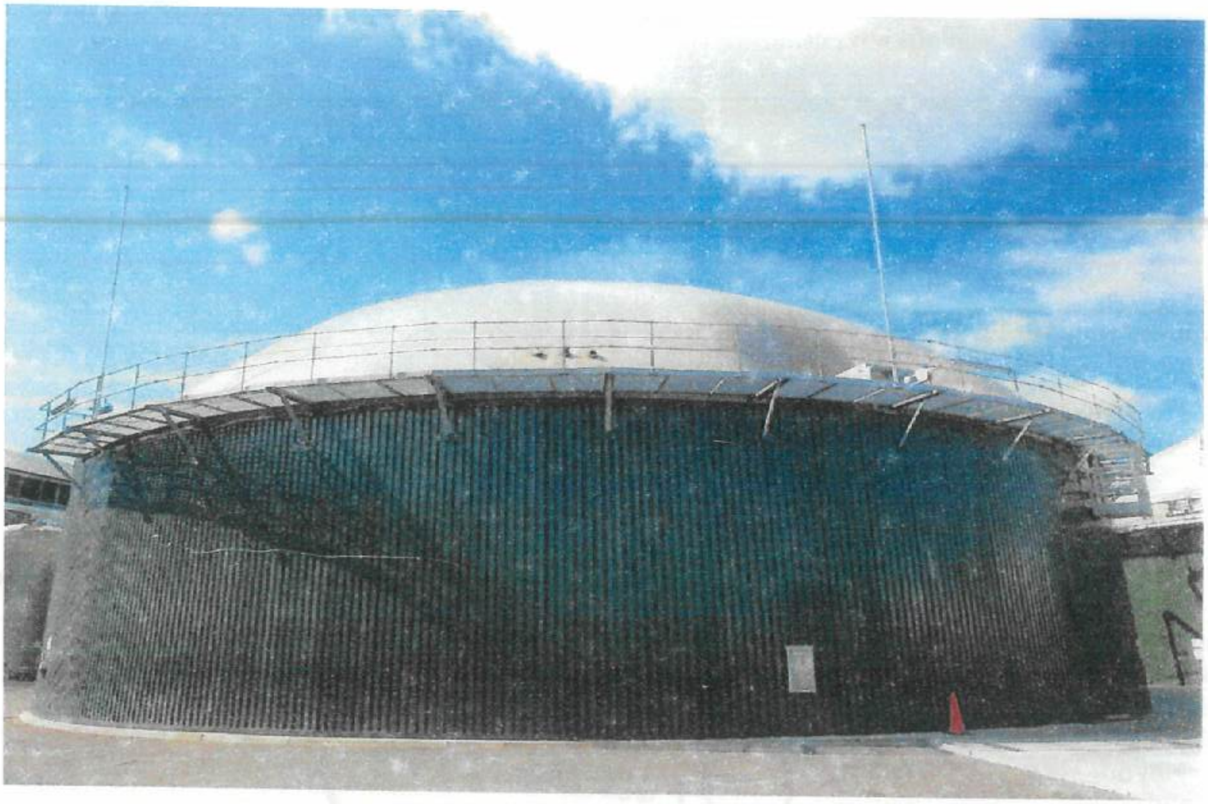
SUSTAINABLE BIO-ENERGY LIMITED

BIOGAS PLANT
GORT
COUNTY GALWAY



ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

(VOLUME 2)

NOVEMBER 2019

Document Control

Client:	Sustainable Bio-Energy Limited
Project Name	Sustainable Bio-Energy Limited Biogas Plant, Gort, County Galway.
Project Ref. No.	SEP-0251

Document Checking:

Author:	Colm Staunton	Signed:	

Reviewed By:	William Dwyer	Signed:	

Issue	Date	Status
v2.0	18/11/19	FINAL

Halston Environmental & Planning Limited
IHub Building
Westport Road
Castlebar
Co. Mayo
Ireland
F23 K162

Tel. +353 (0)94 9010111

TABLE OF CONTENTS

LIST OF FIGURES

PLANNING & DEVELOPMENT SECTION
21 NOV 2019 1812
GALWAY COUNTY COUNCIL

LIST OF TABLES

PLANNING & DEVELOPMENT SECTION
21 NOV 2019 1812
GALWAY COUNTY COUNCIL

LIST OF APPENDICES

1 INTRODUCTION

1.1 Overview

This Environmental Impact Assessment Report (EIAR) has been prepared to accompany an application to Galway County Council for full planning permission by Sustainable Bio-Energy Limited for the development of a biogas plant in the townlands of Ballynamantan, Glenbrack and Kinincha, Gort, County Galway.

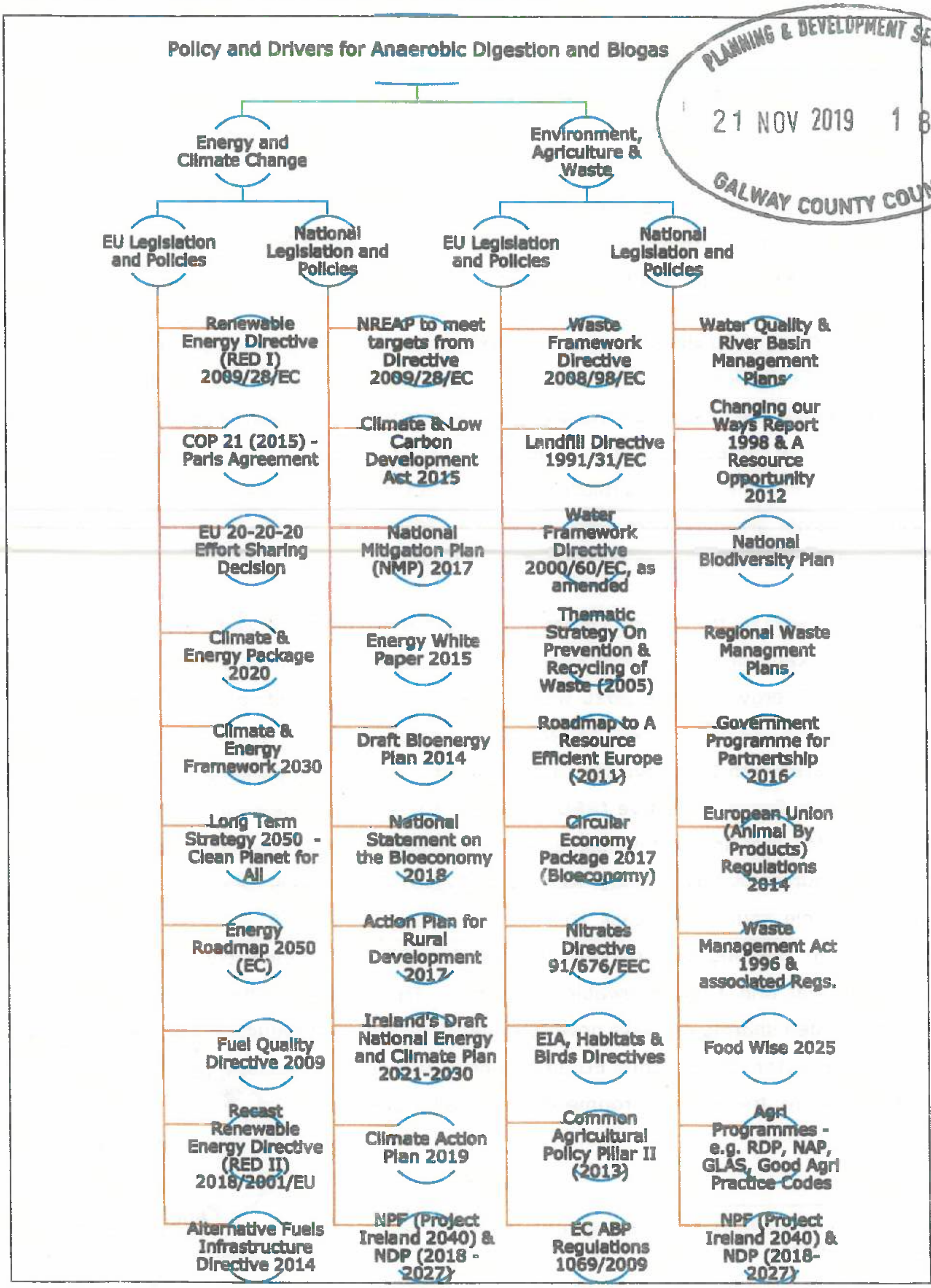
The Department of Agriculture Food and Marine (DAFM) define a biogas plant as *a plant in which animal by-products or derived products are at least part of the material, which is submitted to biological degradation under anaerobic conditions* [Anaerobic Digestion]. *It shall include the site on which the Plant is located, all services and facilities used in any way thereon, for, or in connection with the Plant and any buildings erected, located, or to be erected and located on the site, all of which are confined within a defined perimeter boundary, hereinafter referred to as a 'Plant'.*

Sustainable Bio-Energy Limited propose to accept and process naturally occurring feedstocks sourced largely from the agri-food sector. Incoming organic feedstocks will be fed to the AD process; into a sealed airless vessel (digester). In this oxygen free environment, bacteria naturally break down the organic material to produce biogas [a mixture of carbon dioxide (CO_2) and methane (CH_4)] and digestate. The renewable gas produced (biomethane) will be used as an alternative and substitute energy source for fossil fuels and as a flexible renewable fuel can be used in the electricity, heat and transport sectors. Carbon dioxide produced will be supplied back to industry as a raw material, e.g. as an input material in the food and beverage sector. The digestate arising from the breakdown of organic material will be used as a renewable organic fertiliser /soil conditioner (OFSI).

1.2 Need for the Development & Policy Context

The need for the project is driven by a wide range of policies which are relevant to the development proposal, including directives and communications on climate change, waste, renewable energy, transport and agriculture. There are a number of drivers inputting into a steady and constant growth of the biogas/biomethane sector in Ireland. The dominant policy and legislative drivers are grouped under (a) Energy and Climate Change and (b) Environment, Agriculture and Waste as illustrated in Figure 1.1.

Figure 1.1 Policy and Drivers for Biogas Plants



1.2.1 Energy and Climate Change Policy

The United Nations Framework Convention on Climate Change (UNFCCC), agreed in 1992, is the main international treaty on fighting climate change. Its objective is to prevent dangerous man-made interference with the global climate system. The Paris Agreement (COP 21[1]) adopted by all UNFCCC Parties in December 2015 is the first-ever universal, legally binding global climate agreement. Before 2020, the world's only legally binding instrument for cutting greenhouse gas emissions is the 1997 Kyoto Protocol. The Protocol has been ratified by 192 of the UNFCCC Parties, including the EU and its member countries.

The development of EU climate policy was first discussed by the European Council in 1990. At this time, EU leaders agreed to implement the first European climate target, namely to stabilise greenhouse gas (GHG) emissions of the European Community (EC) at 1990 levels by 2000. At the climate summit in Kyoto in 1997, the EC committed to 8% reductions of six GHGs during the first commitment period 2008-2012 (compared to 1990 levels). Specific internal arrangements were agreed in 1998 and the approved burden sharing agreement became binding on Member States in 2004.

This was followed by the second commitment period (2013-2020) and introduction of the EU's first package of Climate and Energy measures, which were adopted in 2008. The Climate and Energy Package 2020 includes a set of three binding targets for Member States including the requirement to reduce greenhouse gas (GHG) emissions by 20% by 2020 (compared with 1990 levels). One of the four constituent parts[2] of the package was the Renewable Energy Directive (RED I)[3]. RED I is a central element in EU policy and a key driver for meeting renewable energy targets; 20% consumption to come from renewable sources by 2020. Under RED I (2009/28/EC) Ireland is committed to producing from renewable sources at least 16% of all energy consumed by 2020. Ireland has committed to meeting this national target through 40% renewable electricity, 12% renewable heat and 10% renewable transport. The EU Effort Sharing Decision (ESD) replaced burden sharing and lays down binding GHG emission reduction targets related to the non-ETS sector (55% of total EU emissions). The non-ETS sector includes agriculture, transport, waste, the built environment and small industry.

[1] *"Conference of the Parties" – referring to the countries that signed up to the 1992 UNFCCC. The COP in Paris is the 21st such conference. COP 24 was held in Katowice (Poland) in December 2018.*

[2] *The other three parts being a reviewed Directive on Emissions Trading (ETS Directive), the Effort Sharing Decision (ESD) and a Directive on Carbon Capture and Storage*

[3] *European Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*

The 2012 Energy Efficiency Directive (EED) (2012/27/EU) establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. Under the 2012 EED, all EU countries are required to use energy more efficiently at all stages of the energy chain, including energy generation, transmission, distribution and end-use consumption. Article 7 of the EED obliges Members to deliver savings of 1.5% of annual energy sales to final customers. In Ireland, the Energy Efficiency Obligation Scheme (EEOS) is projected to deliver half of the required 1.5% target.

