m^3 ( ) for cumulative emission for Scenario 4 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

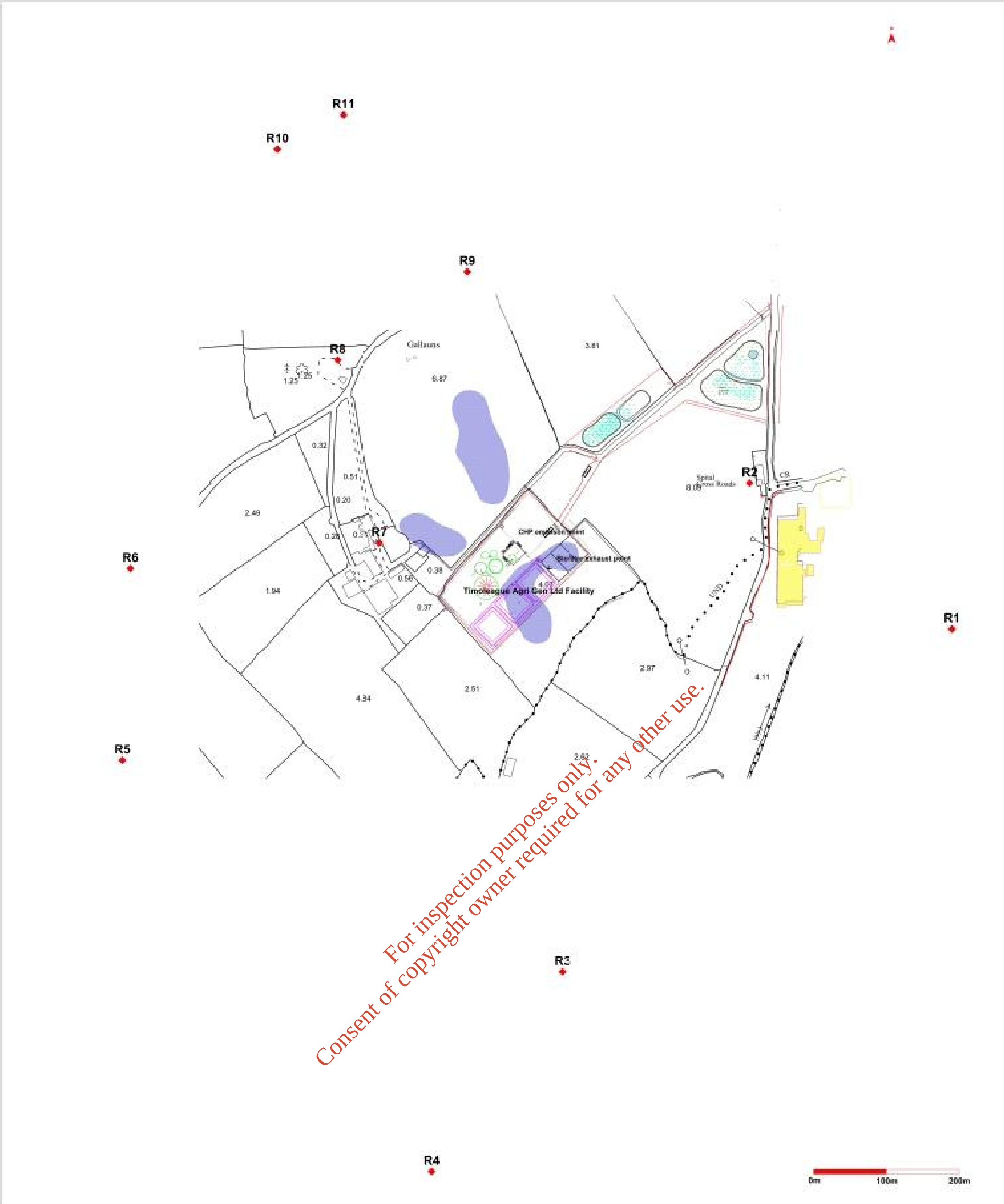

Figure 6.6. Predicted 99.18th percentile of 24 hr averages for SO_2 ground level concentration of 30 µg/m^3 (———) for cumulative emission for Scenario 5 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

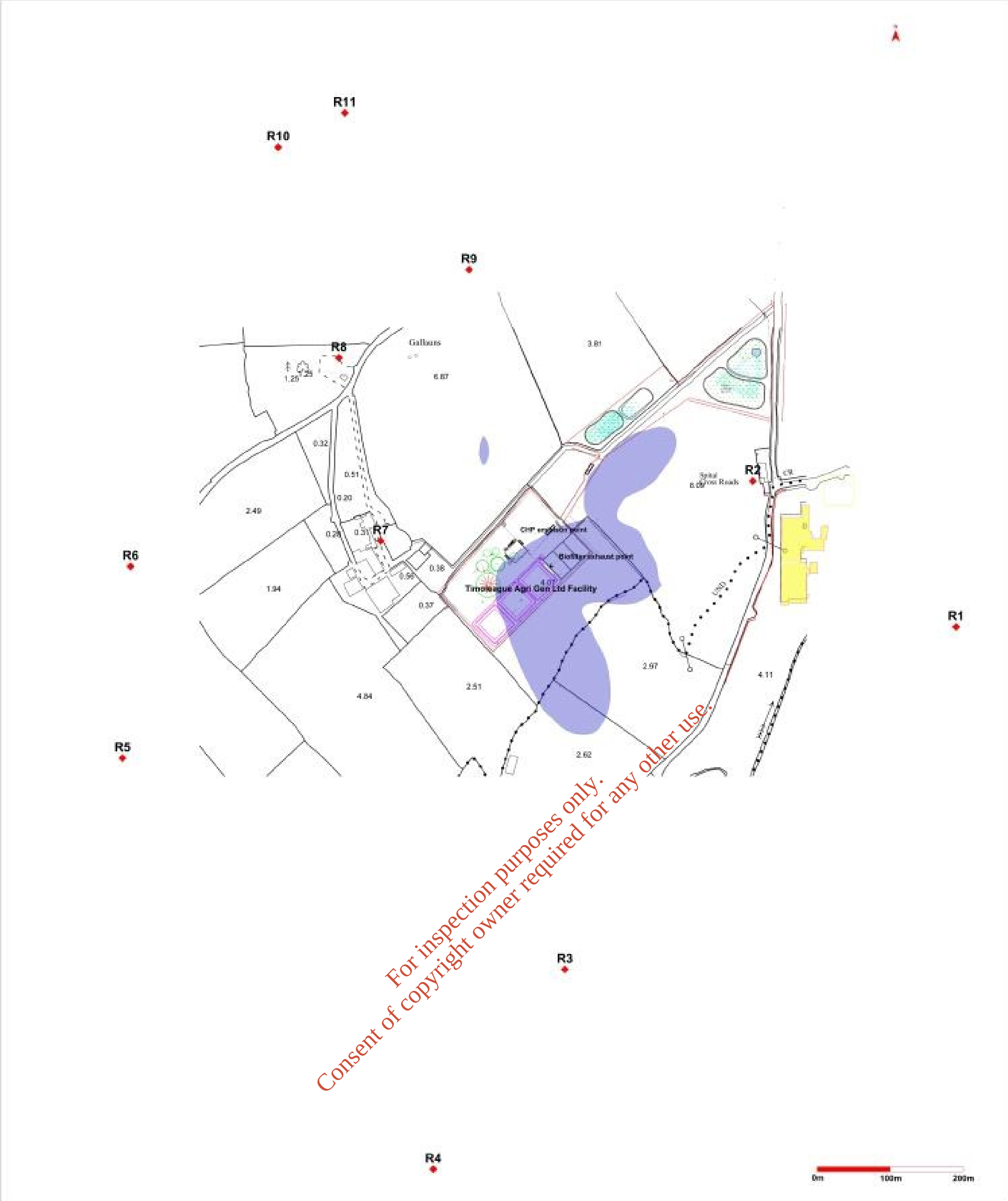

Figure 6.7. Predicted annual average SO_2 ground level concentration of 2.5 µg/m^3 (▬▬) for cumulative emissions for Scenario 6 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