In October 2014 the European Council agreed on a new target framework for 2030 that continues the triple target approach of 2020 (the 2030 Climate and Energy Framework). The 2030 Climate and Energy Framework includes targets and policy objectives for the period 2021-2030. The targets for renewables and energy efficiency were revised upwards in 2018 following agreement on a recast of RED I. The recast directive, RED II (Directive 2018/2001), provides a framework towards meeting the binding Union target of at least 32% renewable energy in gross final energy consumption by 2030 and a cut in GHG emissions by at least 40%[4]. Notably, RED II increased the sustainability criteria for biofuels used in transport and bioliquids, and solid and gaseous biomass fuels used for heat and power. A minimum 65% GHG saving for fuel used in transport was introduced and a minimum 70% GHG saving threshold is introduced for bioenergy pathways in the electricity, heating and cooling sectors. RED II (Article 23) also sets out the need to increase the level of renewable energy in the heat sector by 1.1 to 1.3% per annum from 2021 to 2030.

In response to concerns relating to indirect land use change (ILUC), RED II also contains a number of provisions to encourage the use of advanced biofuels over biofuel produced from feed and food crops. These include GHG saving criteria and linking financial incentives to biofuels produced from Annex IX Part A[5] feedstocks. Under the new 2030 Climate and Energy Framework, which is also part of the *Clean Energy for all Europeans Package*[6], EU countries are required to draft 10-year National Climate and Energy Plans (NECPs) for 2021-2030, outlining how they will meet the new 2030 targets for renewable energy and for energy efficiency. The final plans must be submitted by the end of 2019.

[4] Requirement for the ETS sector to cut emissions by 43% and the non-ETS sector by 30% (compared to 2005).

[5] Annex IX Part A. Feedstocks for the production of biogas for transport and advanced biofuels, the contribution of which towards the minimum shares referred to in ..Article 25(1) may be considered to be twice their energy content: This includes; (d) Biomass fraction of industrial waste not fit for use in the food or feed chain….., (f) animal manures, and (p) "Other non-food cellulosic material" whose definition includes: (42) grassy energy crops with a low starch content, such as perennial ryegrass

[6] This addresses the 5 dimensions of the Energy Union (1) energy security; 2) the internal energy market; 3) energy efficiency; 4) decarbonisation of the economy; and 5) research, innovation and competitiveness.

In 2018, the Directive on Energy Efficiency (2018/2002/EC) was agreed (amending 2012/27/EU) to update the policy framework to 2030 and beyond. Article 7 of the amending EDD sets a binding target for Member States to make new annual energy savings equivalent to 0.8% of their final energy consumption each year to meet a cumulative target by 2030. To meet these requirements Government has to put policies and measures in place that will result in energy savings.

In light of the Intergovernmental Panel on Climate Change (IPCC) Special Report in 2018 on the "*Impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways*", the EC presented its strategic long-term vision for a climate-neutral (net zero target) economy by 2050 in November 2018. The purpose of the Strategy (*A Clean Planet for all),* isn't to set targets. Rather it creates a vision and plan and provides a portfolio of pathways to stakeholders in line with the Sustainable Development Goals[7] to help achieve a climate neutral net zero target by 2050.

1.2.2 Environment, Agricultural and Waste Policy

The Water Framework Directive (2000/60/EC) requires Member States to manage water at the river basin scale, and collaboration of state bodies is required to fully implement EU related legislation such as the EIA Directive, Nitrates Directive, Habitats and Birds Directives, Drinking Water Directive, etc. In April 2018 the Government published the River Basin Management Plan for Ireland 2018-2021. The Plan sets out the actions that Ireland will take to improve water quality and achieve *'good'* ecological status in water bodies (rivers, lakes, estuaries and coastal waters) by 2027. The Nitrates Directive (91/676/EEC) aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. The Nitrates Directive implemented by means of the Nitrates Action Programme (NAP) is the key legal measure in Ireland's River Basin Management Plan dealing with Agriculture.

The Habitats Directive and the Birds Directive form the basis of nature conservation policy within the EU and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments. The Waste Framework Directive (2008/98/EC) enshrines a principle aiming to move waste away from landfill and towards treatment options, including AD, which are better for the environment than disposal. The separate collection of biowaste with a view to its biological treatment is also encouraged by this Directive.

[7] *https://www.un.org/sustainabledevelopment/sustainable-development-goals/*

The EU's common agricultural policy (CAP) is the European Union's chief agricultural policy and has a significant social, economic and environmental reach. It was initially introduced in 1962 with the objectives of providing affordable food for EU citizens and a fair standard of living for farmers. In 1992 CAP was adapted to better serving the aims of sustainability, including environmental protection. It was reformed in 2003 to cut the link between subsidies and production and again in 2013 (*"Greening"* introduced for the period 2014-2020) with the aim of strengthening the competitiveness of the sector and further promoting sustainable farming, innovation, jobs, growth in rural areas and to move financial assistance towards the productive use of land. The CAP has a significant proportion of the total EU budget (37% in 2017) but its share of the overall EU budget has decreased overtime. CAP is financed through two funds; Pillar 1[8] which primarily finances direct payments to farmers (Basic Payment Scheme) and Pillar 2[9] which finances the EU's contribution to rural development. Farmers are eligible for Basic Payments provided they satisfy of a number of cross compliance standards that include thirteen statutory management requirements and Good Agricultural and Environmental Condition (GAEC) regulations. In addition, a proportion of the Basic Payment represents *"Greening"* payments which are received following the implementation of specific on-farm measures. Pillar II incorporates measures such as the Rural Development Program which funds the Green, Low-Carbon, Agri-Environment Scheme (GLAS), the Organic Farming Scheme, disadvantaged areas supports and a number of other schemes.

Work on the post 2020 CAP are ongoing and are focused on dealing with climate change issues, technological innovations and global trade conflicts. It is expected that funding for CAP will be further reduced and fall to less than 30% of the overall EU budget. Member States will also be required to allocate a minimum of 30% of their rural development budget to environment and climate measures.

Under the new CAP, each Member State will have to develop its own CAP Strategic Plan, which will include the measures that will deliver the required socioeconomic and environmental outcomes. The plan will have to include eco-schemes under Pillar 1 in addition to the traditional environmental payments under Pillar 2. A set of impact indicators will be used by the EC to monitor progress in relation to environment, climate change mitigation and biodiversity in Member States to ensure that effective measures are adopted.

[8] *European Agricultural Guarantee Fund (EAGF)*
[9] *European Agricultural Fund for Rural Development (EAFRD)*

In December 2015, the Commission adopted a Circular Economy Action Plan[10] (CEAP) to give a new boost to jobs, growth and investment and to develop a carbon neutral, resource-efficient and competitive economy. The plan has also contributed to moving towards the achievement of the 2030 Agenda for Sustainable Development[11]. The 54 actions under the action plan have now been completed or are being implemented. Circularity has also opened up new business opportunities, given rise to new business models and developed new markets. The aim of the CEAP is to extract the maximum value and use from all raw materials, products and waste, promoting greenhouse gas emissions reductions and energy savings. The first deliverable in form of a legal act is the new Fertilising Products Regulation ((EU) 1009/2019). The new EU Fertiliser Products Regulation was approved by the European Parliament and the Council of the European Union on 5th June 2019. The Regulation will apply from 16th July 2022 and will be binding in its entirety and directly applicable in all Member States. The new Regulation enables production of fertilisers from recovered bio-wastes and other secondary raw materials and includes products such as digestate and compost. The new Regulation allows for the CE marking of a range of fertilisers including digestates, and the inclusion of certain products derived from animal by-products (ABP), within the meaning of Regulation (EC) No 1069/2009 that have reached an end point in the manufacturing chain as determined by that regulation. The new Regulation replaces Regulation (EC) No 2003/2003 which exclusively covers fertilisers from mined or chemically produced, inorganic materials. This will boost domestic sourcing of plant nutrients which are essential for sustainable agriculture, including the critical raw material phosphorus. It also contributes to a better implementation of the waste hierarchy, by minimising landfilling or energy recovery of bio-wastes, and hence to solving related waste management problems. A shift towards fertiliser production from organic or secondary raw materials reduces CO_2 emissions, hence contributing towards a low carbon economy and the sustainability of the fertilisers sector.

1.2.3 The Role and Benefits of a Biogas Industry in Ireland

It is clear from that which is outlined above that the EC has established several cross sectoral policies, regulations, directives and actions with a clear target and roadmap aimed at sustainable agriculture, sustainable energy generation, greenhouse gas emissions abatement, preservation of soil and aquatic systems and food security.

[10] COM (2015) 614

[11] e.g. SDG 2 (promoting water reuse and organic fertilisers, ….), SDG 8 and 9 [illegible] innovation, jobs and added value), SDG 12 (supporting waste prevention and responsible management of waste….) and SDG 13 (potential of material efficiency to reduce CO_2 emissions)

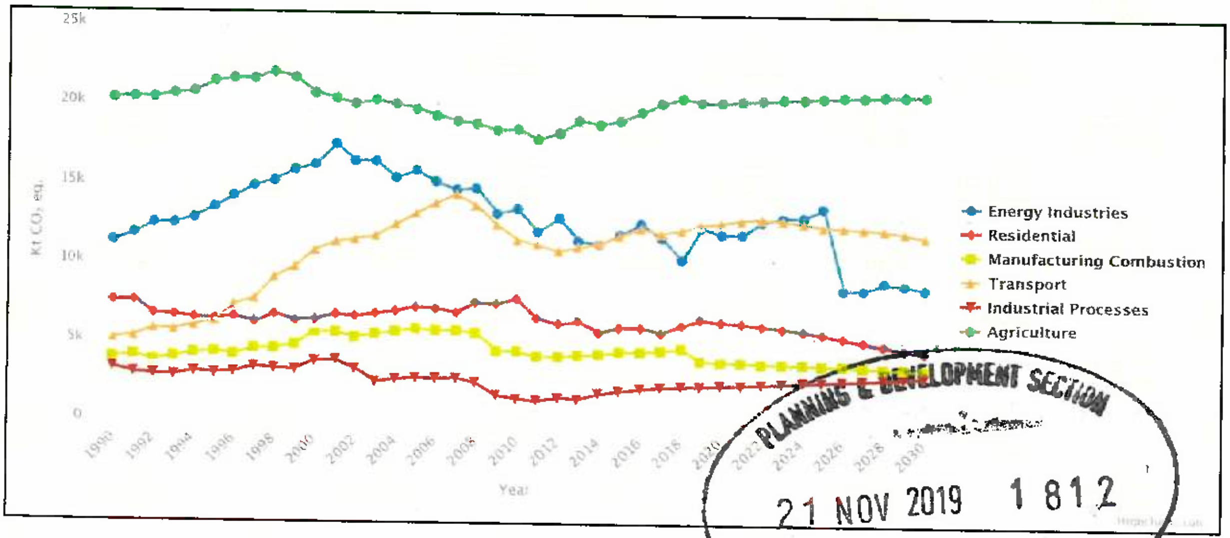
To further address circularity aspects relating to bio-based products and the sustainable use of renewable natural resources, Europe's Bioeconomy Strategy[12] (complimentary to the circular economy) was launched in 2012 and updated in 2018. The EC defines the bioeconomy as *"the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy"*. Ireland enjoys some important comparative advantages in relation to the bioeconomy and government policy is to pursue and capitalise on these. Much of Ireland's advantage in the bioeconomy sphere is attributed to the agri-food sector and relatively long growing season (potential for crop growth up to 10 months of the year) which arises from its temperate climate and fertile soils. However, the ever-growing pressures and challenges on the agri-food sector and the urgent need to respond to sustainable production and globalisation of trade markets undermine the potential and competitive advantage of the sector. A circular model of the bioeconomy presents alternative markets opportunities and activities to the agriculture and land use sector generating new income streams and enhance economic stability, therefore bringing social benefits, while also maintaining and enhancing the natural resources on which the sector is based. The circular approach helps drive the bioeconomy, ensuring the renewed and optimal use of resources and therefore the efficiency of the system, while avoiding fossil fuels. The circular economy and bioeconomy are increasingly recognised as a strategy in achieving decarbonisation, regional development, energy security from renewable sources, along with environmental protection in Ireland. This is as outlined in the recent National Policy Statement on the Bioeconomy[13] which was published as part of Project Ireland 2040.

A biogas industry in Ireland would deliver many cross-sectoral environmental, economic and social benefits (direct and indirect) particularly to the agri-food sector and would generate renewable energy for the electricity heat and transport sectors.

According to EPA GHG figures published in October 2019[14], Ireland exceeded its emissions budget in respect of climate change commitments for the third year running. Figure 1.2 below shows trends in emissions and projections (WAM 2019-2030) for the largest sectors.