6.2.4 Scenario 7, 8 and 9 - Total particulates

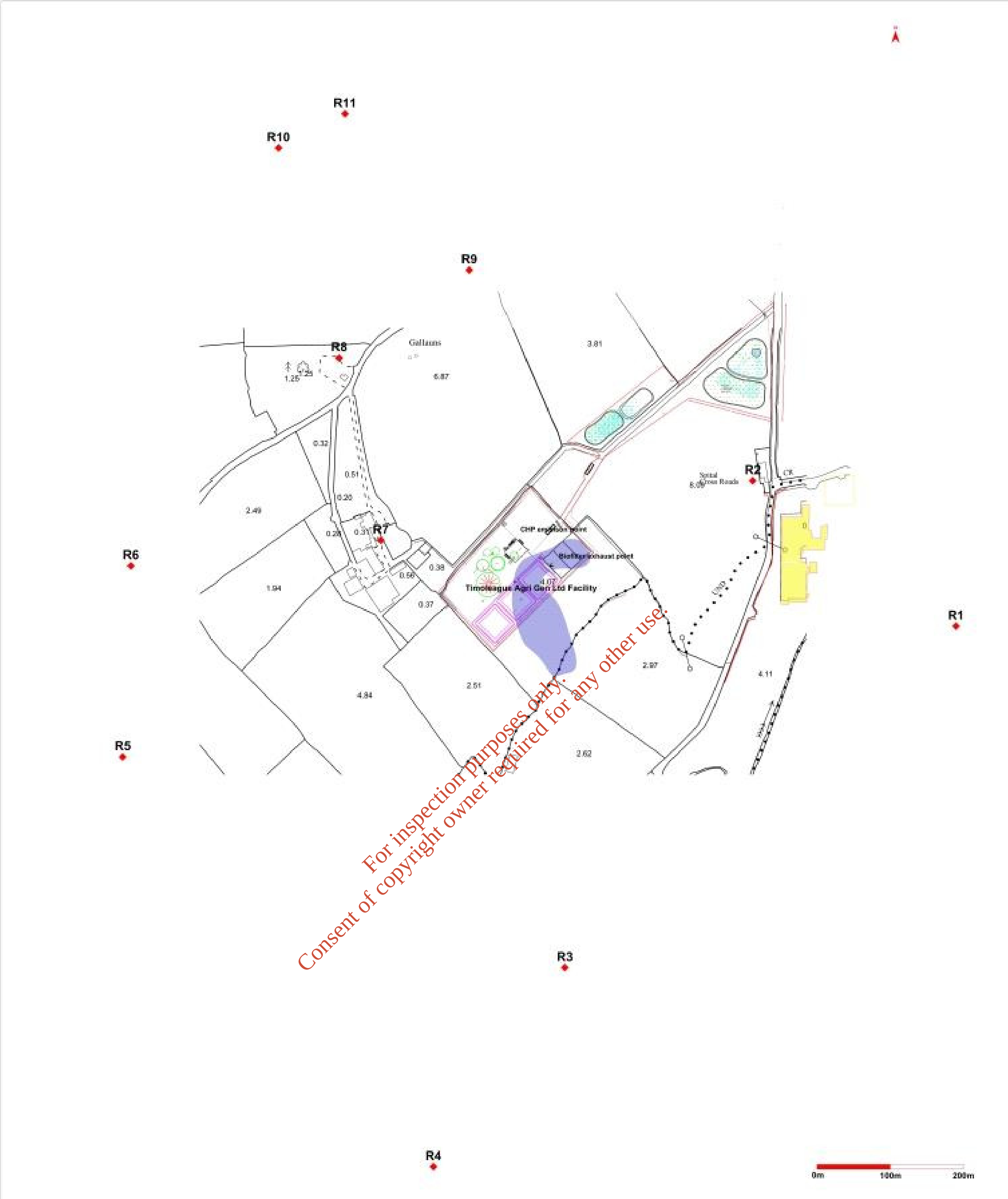

Figure 6.8. Predicted 90.40th percentile of 24 hr averages for Total particulates ground level concentration of 1.30 µg/m^3 (▬▬) for cumulative emission for Scenario 7 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

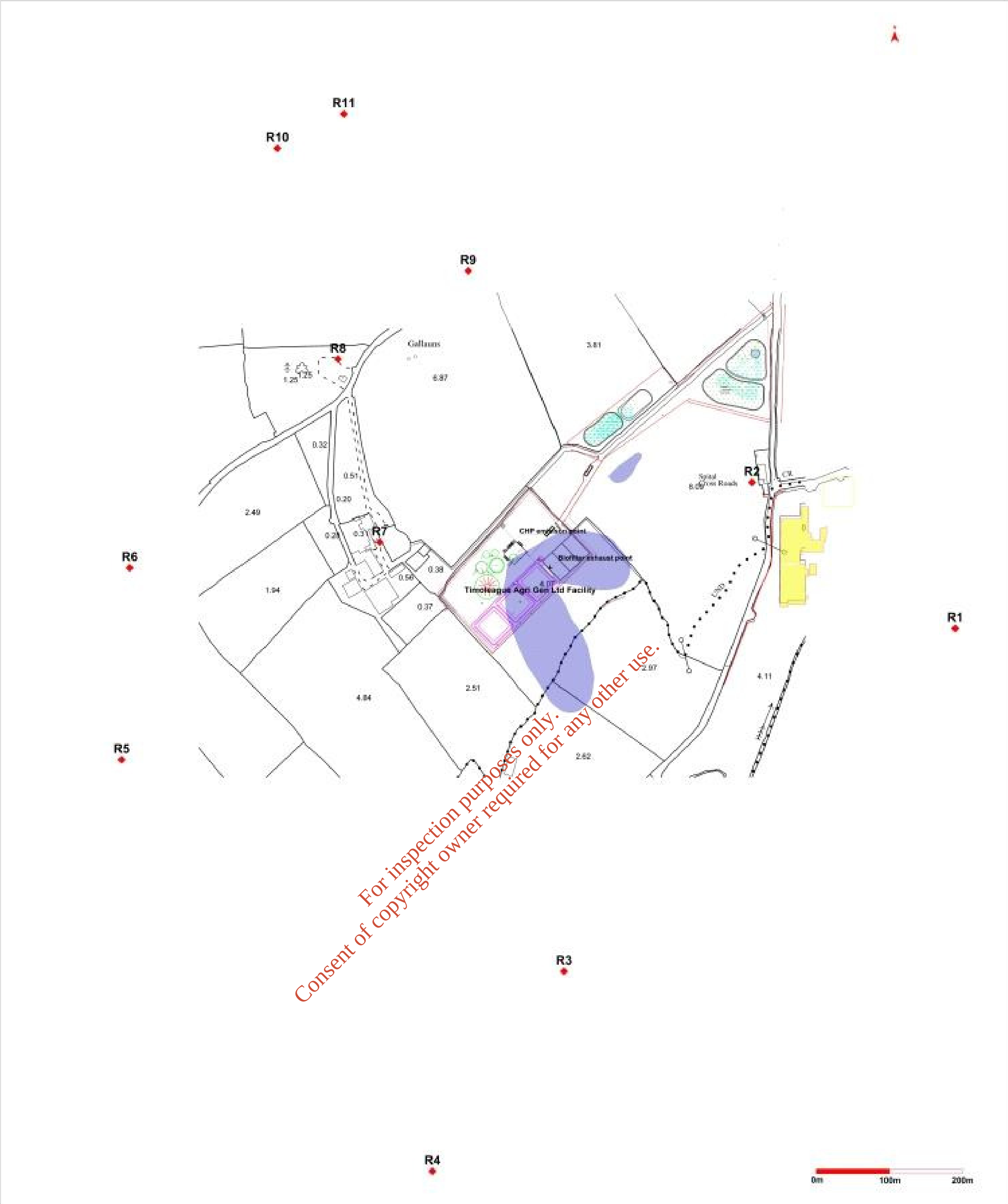

Figure 6.9. Predicted annual average Total particulates ground level concentration of 0.30 µg/m^3 ( ) for cumulative emissions for Scenario 8 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