[12] COM(2012)60, Innovating for Sustainable Growth: A Bioeconomy for Europe, 13.02.2012
[13] National Policy Statement on Bioeconomy, February 2018
[14] http://www.epa.ie/ghg/currentsituation/

Figure 1.2 Trends in Emissions and Projections (WAM 2019-2030) for largest sectors



On analysis of the sectoral figures, the ETS sector was shown to have achieved significant reductions (mainly due to electricity generators, with renewable electricity now at 32.6% in Ireland). However, this was undone by increases in household emissions (increased by 7.9% in 2018) associated with heating, transport (increased by 1.7% in 2018) and agriculture (increased by 1.9% in 2018). As mentioned previously, GHG emissions from the non-ETS includes transport, buildings, agriculture and waste and are governed by EU Effort Sharing Decision (ESD) legislation. In 2018, ESD emissions across the EU increased by 2.8% or 1.24 Mt CO_2eq[15] compared to 2017. In their latest report, the Irish EPA show that the gap from total ESD emissions (44.974.0 kt CO_2 eq) to ESD targets compliance (39,807.1kt CO_2 eq in 2018) is increasing in Ireland; reported as being difference of 5.17Mt CO_2 equivalent. Projections to 2030 by the EPA show this increasing trend to continue. The EPA report that agriculture was responsible for 34% of Ireland's GHG emissions in 2018. In terms of gases, methane is the second most significant contributor to GHG emissions in Ireland with agriculture accounting for 92.6% of total methane emissions. Like methane, nitrous oxide emissions have continuously increased over the last three years with agriculture accounting for 93.4% of total nitrous oxide emissions in 2018.

The current River Basin Management Plan for Ireland, 2018-2021, sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in water bodies (rivers, lakes, estuaries and coastal waters) by 2027. Water quality in Ireland has deteriorated over the past two decades. The Plan provides a coordinated framework for improving the quality of our waters, protect public health, the environment, water amenities and to sustain water-intensive industries, including agri-food and tourism,

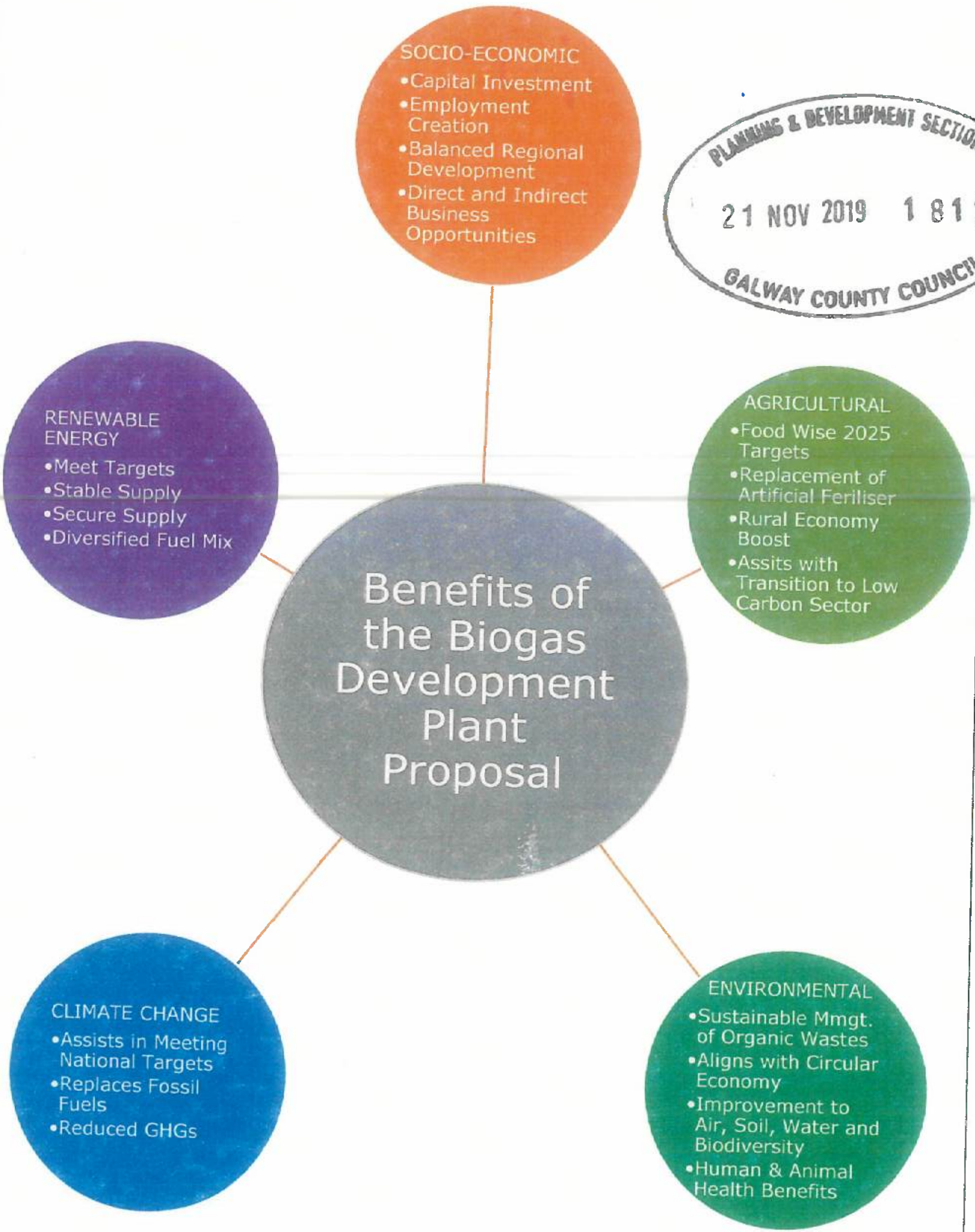
[15] *greenhouse gases other than CO2 (i.e. methane, nitrous oxide and so-called F-gases) may be converted to CO2 equivalent using their global warming potentials.*

particularly in rural Ireland. The Irish River Basin District (RBD) covers an area of 70,273km^2, with 46 catchment management units, consisting of 583 sub-catchments, with 4,829 water bodies. The 2013-2015 water-body status information shows that 57% of river water bodies, 46% of lakes, 31% of transitional waters and 79% of coastal waters had achieved good or high-status. For groundwater, 91% of water bodies are classified as having good status. Of the 4,829 water bodies. Currently 2,113 water bodies are classified as *Not at Risk* (44%) and 1,460 are classified as *At Risk* (30%), with the remainder requiring further investigation. The current plan states that the significant pressure that is impacting on the 1,460 water bodies (river, lake, coastal, transitional and groundwater) that are *"At Risk"* of not meeting their objectives is agriculture (53%).

The challenge of sustainable agriculture is to continue to protect and improve our environment (in particular addressing GHG emissions, water quality deterioration and biodiversity loss) whilst facilitating the growth of the agricultural sector in line with the 10-year Food Wise 2025 plan published in 2015.

The biogas industry in Ireland has the potential to play a vital role in helping to achieve emissions reductions in the agri-food sector. The proposed biogas development will assist Ireland in meeting binding EU targets and national policy commitments and the plant will have a wide range of cross-sectoral benefits both at local and national levels. Figure 1.3 below illustrates benefits from this type of development.

Figure 1.3 Benefits of Biogas Plant Developments



1.3 ENVIRONMENTAL IMPACT ASSESSMENT

1.3.1 Environmental Impact Assessment Legislation

The obligations under Irish law in respect of EIA are derived from obligations incurred as a result of membership of the European Community. Under Irish legislation, the definition of the process of EIA and the type of development for which an EIAR is required is set out under *Part X* of the Planning and Development Acts 2000 to 2018 and Part 10 of the Planning and Development Regulations 2001 to 2019. Within the Regulations, Schedule 5, 6, 7 and 7A prescribes details in respect of '*Development for the Purposes of Part 10', Information to be contained in an EIAR*, '*Criteria for determining whether Development listed in Part 2 of Schedule 5 should be subject to an Environmental Impact Assessment,* and '*Information to be provided by the Applicant or Developer for the Purposes of Screen Sub-threshold Development for Environmental Impact Assessment'.*

The type of development for which EIAR is required is prescribed in the planning and development legislation outlined above. Following review of the relevant legislation and consultation with Galway County Council, it was determined that a full EIAR should be prepared in support of the planning application.

This environmental assessment has been prepared in accordance with the following guidance

- European Commission (EC) (2017), "Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Environmental Protection Agency (2017), "*DRAFT Guidelines on the information to be contained in Environmental Impact Assessment Reports";*
- Environmental Protection Agency (2015) DRAFT Advice notes for preparing Environmental Impact Statements;
- Environmental Protection Agency (2003), "*Advice notes on current Practice (in the preparation of Environmental Impact Statements)"*;
- Environmental Protection Agency (2002), "Guidelines on the information to be contained in Environmental Impact Statements";

1-13
1-21

1.4 EIAR Structure

This EIAR is structured as follows:

- **Volume 1 Non-Technical Summary**
- **Volume 2 Environmental Impact Assessment Report (EIAR)**
  - Chapter 1 Introduction
  - Chapter 2 Description of the Proposed Project
  - Chapter 3 Planning and Policy
  - Chapter 4 Population and Human Health
  - Chapter 5 Biodiversity
  - Chapter 6 Soils and Geology
  - Chapter 7 Waters
  - Chapter 8 Air Quality, Odour and Climate
  - Chapter 9 Noise and Vibration
  - Chapter 10 Landscape and Visual
  - Chapter 11 Traffic and Transport
  - Chapter 12 Archaeology and Cultural Heritage
  - Chapter 13 Material Assets
  - Chapter 14 Interactions
- **Volume 3 Environmental Impact Assessment Report (EIAR) Appendices**
  - Appendix 1.1 Enquiry /Response Correspondence with Irish Water
  - Appendix 1.2 Enquiry Correspondence with Gas Networks
  - Appendix 5.1 Natura Impact Statement
  - Appendix 5.2 EcIA Figures
  - Appendix 6.1 Consultations
  - Appendix 6.2 Trial Pit Logs
  - Appendix 6.3 EPA Licence Site Report
  - Appendix 6.4 Irish Water Annual Environmental Report 2014 (Gort)
  - Appendix 7.1 Consultations
  - Appendix 7.2 Refer to Appendix 6.4
  - Appendix 7.3 Refer to Appendix 6.2
  - Appendix 7.4 Flood Risk Assessment Report
  - Appendix 7.5 Stormwater Report
  - Appendix 7.6 Surface Water Drainage Drawings
  - Appendix 8.1 Aermod Dispersion Modelling Outputs
  - Appendix 9.1 Baseline Noise Data
  - Appendix 9.2 Noise Impact Assessment Figures
  - Appendix 10.1 Photomontages (provided in separate booklet)

- Appendix 10.2 Landscape Mitigation Plan (provided in separate booklet)
- Appendix 11.1 Road Safety Audit Report
- Appendix 11.2 Traffic Counts
- Appendix 11.3 Traffic Calculations Summary
- Appendix 11.4 PICADY Analysis
- Appendix 12.1 Relevant Archaeological Inventory Entries
- Appendix 12.2 Relevant NIAH entries
- Appendix 12.3 Relevant Excavation Database Entries

1.5 EIAR Preparation & Contributors

This EIAR has been prepared and managed by Halston Environmental & Planning Limited (Halston), IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162, on behalf of the applicant. Grealish Glynn & Associates was engaged by the applicant to prepare all engineering drawings and details for the purposes of planning.

Table 1.1 provides details of the author of each EIAR Chapter and a statement of authority is provided under Section 1.4.1

Table 1.1 List of EIAR Contributors

Chapter No.	EIAR Chapter	Contributor
1.	Introduction	Halston Environmental & Planning, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
2	Description of the Proposed Project	Halston Environmental & Planning, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
3	Planning and Policy	Halston Environmental & Planning, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
4	Population and Health	Halston Environmental & Planning, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
5	Biodiversity and Natura Impact Assessment	Woodrow Sustainable Solutions, Main Street, Ballisodare, Co. Sligo Ireland
6	Soils and Geology	WYG, 1 Locksley Business Park, Montgomery Road, Belfast, BT6 9UP

Chapter No.	EIAR Chapter	Contributor
		Gavin and Doherty Geosolutions, Unit 2A, Nutgrove Office Park, Rathfarnham, Dublin 14, D14 X627
7	Water	WYG, 1 Locksley Business Park, Montgomery Road, Belfast, BT6 9UP
	Stormwater Design and Flood Risk Assessment	JBA Consulting, 24 Grove Island, Corbally, Limerick
8	Air Quality, Odour and Climate	Aona Environmental Consulting, Unit 8a, Northwest Business Park, Collooney, Co. Sligo
9	Noise and Vibration	Aona Environmental Consulting Ltd., Unit 8a, Northwest Business Park, Collooney, Co. Sligo
10	Landscape and Visual	Macroworks, Hibernia House, Cherrywood Business Park, Loughlinstown, Dublin 18
11	Traffic and Transport	Traffic Transport and Road Safety Associates, Barran, Blacklion, Co. Cavan
12	Archaeology and Cultural Heritage	John Cronin & Associates, 3 Westpoint Business Centre, Link Road, Ballincollig, Co Cork
13	Material Assets	Halston Environmental & Planning, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
14	Interactions	Halston Environmental & Planning, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162

1.5.1 Statement of Authority

Article 5(3)(a) of amended Directive requires that the developer (applicant) shall ensure that the environmental impact assessment report (EIAR) is prepared by competent experts and that sufficient expertise, in the relevant field of the project concerned, is required for the purpose of its examination by the competent authorities in order to ensure that the information provided by the developer is complete and of a high level of quality.

The applicant considers that each of the experts involved in the preparation of this EIAR possess sufficient experience, knowledge and expertise appropriate to the nature of work and roles within the overall EIA team.