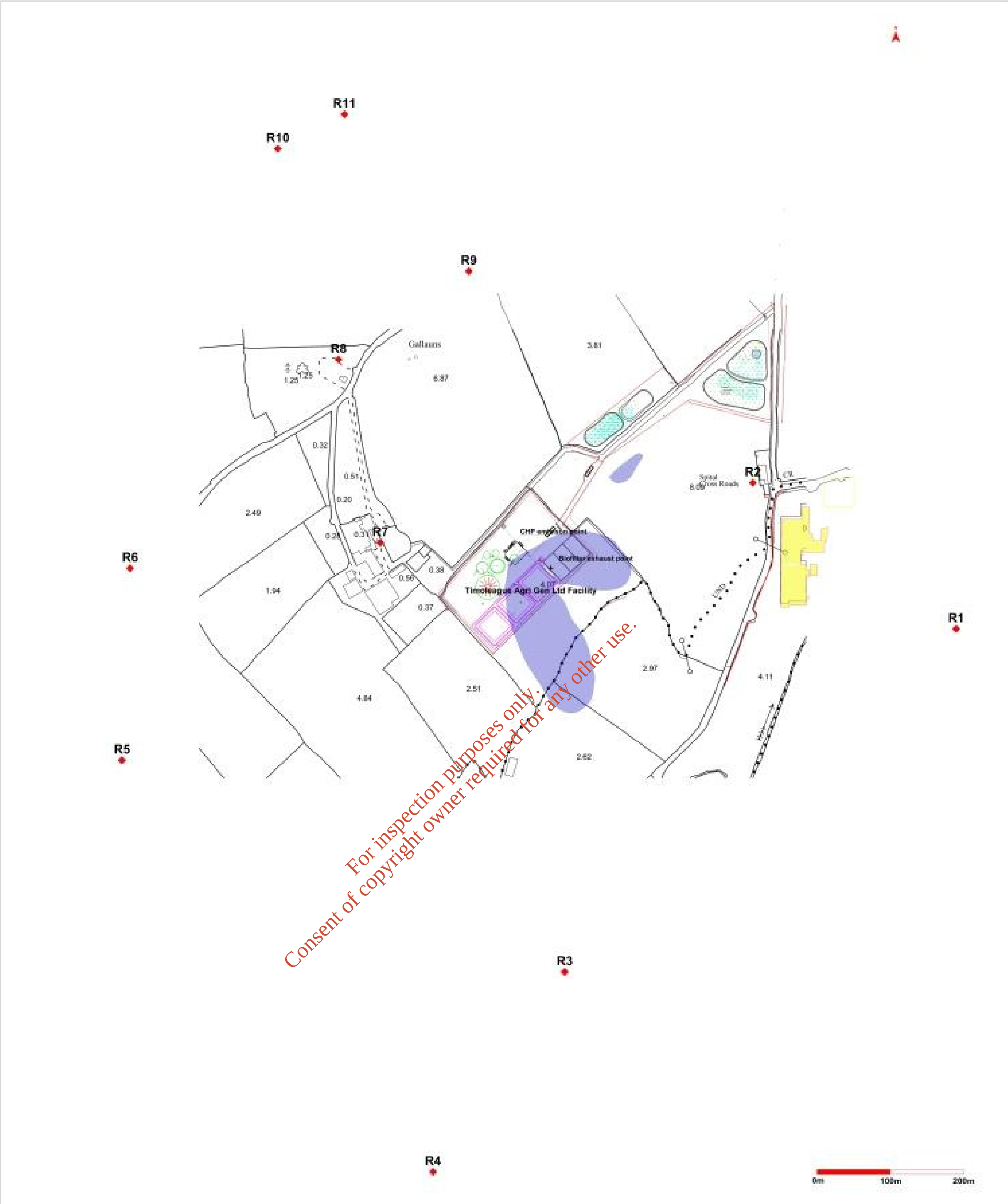

Figure 6.10. Predicted annual average Total particulates as $PM_{2.5}$ ground level concentration of 0.30 µg/m^3 (▬) for cumulative emissions for Scenario 9 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

6.2.5 Scenario 10 – TNMVOC as Benzene

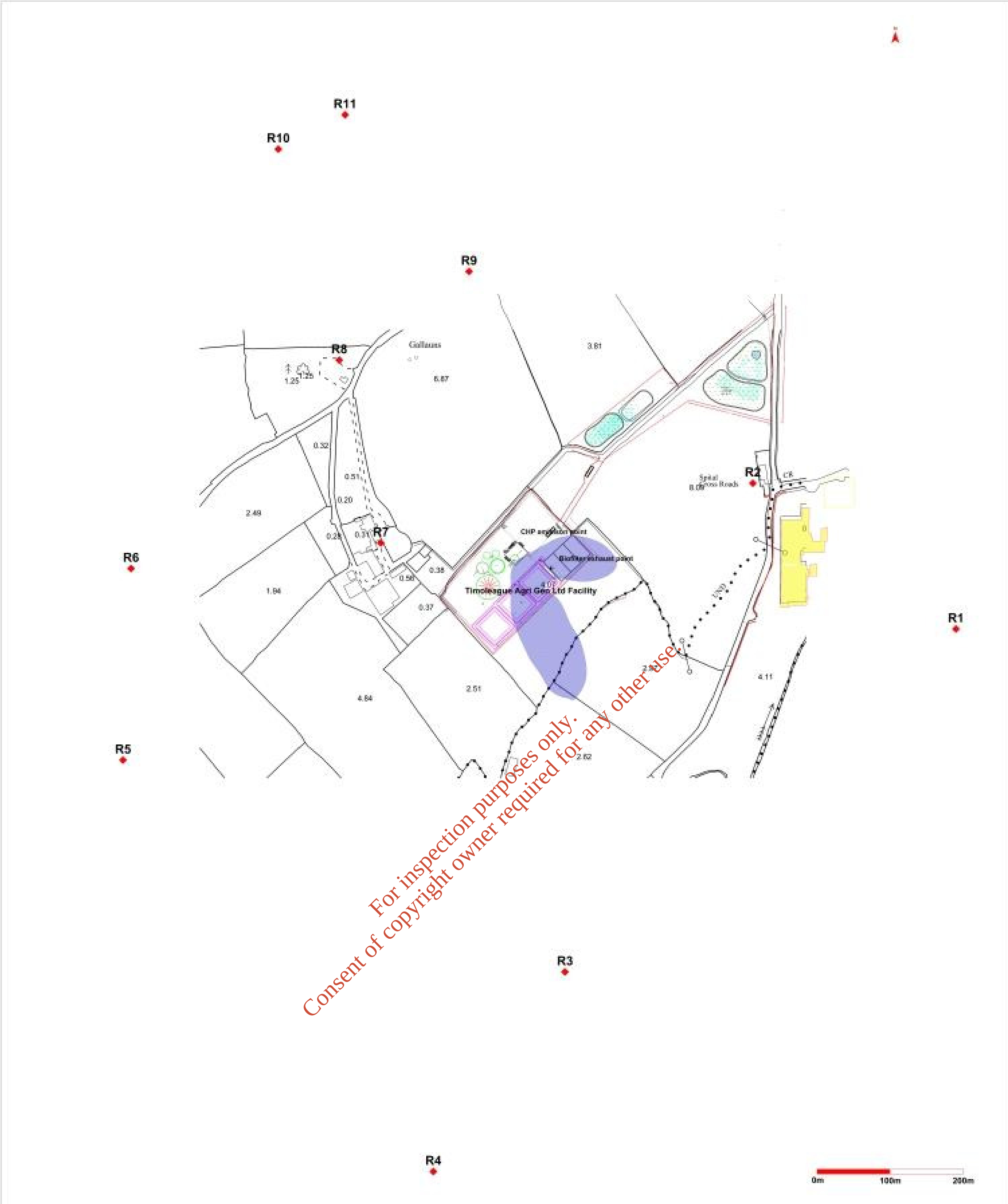

Figure 6.11. Predicted annual averages for TNMVOC as Benzene ground level concentration of 0.5 µg/m^3 ( ) for cumulative emission for Scenario 10 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