The EIA team was led and managed by Mr Colm Staunton, MSc. BSc., Director of Halston Environmental & Planning Limited. Colm is a member and Certified Project Management Associate with the International Project Management Association (IPMA®), a qualified Practitioner Member of the Institute of Environmental Management & Assessment (PIEMA) and a member of the Irish Bioenergy Association (IrBEA) and Occupational Hygiene Society of Ireland (OHSI). Colm's experience predominantly relates to Project Management of Environmental Impact Assessments (EIA), Environmental Licensing and Environmental Due Diligence. Colm has a long track record of ensuring projects are delivered to a high quality and he has worked as an environmental consultant in Ireland for over 17 years. Through his professional career, Colm has gained the required expertise and project specific technical knowledge from working as lead consultant and a specialist within multidisciplinary teams, dealing with high profile planning applications and providing expert witness testimony at public enquiries, oral hearings, planning appeals and under oath in courts of law.

Colm has prepared and project managed environmental planning and licensing components for various types of related energy developments, including, biogas and AD plants, biomass plants, gas-fired power generation plant and grid connected energy storage system (ESS) plants. Colm is very familiar with all environmental and animal by-product legislation which govern planning and licensing aspects of biogas plant development and operation in Ireland. His academic and professional qualifications and his ongoing involvement in small and large complex projects requiring environmental planning and licensing ensures that he has sufficient; (a) knowledge of the specific tasks to be undertaken, (b) understanding of the project type and impacts which may arise, and (c) the experience and ability to fulfil the role and responsibilities required in carrying out duties and actions under the EIA Directive.

BIODIVERSITY

This Chapter of the EIAR was undertaken by Will Woodrow MSc, BCIEEM, CEcol and Hazel Doyle BSc, Msc Grad CIEEM. The authors have considerable experience in impact assessment of projects, and specifically in Article 6 assessments under the EU Habitats Directive. As members of the Chartered Institute of Ecology and Environmental Management ("CIEEM"), the authors are required to abide by a strict code of professional conduct in all aspects of their work.

Vegetation surveys were undertaken by Róisín Nigfhloinn, a highly experienced ecologist and a Senior Ecologist with Woodrow. Róisín holds a with a BAMod in Natural Sciences and an MSc in Ecology and Management of the Natural Environment and, is a full member of CIEEM. Bird, bat and mammal surveys were undertaken by Hazel Doyle an experienced field ecologist, with an in-depth knowledge of avian and faunal survey techniques according to best practise guidelines, and an Ecologist with Woodrow. Hazel, holds a BSc in Zoology and an MSc in Biodiversity and Conservation, and is a graduate member of CIEEM. Further avian and terrestrial mammal surveys were undertaken by Mike Trewby, an experienced field ecologist and Senior Ecologist with Woodrow. Mike holds a BSc in Zoology and Botany and a PhD in Environmental Studies.

SOILS, GEOLOGY AND WATER

This Chapter of the EIAR was undertaken by Shona Symons MSc. BSc., a qualified hydrogeologist and Conor Lydon, a Chartered Environmentalist with the Institution of Environmental Sciences and Consultant Hydrogeologist. Conor has 13 years of experience in the field of hydrogeology and has produced and peer reviewed in excess of sixty environmental impact assessments, ranging in complexity from small scale developments to Nationally Significant Infrastructure projects. Conor is qualified with a Bachelor of Applied Science degree in Earth Science from the National University of Ireland, Galway and holds a Master of Science degree in Hydrogeology from the University of Birmingham.

A hydrogeological risk assessment carried out by James McAteer Gavin & Doherty Geosolutions (GDG). James is an experienced geologist with a BSc in Geology and Archaeology from University College Dublin. James' work as a geologist to date has focused on GIS development, hydrogeological mapping and geothermal energy.. James has extensive experience working on projects conducting field and laboratory thermal properties tests on Irish rock types and soils. James' experience in hydrogeological mapping includes conducting field work mapping of shallow sand and gravel aquifers across Ireland as well as preforming dye tracing tests in Irish karstic landscapes. James has used his GIS experience to develop databases and report maps for several projects including; shallow aquifer delineations across Ireland, seismic survey route analysis for Stoke City and variations of Irish soil thermal conductivities.

FLOOD RISK ASSESSMENT AND STORMWATER DRAINAGE DESIGN

The Flood Risk Assessment report was undertaken by Ross Bryant BSc MSc CEnv MCIWEM C.WEM. Ross has 17 years' experience within the field of flood risk modelling, mapping and management. He has been involved in a wide variety of projects that range from asset management to national scale flood mapping and risk assessment. His particular areas of expertise are River scour estimation and assessment, flood hazard mapping, river modelling, hydrological assessments. The drainage design report was undertaken by Leanne Leonard BEng (Hons), a qualified engineer with experience in the areas of civil environmental engineering and expertise in design of drainage systems, and Declan White BEng (Hons) CEng MIEI. Declan has over 18 years in the civil engineering and construction sectors and has gained a wide variety of experience with completed projects in Ireland, US and Middle East. His particular areas of expertise are; Civil/Infrastructure Design, Project and Contract Management, Design of Drainage Networks, Site Development, Senior Management/Director Experience

AIR QUALITY, ODOUR CLIMATE AND NOISE

This Chapter of the EIAR was undertaken by Mervyn Keegan, MSc., BSc., whose main area of expertise is in Air Quality, Odour and Noise & Vibration Impact Assessments. Mervyn has over 18 years' experience working as an environmental consultant. He is a member of the Institute of Acoustics and is a Technical Expert & Advisor to An Bord Pleanála. Mervyn has considerable experience and expertise in preparing environmental noise and air quality assessments to support planning and licensing applications for various types of development including biogas and anaerobic digestion plants, biomass plants, road schemes, wind-farms, airports and quarries.

LANDSCAPE

This Chapter of the EIAR was undertaken by Richard Barker, MLA, PG Dip, BA. During his professional career to date, Richard has worked as a Town Planner in New Zealand, London and Dublin before moving into the field of Landscape Architecture. He has spent the last 14 years working as a Landscape Architect in Ireland and has considerable experience in the fields of both Landscape and Visual Impact Assessment (LVIA) and landscape design, covering all stages from project feasibility through to construction. This cross-over of expertise is invaluable in determining and designing the most appropriate and effective form of landscape and visual mitigation for infrastructural development projects. Richard manages the LVIA department in Macro Works undertaking assessment work on a broad spectrum of projects in areas such as renewable energy, roads and large scale industrial and infrastructural development. Richard has also delivered guest lectures to the University College Dublin professional course in EIA Management in relation to LVIA.

TRAFFIC AND TRANSPORT

This Chapter of the EIAR was undertaken by Matthew Steele, company director and an established specialist traffic and transportation consultancy based in Ireland. Matthew: graduated from the University of Westminster in 1998, with a Master's Degree in Transport

Planning and Management; is a Chartered Fellow of the Chartered Institute of Logistics and Transport; a fellow of the Royal Geographical Society; and, a member of the Chartered Institution of Highways and Transportation. Matthew has extensive national and international experience, working on numerous traffic, transport and development related projects in the public and private sectors, including: access studies; specialist input into Strategic Environmental Assessments; and, preparation of traffic and transportation related sections of Environmental Impact Assessments for specific schemes including extractive industries and energy related developments.

ARCHAEOLOGY

This Chapter of the EIAR was undertaken by John Cronin and Tony Cummins. John holds qualifications in archaeology (B.A. (UCC), 1991), regional and urban planning (MRUP (UCD) 1993) and urban and building conservation (MUBC (UCD), 1999) while Tony holds both a primary degree in archaeology (B.A. (UCC) 1992) and a Master's degree in Archaeology (M.A. (UCC) 1994). Both specialists have amassed over 20 years' experience in the preparation of archaeological and cultural heritage assessments.

1.5.2 Chapter Structure

Each assessment included in the EIAR has followed the same general format:

- Introduction; An overview and context of the project.
- Assessment Methodology and Significance Criteria: A description of the methods used in baseline surveys and in the assessment of the significance of effects
- Description of Receiving Environment: A description of the existing baseline relevant for the assessment, based on the results of surveys, desk information and consultations, and a summary of any information that could not be obtained;
- Impact Assessment: A description of how the baseline environment could potentially be affected for the EIA Development, including a summary of the measures taken during the design of the EIA Development to minimise effects;
- Mitigation Measures and Monitoring: A description of measures recommended that will be implemented to minimise and/or off-set potential negative effects and a summary of the assessed level significance of the effects of the Proposed Development and/or the EIA Development after mitigation measures have been implemented;
- Residual Impacts: a summary of final or intended effects which occur after the proposed mitigation measures have been implemented.
- Statement of Significant Impacts
- Statement of Significance

1.6 Applicant

Sustainable Bio-Energy Limited is an Irish renewable energy company (the applicant) set-up to identify, develop and finance viable biogas projects. Sustainable Bio-Energy Limited is a sister company of Connective Energy Holdings, a specialist bio-energy producer, at the forefront of producing clean renewable energy and products for the agricultural and manufacturing sectors. Connective Energy Holdings have interests in a number of operational biogas plants in both Ireland and the United Kingdom, including the 5MWe Glenmore Biogas plant in County Donegal. Sustainable Bio-Energy Limited is focused on developing sustainable biogas projects based on local market conditions and positively contributing to future renewable energy targets whilst also delivering environmental and socio-economic benefits.

1.7 Consultation

Pre-planning consultation meeting in relation to proposals to develop a biogas plant at the site were undertaken with Galway County Council on the following dates:

- 1st June 2017; Planning, Environment, Roads & Transportation Departments; and
- 22nd February 2018; Environment Department; Roads & Transportation, Fire Service.
- 9th April 2019; Planning and Roads & Transportation Department
- 30th April 2019; Environment Department
- 9th September 2019: Planning, Environment, Roads & Transportation Departments

Consultation, where appropriate, with relevant private and public agencies was undertaken by the various EIA specialists preparing each of the EIAR Chapters. Details of this consultation is provided within each Chapter of the EIAR.

A number of information meetings were held with local councillors for the electoral area, members of the farming community and members of the local community.

1.8 Engineering Drawings

This schedule of engineering drawings prepared in support of the planning application to Galway County Council are as follows:

- GBIO-19-001 Site Location Map
- GBIO-19-002 Site Layout
- GBIO-19-003 Site Layout

- GBIO-19-004 Site Layout
- GBIO-19-005 Site Sections
- GBIO-19-006 Feedstock Reception Building
- GBIO-19-007 Digesters and Storage
- GBIO-19-008 Office Switchroom
- GBIO-19-009 CO2 Building
- GBIO-19-010 Wash water and Clean Water Tanks
- GBIO-19-011 Gas Plant & Flare
- GBIO-19-012 CHP & Boiler
- GBIO-19-013 Weigh Bridge
- GBIO-19-014 Entrance Details

1.9 Availability of Information

A copy of the EIAR may be viewed on-line on the planning application section of the Galway County Council website. A paper copy of the EIAR may be viewed at the at the offices of the Planning Authority at the Planning Office, Galway County Council, County Hall, Prospect Hill, Galway during office hours 9.00am to 4.00pm Monday to Friday (Wednesday 10.00 am to 4.00pm).