6.2.6 Scenario 11 – Hydrogen sulphide

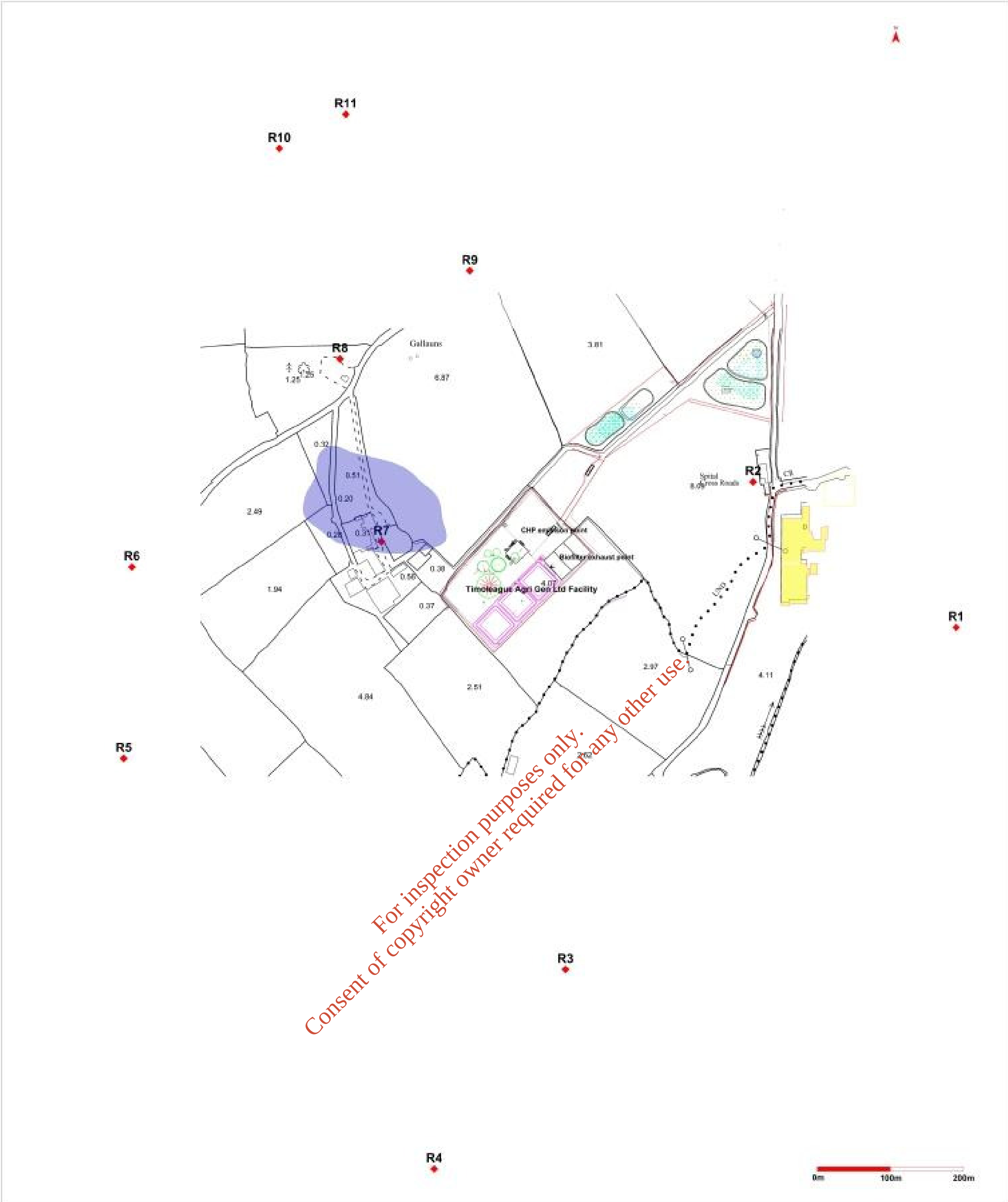

Figure 6.12. Predicted 1 hr max averages for an Hydrogen sulphide ground level concentration of less than or equal to 1.0 Ou_E/m^3 ( ) for cumulative emission for Scenario 11 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

6.2.6 Scenario 12 – Odour

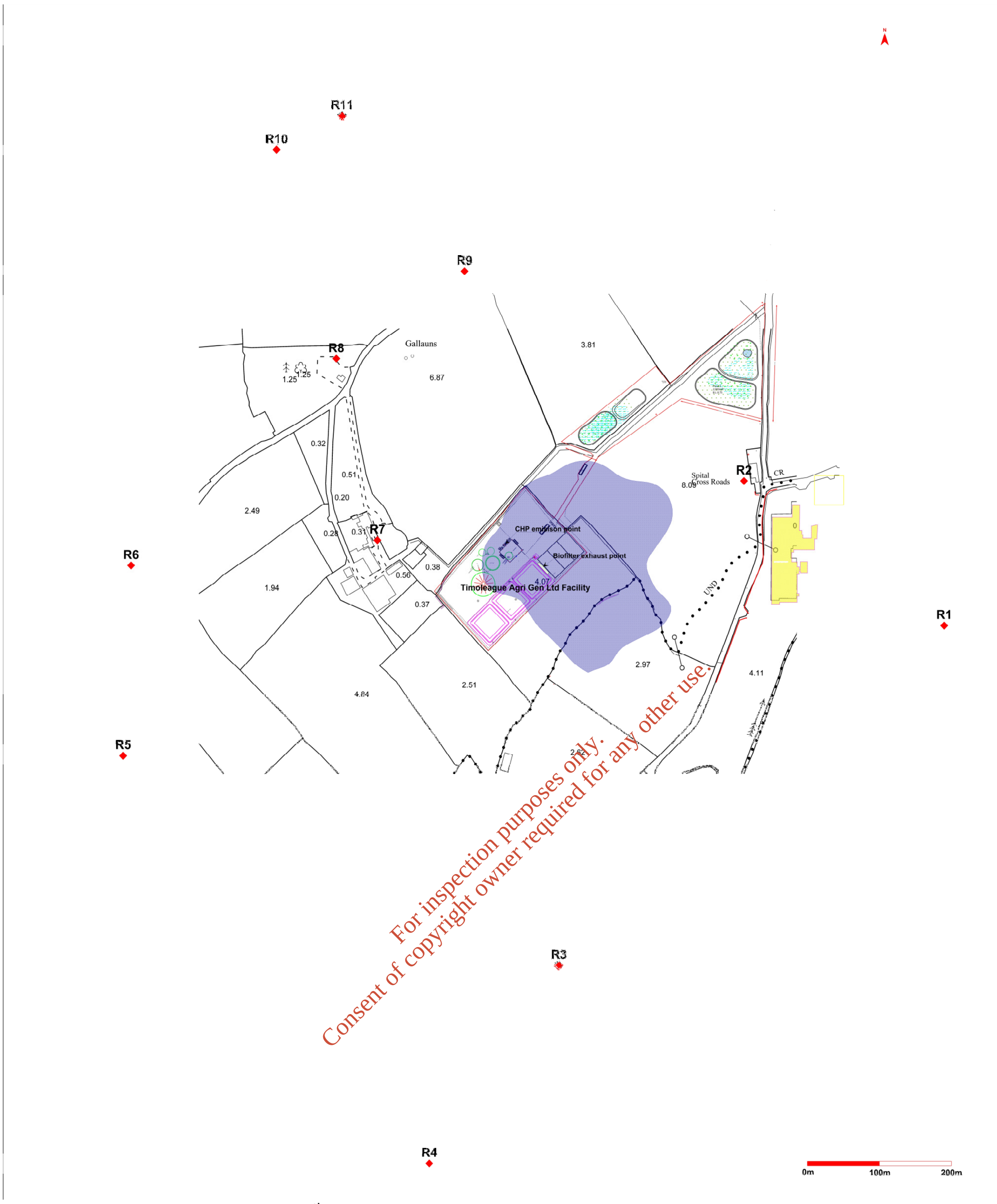

Figure 6.13. Predicted 98th percentile of 1 hr averages for an Odour ground level concentration of less than or equal to 1.5 Ou_E/m^3 ( ) for cumulative emission for Scenario 12 for Cork meteorological station (worst case year 2007) - 24 hr plant operation.

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

Meteorological file Cork 2003 to 2007 inclusive

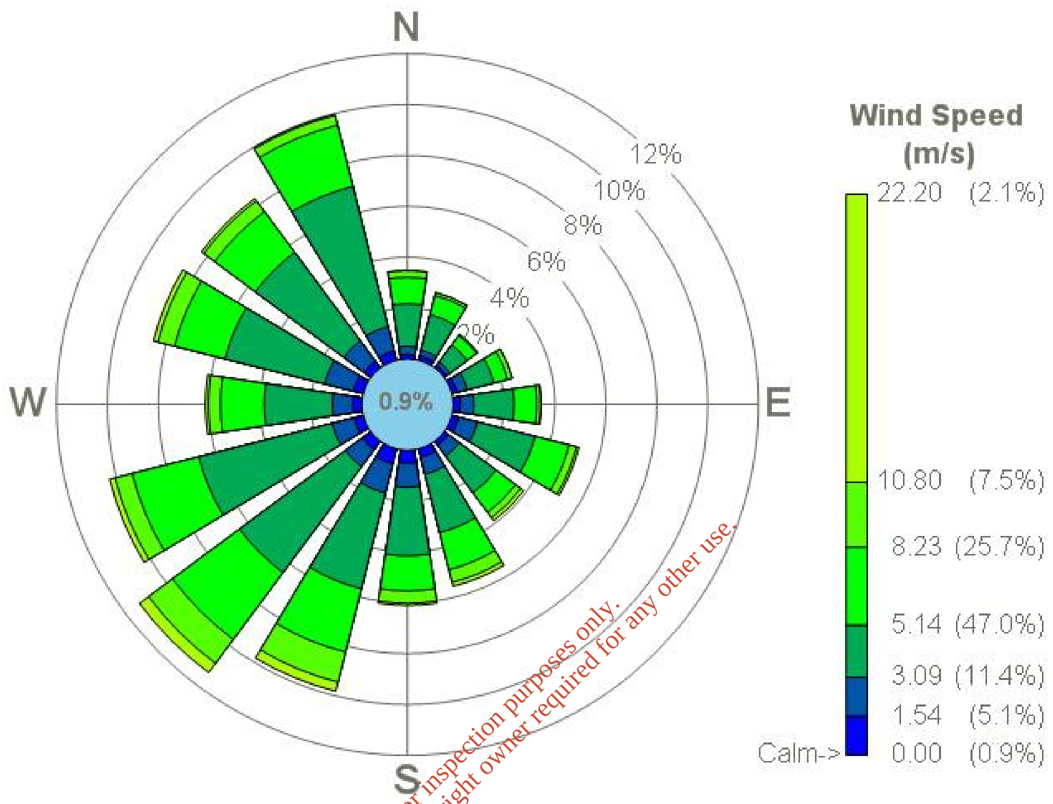

Figure 7.1. Schematic illustrating windrose for meteorological data used for atmospheric dispersion modelling, Cork 2003 to 2007 inclusive.

Table 7.1. Cumulative wind speed and direction for meteorological data used for atmospheric dispersion modelling Cork 2003 to 2007 inclusive.

Cumulative Wind Speed Categories							
Relative Direction	**> 1.54**	**>3.09**	**>5.14**	**>8.23**	**> 10.80**	**< 10.80**	**Total**
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	0.12	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	0.28	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	0.20	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	0.51	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	0.42	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	0.35	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	0.33	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

8. *Appendix III* - Checklist for EPA requirements for air dispersion modelling reporting

Table 8.1. EPA checklist as taken from their air dispersion modelling requirements report.

Item	Yes/No	Reason for omission/Notes
Location map	Section 6	-
Site plan	Section 6	-
List of pollutants modelled and relevant air quality guidelines	Yes	-
Details of modelled scenarios	Yes	-
Model description and justification	Yes	-
Special model treatments used	Yes	-
Table of emission parameters used	Yes	-
Details of modelled domain and receptors	Yes	-
Details of meteorological data used (including origin) and justification	Yes	-
Details of terrain treatment	Yes	-
Details of building treatment	Yes	-
Details of modelled wet/dry deposition	N/A	-
Sensitivity analysis	Yes	Five years of hourly sequential data screened from nearest valid met station- Cork 2003 to 2007.
Assessment of impacts	Yes	Pollutant emissions assessment from process identified.
Model input files	No	DVD will be sent upon request. Files are a total of 4.1 GB in size.

Non Technical Summary

1. NON-TECHNICAL SUMMARY

This is the summary of the information contained within the Environmental Impact Statement, which reports the findings of the assessment into the environmental effects associated with the proposed development of a Biogas Plant at Barryshall, Timoleague, Bandon, Co. Cork.

The Environmental Impact Assessment was prepared by NRGE Ltd as a submission to be included in support of a Planning Application to Cork County Council and a Waste Facility Licence to the Environmental Protection Agency. The Environmental Impact Assessment has been produced in accordance with the European Community Directive Environmental Impact Assessment Directive 85/337/EEC (as amended by Directives 97/11/EC, 2003/35/EC, 2009/31/EC) and the Regulations implementing the Directive in Ireland: the Planning and Development Act 2000-2010, the Planning and Development Regulations 2001-2012 and the European Communities (Environmental Impact Statement) Regulations 1989-2000.

Planning for the Biogas Plant was granted to Timoleague Agri Gen Ltd. of Barryshall, Timoleague, Co. Cork, by Cork County Council on the 3rd September 2013.

- Final grant dated 03/09/2013
- Managers Order and Schedule of Conditions dated 29/07/2013
- Decision Notification Grant dated 30/07/2013

The proposed project has involved consultation with stakeholders locally, regionally and nationally, including statutory bodies and regulatory authorities, in an attempt to identify concerns and predict any likely environmental effects of the development, and the evaluation of these effects against specified criteria such as legal guidelines and limits.

This project has involved formal and informal discussions with a large number of stake holders from the local, regional and national categories, to help formulate an integrated model, that will stand up to detailed critical analyses. In the current climate such critical analyses will be applied not only from an environmental perspective, but also from an economical and sustainable perspective. The vision is to create a centre of excellence for an Anaerobic Digester and associated integrated business, which will provide a template that can be applied to other similar regions throughout the jurisdiction.

It is the intention of this summary to provide all the relevant information contained within the Assessment, in a non-technical and comprehensible manner. The Environmental Assessment is an evaluation of the potential significant likely environmental impacts that this development will have on the locality.

Timoleague Agri Gen Ltd. is a limited company with two directors, both of whom are active progressive farmers in the local community. These are Mr. Colin Bateman, upon whose farm the proposed development is located, and Mr. Martin O' Donovan, whose pig farm unit is located to the North of the proposed site. The Directors of the company or the company have at no stage been convicted of an offence under the Act of 1996, the Local Government (Water Pollution) Acts 1977 and 1990 or the Air Pollution Act 1987 or The EPA Acts 1992 and 2003.

The development will occupy a landscaped site of approximately 3.67 hectares (9.07 acres). The proposed development consists of a Biogas Plant consisting of 2 no Digester tanks, 2 no validation tanks, 1 no homogenising tank, 3 no geo-membrane lined manure storage tanks, 1 no fibre store, 1 No Feed Tanks, Reception Building, Plant Building, Pasteurisation Tanks, Weighbridge and associated site works including an integrated constructed wetland, to produce renewable energy and fertiliser. The proposed Anaerobic Digester will reduce net emissions from Mr. O' Donovan's Pig Farm as it will require fresh delivery of manure from the pig houses. It will also effect a net reduction of emissions in the area.

This proposal will aid compliance with Nitrate Directive Regulations and incorporates emission reduction measures. A map (Scale 1:2500) in ***Attachment 1*** of the Environmental Impact Statement clearly outlines the site boundary, marked red.

Facilities

The buildings and their layout will be state of the art for the industry. A thorough review across Europe was undertaken of best available techniques to minimise emissions from the proposed development, and to maximise beneficial outputs. The Biogas Facility's storm water will be routed to a single storm-water monitoring point (identified as SW1 on Drawing 003 - *Overall Site Plan* included in ***Attachment 2 of the EIS***), and then piped to the land drainage watercourse. Each individual component of the Biogas Plant will have an independent leak detection system with an individual inspection chamber for each section. These inspection points are identified as LD1 to LD12 on Drawing 001 - *Site Plan* included in ***Attachment 2*** of the EIS.

Drawings of the facility, Numbered 001 to 035, detail the various aspects of the development including location maps no 007 and no 008. Drawings No 028 and no 029 are Process Flow Diagrams. Drawing No 28 is a simplified schematic diagram indicating the rudimentary outline of the process. Whereas Drawing No 029 is a detailed schematic indicating where pumps, values probes etc are located on the process neither provides a specific position of the structures on the site.

Drawing 003 indicates the specific location of the structures on the site in accordance with the requirement of the Planning Regulations. The necessity of the Process Diagram 029 is the scale of the site plan 003 is too small to indicate all pipe routes which would be too cluttered on an overall site plan.