-2-1
-2-30

2 DESCRIPTION OF THE

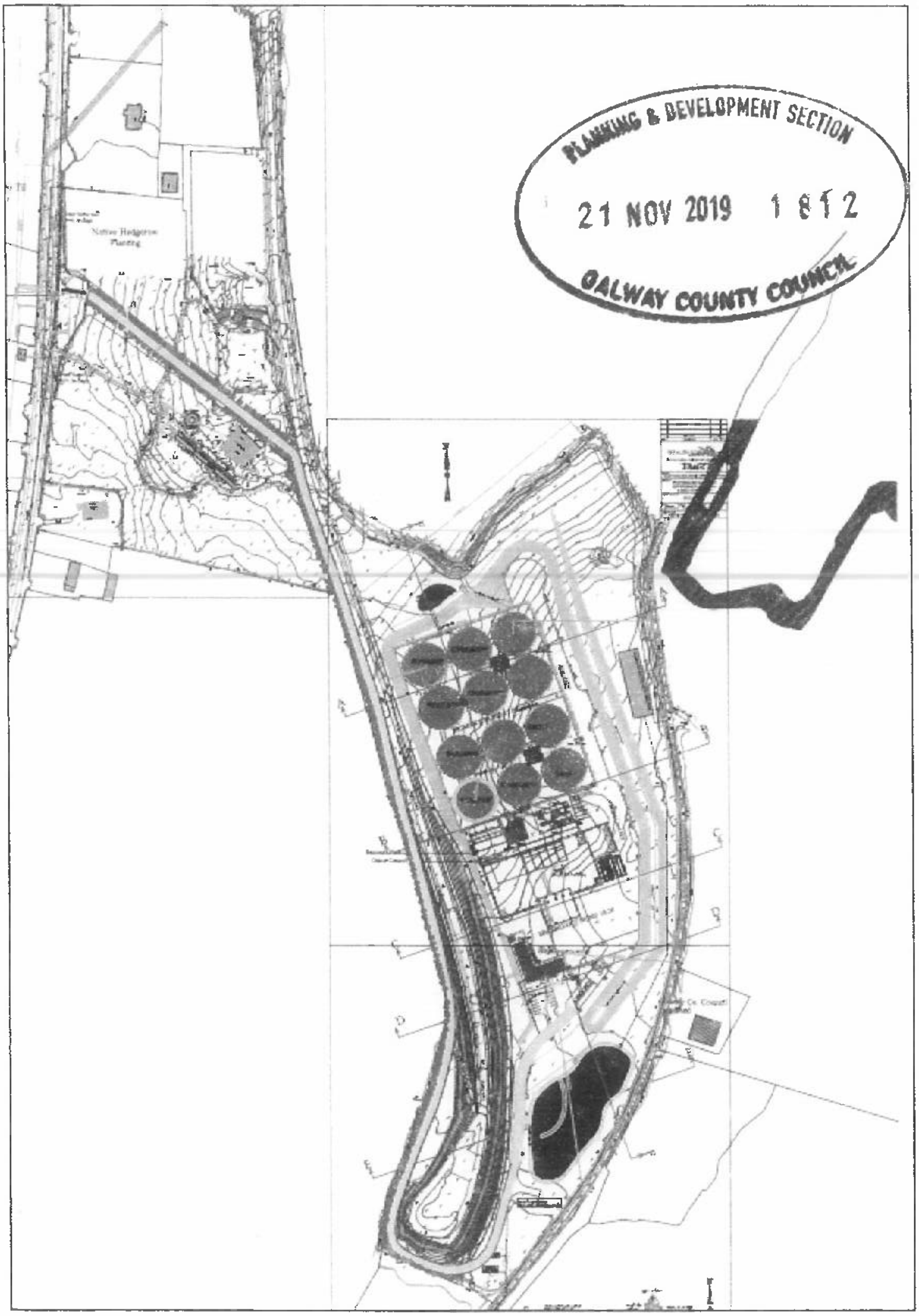
2.1 Introduction

2.1.1 Proposed Development Overview

The applicant, Sustainable Bio-Energy Ltd propose to develop a Biogas Plant on a site located in the townlands of Ballynamantan, Kinincha and Glenbrack, County Galway. The facility will accept and process up to 90,000 tonnes of feedstock per annum for the purpose of generating biogas and organic fertiliser. The feedstocks for the proposed facility will be sourced locally and will predominately comprise grass silage which will be supplemented with agricultural residues, animal by-products and food processing residues. Further information about the type, quantity and origin of feedstocks is included in Section 2.4 below.

The biogas generated from the facility will be upgraded to produce biomethane (CH_4) and carbon dioxide (CO_2). It is proposed that the biomethane will be compressed and exported from site for injection into the national gas grid or supplied to other third parties as a flexible, dispatchable renewable fuel. The renewable carbon dioxide will be upgraded to food grade quality before being shipped off-site for supply to the food and beverage industry. The digestate produced at the facility will used as organic fertiliser and is a direct replacement for chemical /mineral fertilisers. As part of feedstock supply arrangements with local farmers, digestate will be delivered back to the local farms, thereby recycling nutrients to agricultural lands. The use of digestate as an organic fertiliser closes the nutrient cycle and supports the bioeconomy. Further information about the outputs from the Biogas Plant is included in Sections 2.8 - 2.9 below. The proposed site layout is shown in Figures 2.1(a) - 2.1(c). Please refer to the planning application engineering drawings for more information.

Figure 2.1(a) Proposed Plant Layout (Entire Site)



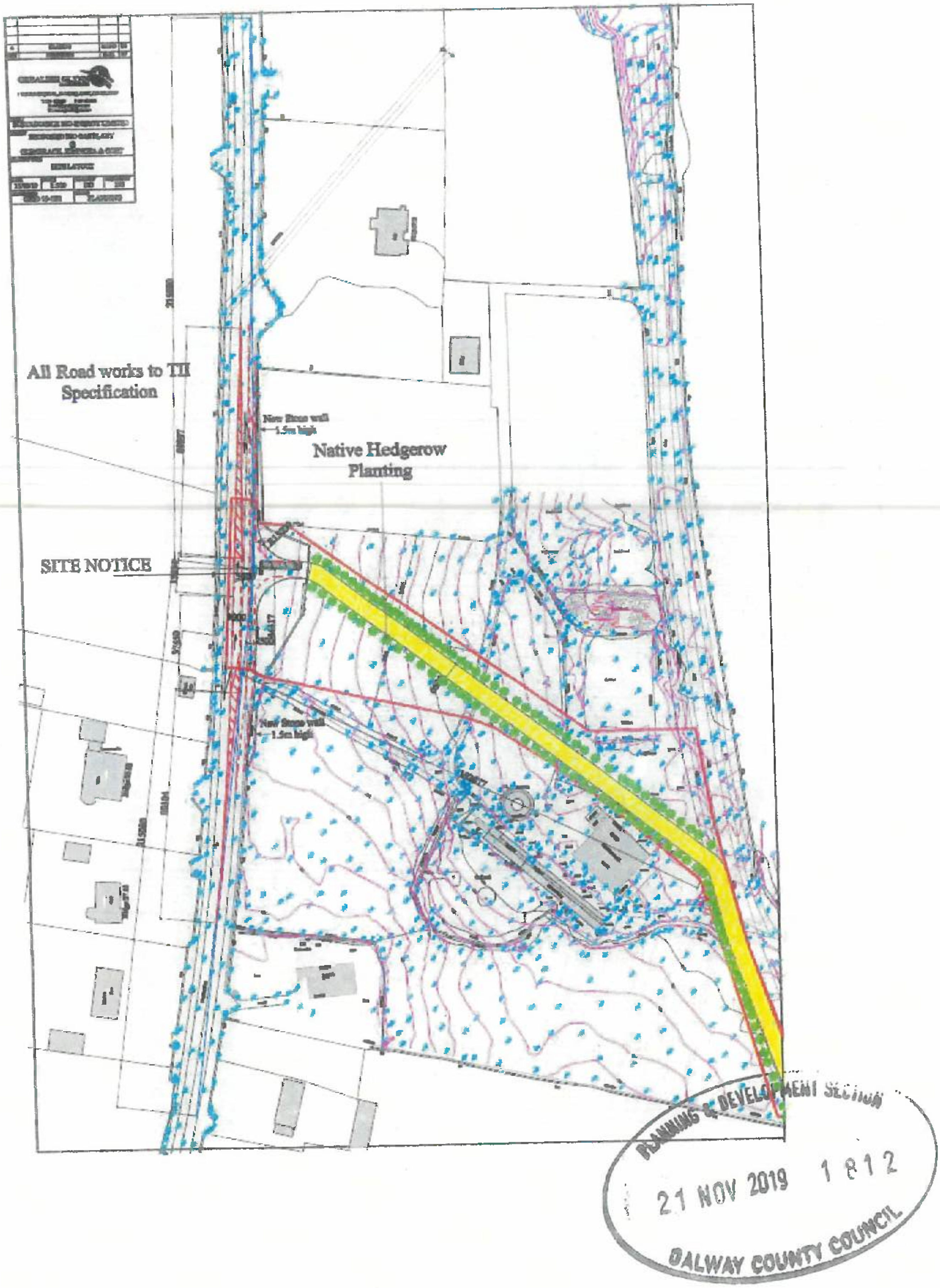


Figure 2.1(b) Proposed Site Layout (Entrance)

Figure 2.1(c) Proposed Plant Layout (main site)

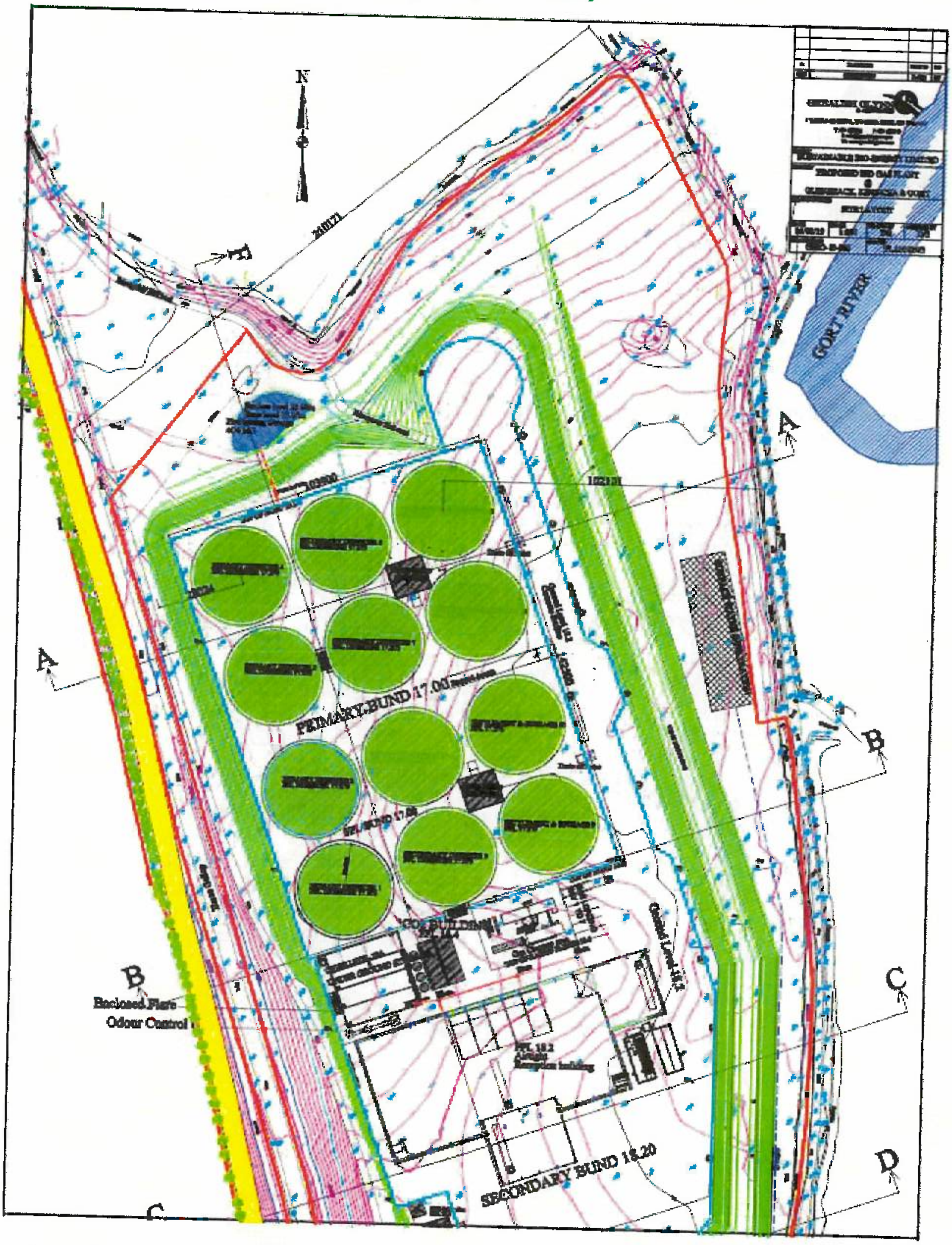


Figure 2.1(d) Proposed Plant Layout (southern part)