Energy and resource usage will be consumed efficiently. An energy audit will be carried out as required and in compliance with the conditions for High Efficiency CHP units to determine possible cost.

All manure will be transported by tractor tanker/articulated lorries from Martin O' Donovan's Pig Farm Unit to the proposed development at Barryshall, Timoleague, Co. Cork as per Planning Permission.

Geo Membrane Lined Manure Basins

The Geo-membrane lined manure basins will be built as per Odournet UK 2001's report "**Odour Impacts and Odour Emission Control Measures for Intensive Agriculture - Part A Odour annoyance assessment and criteria for intensive livestock production in Ireland"**.

Enclosed slurry storage

"Flexible solutions are becoming more popular, using methods of cover that avoid creation of headspace. An example of a covered storage without headspace are foil basins in an earth enclosure, with a floating foil cover.

Floats support the cover, and an extraction system for escaping digestion gas is provided in the design. They are made out of reinforced plastic (PVC) foil of 1 mm thick (see Figure 9). Stirring of the slurry is achieved through pumping slurry through a specially designed fixed tubing system. These fully enclosed foil basins have an economic lifespan of at least ten years.

Hundreds if not thousands of these systems have been installed in the Netherlands, at commercial pig units. No precise cost data are available, but the supplier indicates that the investment cost is close to half the cost of a concrete storage tank of the same capacity. The foil liner will be viable for an economic life of 10-14 years."

Biogas

Biogas production takes place in both of the Digester Tanks at the optimum temperatures and an oxygen free environment. In the vertical Primary Digester the operating temperature is 50 - 55^{O}C. The gas produced occupies the void at the top of the digester tank which has a fixed steel rigid roof; the accumulated gas is piped to the CHP unit and /or boiler.

In the horizontal secondary digester the operating temperature is 38^{o}C. This is a steel sectional tank with a double membrane cover; an air blower maintains a constant pressure of 0.5 Bar between the 2 sheets of the membrane. The gas collection route pipe-work is connected to both digester tanks to maintain a minimum pressure throughout the tanks. This pushes the accumulated biogas to the CHP Unit (The blower is similar to those used by Bouncing Castles).

Conversion of gas to Electricity and Heat is done in a Combined Heat and Power Unit (CHP). This consists of an internal combustion engine coupled to an alternator. The biogas is delivered to the engine using air pressure generated by the double membrane cover on the Secondary Digester. The engine is a spark ignition engine which turns the crankshaft and the alternator to generate electricity which also produces heat around the engine's combustion chambers; water used to cool the engine provides the heat for the digestion process and for space heating.

Gas production is calculated to approximately the capacity of the CHP Unit, in this case approximately 1.1MW of electricity and 1.25MW of heat. The electricity will be exported off-site to a dedicated grid connection, this connection will be a 10/20kv 3 phase line which consists of series of single poles with 3 cables approximately 40mm diameter similar to any existing rural 10/20kv line. It is intended to generate electricity for export to the national grid on a continuous basis with 500 hours down time (5% per year estimated).

Heat produced by the CHP Unit will be utilised to provide process heating for biogas production and exported to the adjoining Glass-House facility (Planning Reference 13/90) using insulated water-pipes to heat exchange at the glass house complex.

Manure storage capacity

The proposed facility provides storage on site in three geo-membrane lined storage basins, 4,500 m^3 capacity each. The secondary digester has a 4,300 m^3 capacity. The pre-mix tanks have 220 m^3 and 1,500 m^3 capacity respectively. In addition there are separate plans to provide additional 7,000 m^3 storage on customer farms. This is a total of 22,020 m^3 which is equivalent to 29 weeks output on site.

Land-spreading Areas

The pig manure from Mr. O' Donovan's Farm is currently being recovered on customer farms as a fertiliser in the general area of South West Cork. There is a total of 2,461 hectares of good agricultural land available in the area for this purpose. Upon the completion of this Anaerobic Digester, this same list of customer farms will be used to recover the liquid digestate as a fertiliser source. The bedrock in the region is mostly Devonian Old Red Sandstones (DORS), containing a Locally Important Aquifer.

Timoleague Agri Gen Ltd. and O' Donovan Pig Farm Unit have, with the consent of the existing customer farm list sufficient capacity to recover the nutrients in the liquid digestate form, with sufficient capacity to provide a 20% reserve.

Manure Spreading

The application of digested manure to farmland is regulated under European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2009 S.I. No. 610 of 2010 and distribution of digested manure from this site will comply with those regulations.

Digested Manure will not be supplied to customer farms between 15th October and 15th January in any year except with the consent of the local authority, or any other relevant authority. Outside that period, digestate manure will be supplied from the site to a customer farmer, only in response to an order. Managed and used in this way, manure digestate produced at this Facility will not have any adverse impact on environmental parameters either inside or outside the site. However recognition must be taken of the fact that 50% of these traffic movements occur in the general area currently, and will continue to do so irrespective of the construction of this proposed development, in the form of current deliveries of pig slurry, belly grass, dairy sludge and other organic materials to farms in the general area for use as agricultural fertiliser.

It is planned to import an additional 25,567 tonnes of organic material per annum to mix with the pig manure to increase the efficiency of the proposed Anaerobic Digester. The additional organic material is laid out in ***Table 1*** below, along with the estimated volume and source of each. A menu of these materials will be used subject to their availability and appropriate 'mix' of materials.

The current volume of pig manure produced on Martin O' Donovan's farm is 14,600 tonnes. Planning permission has being granted to increase his sow number from 1,150 to 1,750, which will increase the slurry production to 23,000 tonnes referenced. It is likely that the construction required to house this additional stock will commence in quarter three 2013.

Table 1: The Intended Feedstock for Processing

TYPE	**Volume**
	(TONNES)
Pig Manure	23,000
Seaweed	5,000
Dairy Flotation Sludge	11,000
Feedmill Residuals	200
Fruit residuals	300
Residuals from vegetables	750
Other slurry fish manufacturing	300
Paunch pigs	300
Paunch cows	5,000
Flotation sludge	1,200
Fat trap waste	600
Draff via Beer Production	750
Bread	100
TOTALS	**48,500**

It is proposed to primarily target organic materials that are currently being land-spread, as this process will greatly reduce current environmental impacts, in accordance with current land-spreading directives. In accordance with Regulations: EC no 1069/2009, EC no 142/2011 and EC (TSE and Animal by-Products) Regulations (S.I. No 252 of 2008 as amended), the approval of the Environmental Protection Agency, Cork County Council and the Department of Agriculture will have to be granted, in order for the permission to treat other waste types at this proposed Anaerobic Digester.

This organic material will be imported onto the site at a rate of 49 weekly in/out movements. It will be delivered directly into the relevant pre-mix tanks. The high fibre material will be transferred directly into the underground pre-mix tanks, and liquid material will be pumped into the sealed storage tanks on site. Waste material will only be accepted on site from approved facilities, to be delivered by approved permitted contractors. All deliveries will be recorded on site, and this register will be available for inspection by officials from Cork County Council, Department of Agriculture, Food and the Marine and the Environmental Protection Agency. Waste acceptance and characterisation procedures are included in the following headed *Organic Waste Acceptance and Characterisation Procedure.*

The plan to develop an Anaerobic Digester in this area first took seed in 2003 when following a detailed review of all available alternative technologies to treat pig manure, it was decided the most suitable technology was Anaerobic Digestion, which is simply the natural breakdown of organic waste in the absence of air.
A Digester is a warmed, mixed, airless vessel which creates ideal conditions for the necessary bacteria to naturally break down this material. A chain reaction of different bacteria attacks the carbon in the digesting material, giving off methane gas as Biogas (65% Methane). This gas can be collected, contained, and then burned to create electricity and heat, or in some cases processed further into a vehicle fuel. It is now accepted within the EU that farming and life in general must become more sustainable with regards to protecting the environment, and maintaining rural life.

There is now a significant amount of legislation that is demanding this sustainable and integrated approach. The use of anaerobic digestion can help to meet many of these targets.

(i) The pig manure produced on Mr. O' Donovan's Pig Farm will provide the required fuel base for this Anaerobic Digester i.e. 23,000 tonnes (at full production) and will be supplied by tanker/articulated lorries to the AD facility.
(ii) The additional fuel waste required (25,000 tonnes) will be sourced locally, and transported to the Facility by lorry, at a rate of 49 in/out weekly movements.
(iii) The gas generated will be used to supply power to the Facility.
(iv) The excess power will be exported to the National Grid.
(v) The solids will be separated, including approximately 80% of the Phosphorous, currently being reviewed as a soil conditioner. Other alternative reuse options are also being investigated.

(vi) The liquid digestate will be used on customer farms, in accordance with a digestate fertiliser plan.
(vii) The odour impact of spreading digestate versus pig manure, belly grass, and/or dairy sludge will be reduced by 80% min.
(viii) The digestion process will destroy 98% of all pathogens & parasites.
(ix) The digestate is relatively stable, and will not produce a crust in storage.
(x) The digestion process will kill all weed seeds.
(xi) The digestate is a pleasant, clean and easy material to handle.

Application methods
The application of liquid digestate to agricultural land as a fertiliser will be carried out using specialist equipment fitted to tractor tankers which will ensure direct application to ground, thereby increasing the nitrogen uptake of plants.

Steps will be taken with the customer farms whereupon it is proposed to use liquid digestate and in designing the management of its use, to ensure that no contamination of surface and groundwater takes place. The proposed development of an Anaerobic Digester will significantly reduce the risk to surface-water and groundwater. The existing customer farm base has the capacity to recover the proposed volume of liquid digestate.

Storm/clean surface water
All clean water is separated from soiled water. Roof water is collected via galvanised gutters and downpipes and piped underground to a nearby watercourse via a stormwater monitoring point identified as SW1 on Drawing 003 - Overall *Site Plan* included in ***Attachment 2*** of the EIS. This monitoring point will be visually inspected on a weekly basis. A register of these inspections will be maintained on site for inspection. A water sample will be taken on a quarterly basis from this point (SW1) for analysis at an independent accredited laboratory.

The surface water collected from the open yard area in front of the reception building, and the access road will be collected and diverted to an integrated constructed wetland (ICW), before being discharged to the adjacent watercourse, via a monitoring point which will also be visually inspected on a weekly basis – SW2. A register of these inspections will also be maintained on site for inspection. All emissions from the facility (including storm water discharges) will be controlled and monitored by condition of the waste licence if granted by the Environmental Protection Agency.

The issue of water is detailed further in *Section 6.4* of the EIS.

Surface Water
Teagasc have put in place a regional monitoring programme at a point up-stream from this site as part of their Agricultural Catchments Programme over recent years, wherein they have recorded flow rates and ambient monitoring has being carried out for phosphorus and nitrogen. Upon completion of this proposed development it is intended to engage with this programme to monitor any impacts from the displacement of applications to land of pig

manure, and other organic materials, in this catchment area, with the digestate fertiliser from the anaerobic digester process.

In order to maximise farm outputs and profits, grassland and tillage production rely on a supply of essential plant nutrients Nitrogen (N) and Phosphorus (P). The use of these nutrients is regulated by recommended guidelines in feed and fertiliser and also the EC Good Agricultural Practice for Protection of Waters (S.I. No 610 of 2010) which implements the EU Nitrates Directive into Irish Law.

One of the main aims of Teagasc's Agriculture Catchments Programme is to protect and improve the quality of water, both surface and ground water. This programme intends to work with 300 farmers across six catchment areas in order to monitor and assess the measures implemented by the Nitrates Action Programme in compliance with the Nitrates Directive and the recommended guidelines.

It is intended to cooperate fully with Teagasc in this programme to monitor on-going future impacts from this proposed development.

See Teagasc report included in ***Attachment 4*** of the EIS.

Groundwater

There is no groundwater monitoring currently within the site boundary. In the context of ground water, the main hazard associated with the proposed development is the storage and handling of liquid organic material – pig manure and other organic material and potential accidental spills of same reaching ground water.

All organic waste storage structure will be constructed to Department of Agriculture requirements and will be sealed and bunded. An integrity assessment will be carried out on all storage tanks prior to commissioning. Storage structures will have individual leak detection systems which will be monitored on an ongoing basis during operation.

Traffic

An assessment of sightlines at the entrance to this Facility was undertaken by Mr. John Mc Eniry in order to ascertain that adequate sightlines were available to support an increase in the level of traffic movement due to the proposed level of organic material to be delivered to the Biogas Plant. This report is included in full in ***Attachment 13***. However, recognition must be taken of the fact that 50% of these traffic movements occur in the general area currently, and will continue to do so irrespective of the construction of this proposed development, in the form of current deliveries of pig slurry, belly grass, dairy sludge and other organic materials to farms in the general area for use as agricultural fertiliser.

A topographical survey was carried out on the existing road from the proposed entrance for the Biogas Plant to Ballinadrollm Bridge, located North of the proposed entrance. The stretch of road varied in width from 6.1 to 6.5 and 300mm wide verges with 1.5 to 2.0m high stone walls on both sides. The stone walls have heritage merit and it is considered that their demolition would be unwelcome. It is proposed to maintain the foliage on top of the walls by cutting back in the appropriate season from September to March.

The issue of Traffic is detailed further in *Section 6.9* of the EIS.

Noise & Odour
This planned operation will be developed on a green site therefore there are no existing significant effects on noise or odour.

On completion of the project, all aspects of the facility which have the potential to cause nuisance noise or odours will be housed in sealed and soundproofed buildings e.g. the Combined Heat and Power Unit and Generators. The only issues will arise from the delivery of the imported organic matter but this will not be a problem outside of the boundary of the site. This imported fraction of matter will also be transported in sealed containers helping control odours. Noise and Odour are discussed in detail in *Section 6.10 Noise* and *6.5 Air* of the EIS.

It is not intended to provide ventilation or air extraction to the stores for the following reasons:

(i) The digestion process reduces significantly the odour potential from the biomass and essentially converts odorous compounds to biogas rendering the solid digestate effectively odourless. The biomass will be allowed to accumulate in the store predominantly in the closed land-spreading period from October to January. The proposed fibrous material store is a 3 section portal framed store with each section enclosed fully separately.

(ii) Maintaining the doors closed during normal operation will reduce the air movement from the building to the surrounding hinterland.

Air Dispersion Modelling
Air Dispersion Modelling in accordance with the Air Dispersion Modelling Guidance Document issued by the EPA 2010, has been prepared by Dr. Brian Sheridan of Odour Monitoring Ireland Ltd. This report is attached.

Dust
Construction and operational procedures have the potential to generate dust emissions. The potential for impact from dusts depend on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. Most of the dust would be deposited close to the potential source and any impacts from dust deposition would typically be within several hundred metres or so of the construction area.

Mitigation Measures

- The site access road onto the public road will be regularly cleaned and maintained as appropriate.
- The site will be regularly dampened during dry and/or windy conditions if required.
- Vehicles delivering materials to site will be enclosed or covered with tarpaulins, where necessary.
- A wheel-wash will be provided on the construction site if needed.
- Material handling systems and stockpiling of materials on site will be arranged to minimise exposure to wind.
- During movement of soil/fill material both on and off-site, trucks will be covered with tarpaulins, where required.
- Vehicles are to be kept in good working order and serviced regularly to minimise emissions.
- Vehicles travelling on access roads will not exceed the designated speeding limit i.e. 20km.
- The vehicle importing the biomass, once emptied, will be washed with an approved detergent or steam, while at the reception tank, using a high pressure washer.

Archaeological Features
An assessment of Archaeological Features in the vicinity of the proposed development has been carried out by Dominic Delany & Associates (***Attachment 7*** of the EIS). It is considered unlikely that there are any unknown archaeological remains or features in the vicinity of the proposed development, or that the development will impact, either physically or visually, on the archaeological heritage of this area.

Heritage Areas
The Biogas Plant and selected spread-lands will not have an impingement on any heritage areas **(*Attachment 7*** of *the EIS).*

Cultural Heritage and Material Assets
Farming traditions in the area have been stock rearing, milk production, pig production and tillage. Animal manures are recycled onto the land reducing the cost of production.

Climate
The most important contribution of this biogas development in the protection of the environment is that it reduces emissions of methane and ammonia. Methane is a gas that has a huge effect on climate that would otherwise be released, uncontrolled, from the land-spreading of raw pig manure, belly grass, and dairy sludge. There are additional potential benefits via the CO_2 recovery systems with the associated proposed development of a Glasshouse facility (Planning Ref: 1390).