2.1.2 Location of the Proposed Development

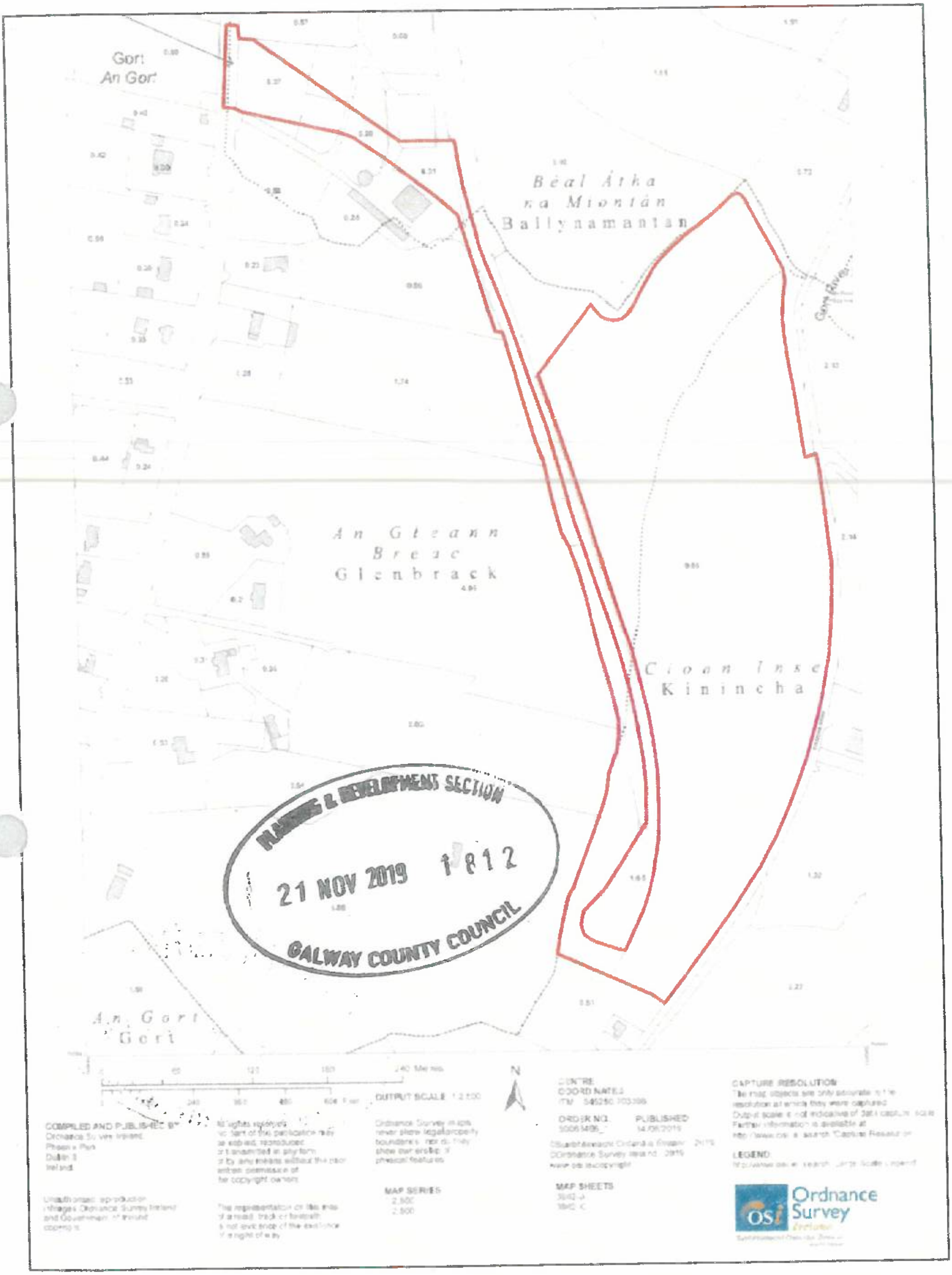
The proposed development site is approximately 10.1 hectares (24.97 acres) in area. It is situated on lands adjacent to the northern boundary of Gort town in Co Galway in the townlands of Ballynamantan, Glenbrack and Kinincha as identified in Figure 2.2 below. The site is bounded to the West by the N18 /R458 road and to the East by the Kinincha Road.

Gort is located approximately 32 kilometres (km) south of Galway Gateway and 64 kilometres north from Limerick Gateway on the M18 Motorway. The M18 motorway is situated to the west of the site and can be accessed by travelling south along the N18 /R458 for approximately 1km from the entrance to the site. The M18 motorway road provides direct access to the M6 (Galway to Dublin Motorway). Gort also benefits from key energy infrastructure; the town is connected to the gas pipeline network and has access to the electricity transmission grid of 38kV, 110kV and 220kV. The 440kV (the main national transmission line from Moneypoint to Dublin) is located close to the southern aspect of the town boundary.

Gort is serviced by a public wastewater collection network with both primary and secondary treatment. The Gort Waste Water Treatment Plant (WWTP) is located on the Kinincha Road to the north of the town. The treated effluent arising from the Gort WWTP is discharged into the Cannahowna/Gort River which goes underground at Kiltartan before finally draining into Corranroe Bay, south of Kinvara.

The site is located in the Galway Bay South East Catchment. This catchment includes the area drained by all streams entering tidal water in Galway Bay between Black Head and Renmore Point, Galway, draining a total area of 1,270km^2. The Cannahowna (Gort) River flows north on the eastern side of Gort, and to the east of the site, before discharging to the Kilchreest River. The Kilchreest River discharges into Coole Lough which is located approximately 2km west /north-west of the site. Waters from Coole Lough drain, via a series of turloughs and underground pathways, to Corranroe Bay (south of Kinvara), approximately 10km north-west of the site.

Figure 2.2 Site Location Map



2.1.3 Site Selection Criteria

The site was selected as the preferred site for the development following preparation of an alternatives site selection assessment study. Key criteria which were considered in the selection of the preferred site included the following:

1. National, regional and local planning policy;
2. The environmental setting including its; proximity to protected sites; surface waters, groundwater, flood affected area, ecological, landscape, cultural heritage;
3. The distance of the boundary to residential and recreational areas, waterways, other agricultural activities and urban sites and areas of high residential density;
4. Proximity and access to infrastructure; including roads, services and feedstock sources;
5. Availability of sites of sufficient area to accommodate the development proposal and compatible ownership rights;
6. The proposed feedstocks and the treatment technology used;
7. Relevant legislation and Guidance; e.g. Commission Regulation (EC) No 1069/2009, Draft (2nd) EU Council Directive on the Biological Treatment of Biowaste, DAFM CN11; Conditions Document for Biogas Plants transforming Animal By-Products in Ireland, May 2014, relevant BAT (Best Available Techniques) and BREF Documents.

Gort municipal wastewater treatment plant is located 150m to the south of the site on the southern side of Kinincha Road. The wastewater treatment plant has both primary and secondary treatment and treated effluent is discharged into the Cannahowna River. The design population equivalent (PE) of the wastewater treatment plant is 3,000PE. The public water supply for Gort is supplied from the Gort Regional Water Supply Scheme which is sourced from the Gort/Cannahowna River, the water treatment plant is located at Rindifin Townland. There are no statutory designated sites within or adjacent to the proposed site.

2.1.4 Existing Site Layout & Use

The current site, described as improved grassland (pastures), is used for agricultural (grazing) and equine related purposes. The existing site layout is shown on Figure 2.2 and on Planning Drawing Reference GBIO-19-001. The current site is represented in the photographs presented in Plates 2.1 to 2.12 below. Review of Corine land cover mapping surveys[16] and historical Ordnance Survey (OS) maps show approximately 50% of the site (south-eastern part) to be covered with transitional woodland scrub with pastures to the north and west.

Ground conditions, ground levels and field boundaries at the existing site were significantly altered to its current state circa year 2000. At this time, it is understood that the site was landscaped by the owner to facilitate development of a horse gallop with access to associated stables and a lunging ring (off-site to the north west of the proposed development site); Galway County Council planning references 95/73, 97/2835 and 98/4738. Works at this time at the site involved excavation of soils, profiling of ground, removal of field boundaries, importation of screened fine soils, grass re-seeding, construction of a perimeter track and fencing.

The topography of lands surrounding the site are generally flat with nearby once-off rural housing primarily located to the west, which front onto the N18 /R458 (now designated as a regional road since the opening of the motorway in 2017). Residential housing estates within the northern boundary of the Gort LAP are located approximately 400m from the southern boundary of the site. Industrial and commercial units are located approximately 390m south of the site along Kinincha Road. The units include a former Abattoir site (Sean Duffy (Exports) Ltd) which is EPA licensed (industrial Emission Licence Reg. No. P0808-01). Site photographs showing the existing site are presented below.

2.1.5 Land Ownership

Land lease contracts are in place with the landowner to support the construction and operation of the Development; see Appendix 1.2.

[16] Irish environmental landscape based on interpretation of satellite images based on EC established CORINE (Coordination of Information on the Environment) specifications

Plate 2.1 Existing Entrance to Proposed Site off Kinincha Road

Plate 2.2 View south along eastern boundary

Plate 2.3 View north across site

Plate 2.4 View of embankment (original ground levels) along western boundary

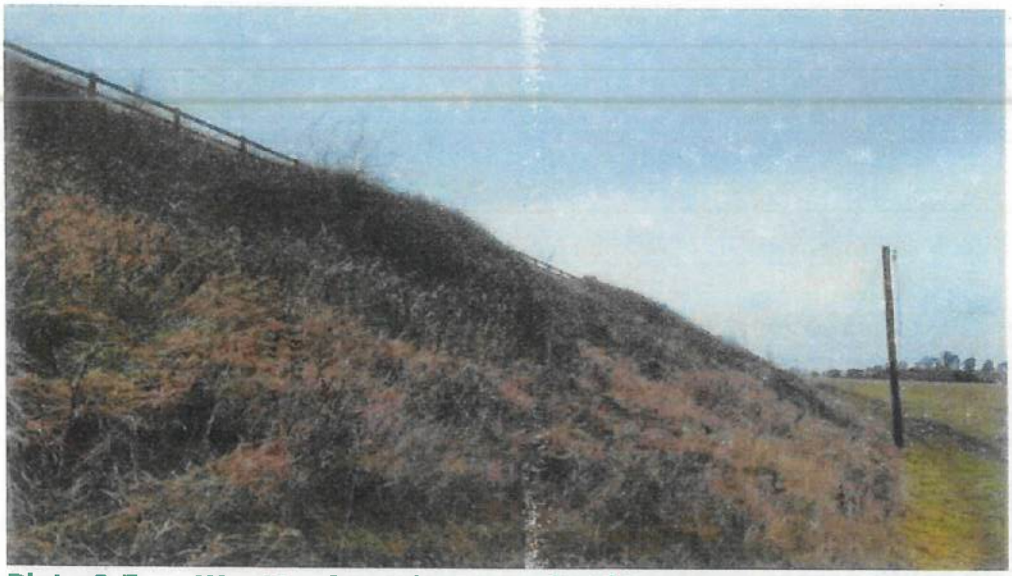


Plate 2.5 Western boundary - embankment

Plate 2.6 View east across site from western boundary

Plate 2.7 View along northern boundary - embankment and perimeter track shown

Plate 2.8 View south across site from northern boundary

Plate 2.9 View SE from NE corner of the site

Plate 2.10 View NW along northern boundary

Plate 2.11 View of equine related items on site – former activities

Plate 2.12 View north along eastern boundary - perimeter track shown

Plate 2.13 View north along public road (N18/R458) at proposed entrance

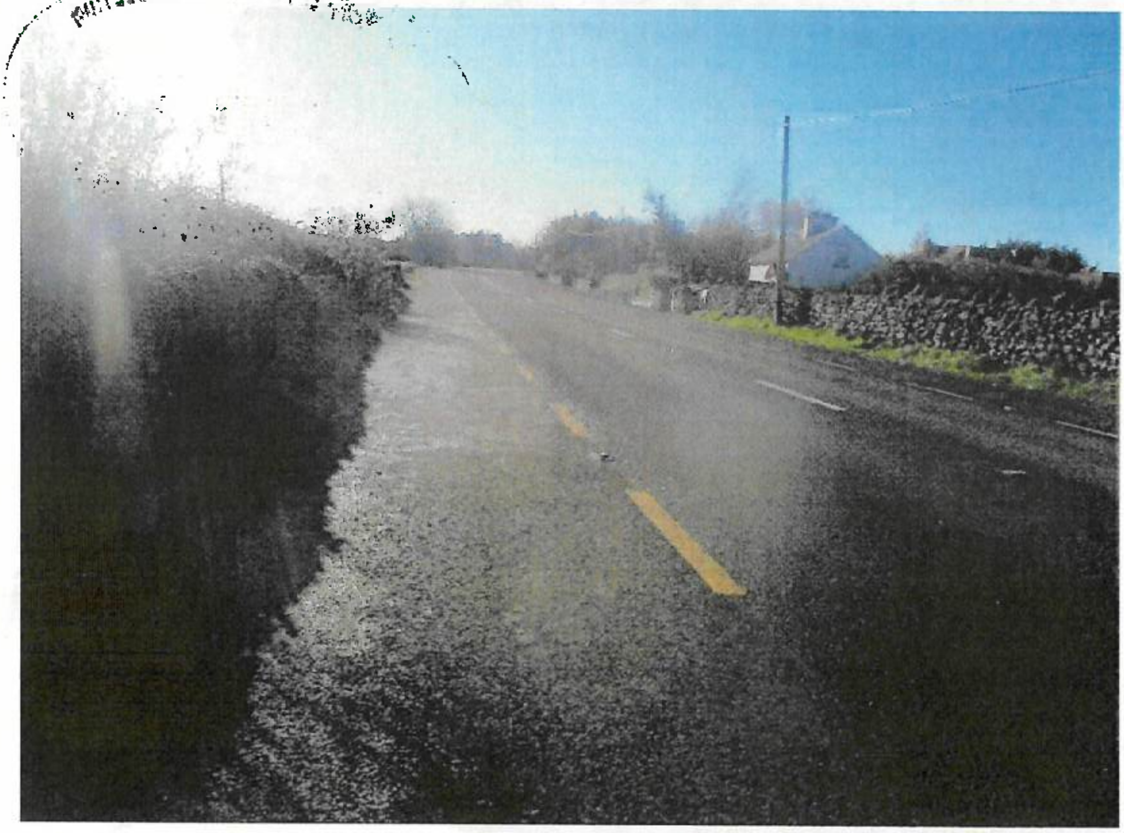


Plate 2.14 View south along public road (N18/R458) at proposed entrance

2.1.6 Licensing & Approvals

Any facility proposing to accept an annual tonnage above 10,000 tonnes must apply to the EPA for a licence. In accordance with the First Schedule to the EPA Act 1992 to 2013, the facility will require an Industrial Emissions Licence. When applying to the Environmental Protection Agency (EPA) for an Industrial Emissions licence a number of legislative requirements must be fulfilled. These are largely set out in:

- EPA (Industrial Emissions) (Licensing) Regulations, 2013 (S.I. No. 137 of 2013)
- European Union (Industrial Emissions) Regulations 2013 (S.I. 138 of 2013)
- The EPA Act 1992, as amended

It was determined following screening of the proposal against the regulations that the class (as defined in the First Schedule to the EPA Act 1992 to 2013) of licensable activity is:

11.4 (b) 'Recovery, or a mix of recovery and disposal, of non-hazardous waste with a capacity exceeding 75 tonnes per day involving one or more of the following activities, (other than activities to which the Urban Waste Water Treatment Regulations 2001 (S.I. No. 254 of 2001) apply):

(i) biological treatment

The regulations also state:

11.4 (c) 'Notwithstanding clause (b), when the only waste treatment activity carried out is anaerobic digestion, the capacity threshold for that activity shall be 100 tonnes per day.'

The use of Best Available Techniques (BAT) is now mandatory for EPA licenced facilities. The EPA have produced a series of BAT Guidance notes and BAT Reference documents (BREFs). BAT is described in the EPA Guidance notes as:

- *Best* means the most effective technique that achieves a high general level of environmental protection.
- *Available* techniques mean those techniques developed on a scale which allows implementation in the relevant class of activity under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the person carrying on the activity.

- *Techniques* includes both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned.

In order to build and operate a biogas plant an operator must comply with the European Communities (Animal By-Products) Regulations 2014 (S.I. No. 187 of 2014) and in accordance with Regulation (EC) No. 1069/2009 and Regulation (EU) No. 142/2011. The proposed biogas plant is designed in accordance with 'CN11 – Approval and operation of biogas plants transforming Animal By-Products in Ireland' and Stage 1 and 2 approvals will be sought from the DAFM.

Obtaining Stage One approval means approval "in principle" to build a biogas plant and involves assessment of feedstock proposals, infrastructural and process elements of the proposals. Supporting documents to the Stage 1 Application form (AP11) will be prepared which will include; feedstock lists, site and building layouts, layouts, flow plans and process schematics. Stage 2 DAFM approval application works comprise, Preparation of Application Form (AP11A), Preparation of Prerequisite Programmes (PRPs), Preparation of Hazard Analysis Critical Control Point (HACCP), Meetings with DAFM inspectorate team, Preparation of Validation Proposal and Validation Audit. Conditional approval is issued by DAFM to the licensee once DAFM are satisfied with documentation. Full approval is issued once DAFM are satisfied and it is demonstrated that acceptance and process attributes of feedstocks to the plant (e.g. examination and demonstration of automated processes and associated failsafes) meet legislative and DAFM requirements.

2.2 Proposed Development

The proposed site layout is shown on Engineering Drawing Reference Numbers GBIO-19-001 to GBIO-19-014. The proposed development will be accessed via a new site entrance and access laneway which will be constructed off the N18 /R458 road. It is proposed that site traffic will avail of the motorway network, particularly travelling to /from destinations located to the south of the site, thereby avoiding travelling through the town of Gort.

The proposed biogas plant will be capable of accepting and processing up to 90,000 tonnes of feedstock per annum primarily sourced from the agri-food industry. The feedstock will be delivered in both liquid and solid forms using heavy goods vehicles (HGVs) to the site. It is not proposed to accept wastes containing packaging or other such contaminants and therefore the facility does not include de-packaging, screening or sorting equipment for incoming feedstocks. All feedstocks will be accepted and unloaded to the feedstock reception building or to incoming feedstock reception tanks. On average 10No. vehicles (HGVs) will be delivering material to the facility each day during normal operating hours

(07:00 to 19:00 Monday to Sunday inclusive). The activity will operate on a 24-hour basis, 7 days per week.

The biodegradable feedstocks will primarily comprise grass silage and organic farm-based residues such as animal slurry which will be sourced from farms in the vicinity of the plant. The plant will also receive organic residues from the food processing industry for processing. Biogas from the plant will be upgraded to biomethane and utilised to produce renewable energy for both on-site and off-site use. The digestate produced at the plant will meet the requirements of an agreed quality standard (such as PAS110 or similar) and it will comply with DAFM transformation parameters and testing requirements as per CN11. Whole digestate (i.e. not separated into liquor and fibre) produced at the plant will be used as an organic fertiliser (OF/SI) for use on agricultural lands and forestry. Like any other organic fertiliser, digestate should be applied during the growing season in order to ensure the optimum uptake of the plant nutrients and to avoid pollution of ground water. Digestate will be used as part of a nutrient management plan for lands on which it will be applied and will comply with S.I. 31 of 2014 (the "Nitrates Regulations") and Good Agriculture Practice guidelines. Digestate which meets an agreed quality standard offers an attractive opportunity to farmers /growers for potential fertiliser cost savings, improvements in sustainability and improvements in soil health and quality. Accordingly, digestate is viewed as a viable alternative to chemical fertilisers.

Sustainable Bio-Energy Ltd will prepare and implement site specific systems in accordance with international ISO standards for the management of quality, occupational health and safety, environmental, energy and food safety requirements at the plant.

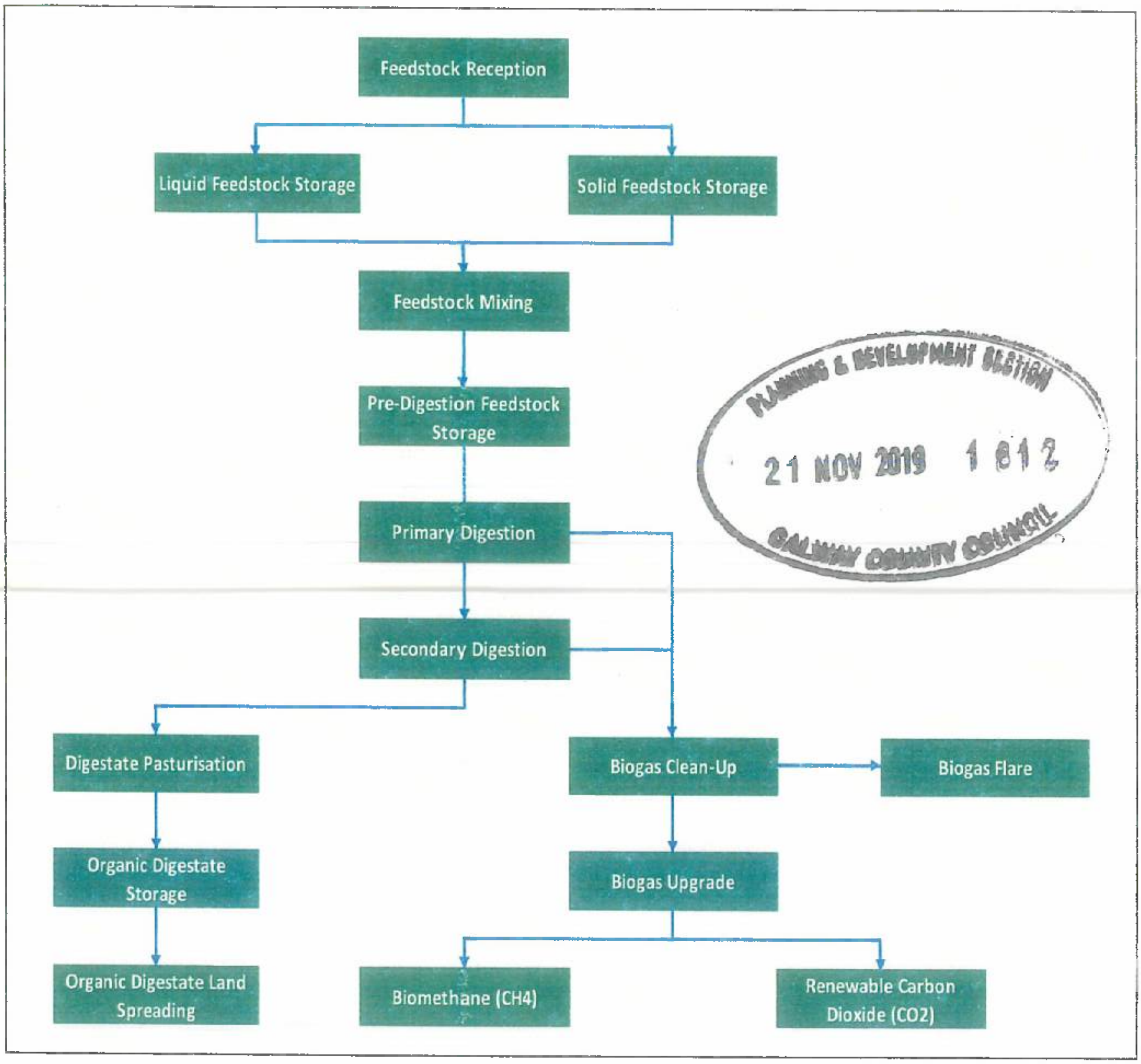
2.3 Plant Description

Anaerobes are the naturally occurring bacteria that break down organic matter in the absence of air. An anaerobic digester is essentially a machine in which this natural process is encouraged and controlled[17].

The Applicant, Sustainable Bio-Energy Ltd., will import up to 90,000 tonnes per annum of organic matter referred to as feedstock which will be put through the anaerobic digestion process for the purpose of producing biogas and digestate (organic fertiliser). Figure 2.3 below shows a simplified process flow diagram.

[17] *Farm Digesters, Jonathan Letcher, 2016*

Figure 2.3 Process Flow Diagram



The main elements of the biogas plant will be constructed within a fully bunded structure Within this, the digesters and digestate storage tanks will be constructed within a purpose-built concrete bund which provides for 25% of the total volume of substances stored within the bunded area. Effluents generated within the feedstock reception building will be contained and collected within the buildings effluent drainage system and routed to the below ground process effluent storage tank for reuse in the process. A tree planted /grassed soil berm will be constructed along the eastern boundary of the site to provide for screening of the development. Existing ground levels in certain area of the site will be lowered to suitably position some components of the development (e.g. tanks). Table 2.1 below present details of the main components of the proposed biogas development.

Table 2.1 Main Components

Item	Details
Main Site Entrance	Gated secured entrance set back 22.3m from public carriageway which will provide 90m site view at 3m setback.
Weighbridge	1 no. weighbridge for weighing of HGVs entering and exiting the biogas site located before a secure lift barrier site entrance.
Office and Control Room Building	1 no. two storey building which will contain; • Reception area • Electrical substation and associated bunded electrical transformers • Welfare facilities – toilet and shower • Canteen /kitchen • Storage room • Generator room • Panel room • Offices and meeting room • Control room • Laboratory
Feedstock Reception Building	1 no. for reception of all feedstocks (liquid and solids). The building will provide plant and equipment for (a) mixing and processing incoming feedstocks and (b) back-end pasteurisation. In summary the building will house the following equipment; • 5 no. 50m^3 liquid feedstock intake tanks, • 4 no. solid feedstock intake bunkers, • HGV wash-down (steam power wash) area, • feed hoppers, • feedstock mixing pit and associated plant, • heat exchanger, • services pit, • 1 no. quarantine area, • 4 no. 50m^3 pasteurisation tanks, • 2 no. 100m^3 holding /test tanks, • Air lock lobby (vehicle entrance /exit) • personnel hygiene areas. • Digestate enhancement area – including plant and technologies to produce different forms of digestate, e.g. fibre digestate using a separator.
Odour Control unit	1 no. odour control system which will recover and treat all odours arising from processes within the feedstock reception building. The system will comprise; • exhaust ducting, • fans, • gas emission scrubber units, • carbon sorption bed, • exhaust stack.
Process drainage and effluent storage tank	2 no. below ground storage tanks will be provided for storage and recovery of effluents to the process. Process effluents (dirty water generated within the site – e.g. wash down within the feedstock reception building) will be collected by floor /ground gullies and conveyed by enclosed pipework to an underground process effluent tank (capacity 488m^3).