The issue of climate is detailed further in *Section 6.6* of the EIS.

Population

The town of Bandon has a population of ca. 6,000 people**,** with a population of ca. 1,500 people in the town boundaries. The nearest settlement location adjacent to the proposed site is Timoleague village (1.5km) which has a population of ca. 300.

The proposed development will have a positive impact on human beings from the increased employment it will create, and the resultant reduction of existing impacts from emissions. The development will be located in an agricultural area; therefore the buildings will blend into the surrounding area. Also, the development will be landscaped with a screening of trees, shrubs and flowers. Thus, there will be no nuisance or loss of amenity (see ***Attachment 20*** *- Photomontage of the proposed Anaerobic Digester Facility*. A *Landscaping Proposal* is included in ***Attachment 14*** of the EIS which includes details regarding the location and height of the proposed berms as well as details regarding numbers and the species of the trees. The mature trees and the historic wall located to the north of the site will be retained. Effects of the development on air are insignificant outside the buildings and adjoining yards. Mitigation measures taken will minimise the effects of odour on the days of digestate spreading. The application of digestate will replace the current practice of pig manure application to land, resulting in an 80% reduction of odours generated, due to gas extraction.

This report was prepared in accordance with the EPA publication - *Odour Impacts and Odour Emission Control Measures for Intensive Agriculture*.

Noise levels from the development are unlikely to be a nuisance. The main sources of noise will be produced by the traffic and the generator. The generator is a permanent source of noise but is quite low and considering the seclusion of the site, this should not be a nuisance outside of the site boundary.

The development will have an insignificant effect on the climate of the area.

Thus, the measures that have been put in place will ensure that impact/effects of the development on human beings, noise, air, climate and the interaction of human beings, fauna, soils, air, water, climate, landscape and material assets will be minimised.

In a discussion paper published by the Environmental Protection Agency (January 2005), it concluded that "*Anaerobic Digestion has the potential to deliver multiple environmental benefits, including reduced water pollution potential, lower green house gas emissions, and reduced odours from agricultural slurries"*.

This proposed development has the potential to benefit all stakeholders adjacent to the proposed site and the customer farms. The net result of this proposed development will be a reduction of existing impacts to the order of at least 30% from the site and 80% from the application of digestate in place of pig manure, belly grass, and dairy sludge to customer farms.

This proposed development has the potential to provide an economic outlet for crops grown by customer farmers in the area, on lands that may not otherwise be utilised fully. These crops can be fertilised by the digestate from the process. This proposed development also has the potential to provide the energy to drive additional projects such as the proposed Glasshouse Facility located adjacent to this site, to be the subject of a separate planning application (planning ref no: 1390). This proposed Glasshouse Facility will utilise heat and CO_2 that would otherwise be released into the environment.

A full process control system (SCADA) has been prepared for this proposed Facility. This report has been prepared by our Associates who have over twenty five years experience in the anaerobic sector. It is based on the professional management systems currently operational on similar Anaerobic Digestion Facilities throughout Europe. It details the type of system software, reporting, alarm systems, data exchange and functional systems required to operate a facility such as the proposed development. This expertise is available to the management and operators of the proposed development, at local and remote levels.

Monitoring and Register

Proposals for monitoring storm water emissions at the site and for monitoring soil fertility are set down in the Environmental Report. A register of slurry quantities, rates and locations of spread-lands will be maintained for inspection and monitoring by Cork County Council and other Regulatory Bodies.

An Annual Environmental Report will be submitted annually to the Environmental Protection Agency, in accordance with the requirements of a Waste Facility Licence.

The intention of the joint developers for this project is that the Anaerobic Digestion and Glasshouse projects will create a synergy to provide valuable employment in the local and regional economies, and at the same time become a centre of excellence which will aid the development of similar projects to benefit the regional and national economies.

Emergency Response Plan

An Emergency Response Plan and Procedures has been put in place to deal with which includes:

- Identification of potential hazards that may be encountered during the decommissioning phase.
- Emergency telephone numbers including, local doctor, garda station and fire brigade along with numbers for other various response services including contact details for the Environmental Directorate.
- Emergency response procedures for accidental spills, fire or injury to personnel.
- Identification of the person in charge of the site and implementation of the emergency plan.

The emergency plan will also detail information in relation to the incident which would have to be recorded in order to prevent a similar incident occurring again.

Hours of Operation

Biogas Production or Anaerobic Digestion is a bacteriological Process which operates 24 hours per day 365 days per year. Wastes are accepted and finished products exported between 7.00 and 19.00 Mondays to Saturday.

Organic Waste Acceptance and Characterisation Procedure

Objectives

- Ensure waste processed on site is suitable for digesting and characterised correctly. Waste unsuitable for the Anaerobic Digestion process is identified, isolated and controlled.

Responsibility

- Facility Manager
- Weighbridge Operators

Procedure

- Before new waste is proposed to enter the site, preclearance is sought from the customer which must include, description, origin of the waste and analysis (if requested). The Environmental/Technical manager will determine the EWC code for the waste and its Animal by-Product status. An internal ABP classification form is filled out to classify the waste.
- Any additional information (e.g. analysis) is retained along with the classification form for reference purposes.
- Once preclearance is given, waste is allowed enter the site and is weighed in at the weighbridge.
- All receptacles (trailers/tankers etc) entering the site must be covered and sealed. Tucks are directed to the waste acceptance area. An operator then signals to the driver when it is clear to tip waste. The load is visually inspected to ensure that it is consistent with the details provided in the waste classification form and, assuming is consistent, is cleared to process.
- If the waste is not cleared to process because of suspected non-conformity with the waste classification form, the plant manager is informed immediately. Following an immediate assessment of the suspected non-conforming load, the plant manager will either pass the load for processing or direct the load to be reloaded and removed from the site.

  All plant and machinery that come in contact with the waste will be thoroughly cleaned.

- Where a load is confirmed to be non-conforming, the non conformance and the corrective action record sheet (RS MC07) is filled in and all details and actions taken recorded in same.
- Once acceptance is completed, the weighbridge operator directs the driver to the weighbridge. The truck is weighed and a detailed receipt is given to the driver.

Waste

Wastes generated on the site are disposed in a manner which will minimize the impact on the environment. A Waste Management Plan has been produced by NRGE Ltd. for the Operational phase of the development. This plan contains all details of the relevant details of the Permitted contractors designated for specific waste streams. A separate Construction Management Plan has been prepared for the Construction phase.

A register of all other wastes will be maintained on site, recording the date, volume and destination. A copy of these registers will be available on site for inspection by Cork County Council, the DOAFM and the EPA, and any other regulatory officials at any reasonable time.

Employment

This development has the potential to provide for 2 full time jobs at the Biogas Plant and 1 part-time with indirect employment potential of 40-50 full time jobs in associated waste and biomass collection sectors. Planning for a sister project has being submitted to Cork County Council, for the development of a glasshouse facility adjacent to this site which will have an additional job creation potential of 20-40 direct job positions, while utilizing heat and CO_2 emissions from the anaerobic digester.

Start-up, shutdowns, leaks, malfunctions, breakdowns and momentary stoppages

Start up: During start up, the loading into the digester will proceed slowly. While doing so careful monitoring and control of the process are essential until the digester attains optimum conditions. Approximately 1-3 months are required to achieve a steady state digester.

Malfunctions, breakdowns and momentary stoppages: If the heat is turned off due to malfunctions, breakdowns and momentary stoppages, a typical digester will lose at least 0.50C to 10C a day if loading of feedstock ceases. Once the temperature has dropped to 280C, the gas production will reduce significantly. To start the digester up again, the contents should be mixed continuously, so there is no mat on the top, and then slowly warmed up again. This process can be used if the operator is in any doubt about contaminated feedstock: if feeding is stopped the digester will recover.

De-Commissioning/Life Span of Development

All facilities of this type require a major capital investment every 15-20 years to keep them efficient and pleasant places to work. So long as this investment is made there is no reason that a facility of this type could not operate for up to 40 years. However, if for economic reasons or technical reasons this does not occur decommissioning will take place, the

Closure, Restoration and Aftercare Management Plan prepared by NRGE Ltd. for the site will be implemented.