Item	Details
	A second underground process effluent storage tank will be installed to provide additional capacity (488m^3) for containment of process effluents arising from non-routine activities e.g. spillages within the feedstock reception building. The process effluent tank will receive effluents from process drainage pipework for recovery to the process. All process effluents will be recovered for reuse in the anaerobic digestion process.
Digesters	8 no. digesters; 4 no. primary and 4 no. secondary each with a capacity of 5,500m^3 and a working volume of 5,100m^3. The primary digesters will be fed by enclosed pipelines directly from the feedstock mixing and process area within the feedstock reception building. The digesters will be constructed in concrete /steel (8m high wall) and the walls will be fitted with insulated cladding. The digesters will be heated (38°C to 42°C) and continuously stirred /mixed. Each digester will be covered with an airtight gas membrane to recover and store raw biogas (each with capacity to hold circa 1,400m^3) produced from the AD process and a second membrane will overlie the gas membrane as a weather proof protection. The digesters will be constructed in a concrete bund designed in accordance with best practice.
Storage Tanks	3 no. vessels will constructed to store Quality Digestate (pasteurised digestate which conforms to prescribed quality standards). 1 no. vessel within the tank farm will be used to store incoming cow slurries sourced from local farmers. The storage vessels will be constructed in concrete/steel and covered with gas membranes to recover any residual biogas generated, prevent releases of fugitive odours and prevent rain /precipitation entering the tanks. The storage vessels will be constructed in a concrete bund designed in accordance with best practice.
Pump House	2 no. pump-house buildings contained with the tank farm bund. The single storey house buildings will contain delivery pipework, pasteurisation pumps, valves and heat exchangers. The pumps will transfer blended feedstock from the feedstock reception building to the digesters and the heat exchangers will be used to heat the feedstock that is contained in the digesters. The temperature will be constantly monitored in each tank at different locations. Dedicated plant and pipework will also deliver pasteurised whole digestate to the digestate storage tanks prior to it being exported as organic fertiliser (Quality Digestate) from the site. The floor of the pump house building will be sloped internally that any spillages will be collected by the drains built into the floor and directed to the process effluent tanks and from here it can be returned to the digesters'
Gas Purification and Bottling Plant	Gas purification, compression and bottling plant will be installed to upgrade biogas to biomethane. The plant will include; • Filters

Item	Details
	• Chiller, • Gas module, • Regeneration Module, • Electrical Room, • Condenser + Condensate tank • Absorber, • Stripper, • Cooler, • Compressors (x 8); including standby, • Service areas to the plant items (access), • Truck filling point, • Gas trailers units (6 no. bays + 1 no. spare). Raw biogas will be upgraded /purified to biomethane and will be temporarily stored on site in six (6 no.) 18,000 litre (l) water capacity modules containing 80 no. Type 4 cylinders (each 450l) suitable for service pressure of 250 bar of compressed natural gas (CNG). Each module can hold a gas mass of c.5,500kg. Therefore, the total storage of biomethane on site at any one time will be equivalent to c. 33 tonnes (6x 5,500kg), which is below the qualifying quantity for application of the Control of Major Accident Hazards (COMAH) Regulations[18].
Carbon Dioxide Compression Building	1 no. process building and associated 50m³ vertically aligned carbon dioxide (CO_2) storage tanks (c.12m in height). Carbon dioxide will be recovered from raw biogas along with biomethane. CO_2 processing equipment will be contained within the building /outdoor enclosures and the equipment will purify and compress CO_2 to a class food grade 3 substance. The purified CO_2 will be compressed and pumped into 4 no. insulated tanks. Bulk tankers will periodically remove the clean compressed CO_2 offsite for use elsewhere. The floor of the CO_2 compression building is sloped internally that any spillages will be collected by the drains built into the floor and directed to the process effluent tank and from here it can be returned to digester vessels.
Gas Flare and gas booster station	1 no. controlled combustion ground flare (approximately c.8m in height) and gas booster station which is provided for emergency use only.
Combined Heat and Power (CHP) enclosure	1 no. container containing a suitably sized CHP (up to 4.5MW) and ancillary plant including; a gas drier, H_2S removal filter, gas booster and dump radiators. The CHP will be equipped with a jacket heat exchanger to supply low grade heat to the digesters and an exhaust stack heat exchanger to supply high grade heat to the pasteurisation and gas purification processes. The CHP will be used to serve the parasitic load of the biogas plant.

[18] Upgraded biogas is classified under entry 18 of Part 2 of Schedule 1 of SI 209 of 2015.

Item	Details
Boiler House	2 no. suitably sized (c. 2MW) standby dual fuel (gas and light oil) boilers will be provided with associated fuel storage (approximately. 5m^3). The boilers will be used during commissioning of the plant (as gas produced in site will be unavailable to serve the CHP during this period) and during periods when the CHP is unavailable (e.g. planned maintenance events).
Storm Water Drainage	A separate and isolated storm drainage system will be provided to manage stormwater from non-risk areas in accordance with the principles of SuDS. It is proposed to route clean storm water collected from hardstanding to a series of lagoons. Stormwater from road areas /parking areas on site will pass through a below ground oil /water separator prior to entering the lagoon system. The lagoons will also act as a water source for process use (if required) and as a fire fighting water source. Firefight water will be provided from a 100mm ring main connection to the public mains at the Kinincha Road. Additional firefighting water will be supplied to the development from a small pond (400m^3) provided to the north of the site (served by storm water collected from the bund). A permanent water level available will be maintained within the pond (with an allowance for evaporation) for discharge to the ring main by gravity for use in the event of a fire. A number of underground storage tanks are provided at the back of the waste storage building. Clean stormwater collected from roofed areas and hardstanding will be conveyed by gravity feed to underground tanks with an overall capacity 708m^3. The storage tank will include a pump station which will receive overflow from the 708m^3 tank. The pump station will be fitted with a continuous in-situ analyser and alarm to prevent contaminated (dirty) stormwater being pumped from underground stormwater storage tanks to the 2,954m^3 lined attenuation lagoon located in the southern area of the site). The attenuation lagoon will effectively have two layers. The bottom layer will contain water to provide for up to 9 days of storage (for reuse as required in the process) and the top layer will be attenuation for exceedance. A gravity storm pipe from the attenuation lagoon will deliver water as required for use in the process via the underground 708m^3 tank. A swale will convey any excess flows from the attenuation lagoon to an infiltration basin located in the northern area of the site. This infiltration basin will most likely not receive any flows for storm events of less than 1% (1 in 100 year) annual exceedance probability (AEP).
Foul Effluent	It is proposed to construct a foul drain from the control building and connect it to the public sewer which routes towards the Gort wastewater treatment plant
Lighting Fencing and Security Gates	Along roads and around site perimeter in accordance with DAFM CN11.

2.4 Feedstocks

2.4.1 Background

Feedstock is the material that goes into an anaerobic digestion plant to be broken down by bacteria and give off biogas. The feedstock will determine the size, design, efficiency and output of the plant[19]. Feedstock can also be referred to by the term *substrate*, however for the purpose of this document the term feedstock will be used.

In general, all types of biomass can be used as feedstock provided that they contain carbohydrates, proteins, fats, cellulose and hemicellulose as main components[20]. One of the primary considerations when assessing the viability of developing a biogas plant is the availability of feedstock. In order for a biogas plant to operate successfully it must have access to sufficient quantities of quality feedstock for the entire life of the plant. Ideally, feedstocks will be sourced from within the immediate vicinity of the plant. Different types of feedstock give off different biogas yields when digested. Therefore, when selecting a feedstock, it is important to pick a combination of feedstocks that will provide the best biogas yield. The following is a list of criteria to be considered when choosing a feedstock for a plant:

1. National Policy
    a. Planning requirements
    b. Licencing requirements
    c. Feedstocks policy
    d. Biogas & biomethane use
2. Location of plant relative to feedstock (rural or urban)
3. Feedstock catchment zone (radius around plant where feedstock is sourced)
4. Type of feedstock available in feedstock catchment zone
    a. Energy crops
    b. Commercial organic waste
    c. Household organic waste
    d. Animal by-products
5. Cost of collecting and storing feedstock
6. Technical complexity of plant operation (the greater the variance in quantity and quality of feedstock the greater the complexity of the plant to operate)
7. Digestate management (storage/enhancement/final end use)

[19] *Anaerobic Digestion – Making Biogas, Making Energy, Tim Pullam 2015*
[20] *Biogas from Waste and Renewable Resources, Dieter Deublein, 2012*

2.4.2 National Context

It is recognised globally that climate change is one of the foremost issues that faces the world today. In May 2019, the Irish Government recognised the threat posed by becoming the second nation in the world to declare a Climate Emergency. This was followed in June 2019 by the release of the Climate Action Plan by the Department of Communications, Climate Action & Environment (DCCAE). This plan sets out a roadmap for Ireland to tackle climate change up to 2030.

The Climate Action Plan sets out a roadmap which is designed to reduce carbon emissions in the following sectors:

1. Electricity
2. Buildings
3. Transport
4. Agriculture
5. Enterprise & Service
6. Waste and the Circular Economy

While there are many actions outlined within the Climate Action Plan and various solutions proposed to achieve a reduction in carbon emissions, anaerobic digestion (AD) is one technology that presents a significant opportunity to reduce carbon emissions across the sectors of Agriculture, Transport and Waste and the Circular Economy.

The Climate Action Plan singles out the Agricultural and Transport Sectors as contributing over 30% and 20% of Ireland's greenhouse gas emissions[21] respectively. The Climate Action Plan goes onto detail that there is an estimate 1 tonne of food waste per home per annum which is harmful to the environment and human health[22]. Further to this, the Environmental Protection Agency (EPA) have recently attributed over 50% of water pollution in Ireland back to Agriculture[23].

It is recognised that AD has the potential to offer considerable solutions not only from a renewable energy standpoint but also from an environmental standpoint. AD is not merely a source of renewable energy. It cannot and should not be directly compared to a wind turbine or PV array. AD provides a proven solution for the treatment of organic wastes

---

[21] *Greenhouse Gas Emissions (GHG): Greenhouse gases trap heat from the sun and warm the surface of the Earth. The main greenhouse gases are carbon dioxide, methane, nitrous oxide and fluorinated gases*
[22] *Climate Action Plan 2019*
[23] *River Basin Management Plan – EPA 2018-2021*

and residues and is a means to reducing greenhouse gas emissions in agriculture and energy. It is a source of biofertiliser through mineralisation of nutrients in slurry to optimise availability. It is a means of protecting water quality in streams and aquifers. It is a source of renewable dispatchable electricity, heat and advanced gaseous biofuel[24].

There has been a substantial amount of research carried out in recent years around the potential for anaerobic digestion and biogas in an Irish context. Grass silage has been identified as a potential biomass resource which is in abundance in Ireland. Grass is an excellent energy crop. In Ireland we have an unrivalled ability to grow grass silage which could then be used to generate biomethane[25]. Biomethane may be used as a direct substitute for natural gas and can be used to decarbonise electricity and more critically heat and transport[26].

Gas Networks Ireland (GNI) have also strongly advocated the implementation of national policy around the development of an anaerobic digestion industry in Ireland. GNI have committed that by 2030, 20% of the national gas grid will be made up of renewable gas[27].

Teagasc, who are the Agriculture and Food Development Authority in Ireland, also strongly advocate the benefits that anaerobic digestion and the creation of biogas can bring to agriculture. They advocate the co-digestion of grass silage along with farm manures. Teagasc also recognise the benefit of using digestate as a direct replacement for chemical fertiliser which will reduce the impact on the surrounding environment.

It should be noted that under the 2050 Carbon-Neutrality as a horizon point for Irish Agriculture Report (Schulte et al. 2013), bioenergy plays a major role in closing the emissions reduction gap. It should also be noted that under this scenario, the primary feedstock for AD would be grass-based. Grass fed AD overcomes the high CO_2 emissions associated with the land-use change associated with the conversion of permanent grassland to crops such as maize or corn.

2.4.3 Sustainability Criteria

In light of the original Renewable Energy Directive (RED) coming to a close and also increased urgency to address the challenge of Climate Change, the European Commission released the recast Renewable Energy Directive (RED II) in 2018 which is an extension of the original Renewable Energy Directive. RED II has set a target that by 2030, at least

[24] Centre for Marine & Renewable Energy – Green Gas in the Energy Transformation - 2019
[25] The Potential for Grass Biomethane as a Biofuel – Jerry D Murphy 2013
[26] The Role of Incentivising Biomethane in Ireland using Anaerobic Digestion – Jerry D Murphy
[27] Gas Networks Ireland – Network Management Plan 2018

32% of the energy used in Europe will be generated from renewable sources and also that carbon emissions will be cut by 40%.

RED I governed that in order for a biofuel or bioliquid to be classified as sustainable in the EU it must meet the sustainability criteria and comply with the verification requirements. However, the RED I did not contain mandatory sustainability requirements for soild and gaseous biomass[28].

RED II is an extension of the RED I and will introduce mandatory sustainability criteria for solid and gaseous biomass for the period to 2030. It includes three overarching sustainability criteria which relate to:

1. Land for agricultural biomass
2. Management of forest biomass
3. Greenhouse Gas (GHG) emissions savings for all biomass

From a land and forest perspective, RED II through the use of sustainability criteria aims to limits the Indirect Land Use Change (ILUC) associated with biomass growing. For example, a biofuel or biogas will not be deemed sustainable if the land used to grow the biomass has been changed from an area with high biodiversity to an area that intensively grows biomass.

In terms of GHG emissions, under RED II, in order for a biofuel or biogas to be deemed sustainable, it must be verifiable that they provide at least a 65% GHG emission saving when used as a transport fuel and a 70% (increasing to 80% by 2026) GHG emission saving when used for electricity, heating or cooling when compared with the equivalent fossil fuel[29].

RED II also aims to regulate the use of energy crops by limiting the percentage of food and fodder crops that will be considered as meeting the sustainability criteria. RED II actively encourages the use of organic wastes and residues in the production of biofuels and biogases.

From an Irish context, the sustainability criteria prescribed in RED II aligns with the agricultural sector very well. Irish livestock and dairy farming are predominately grass based and owing to the lifting of dairy quotas in 2015, there has been an increase in the national herd numbers which consequently has increased the volume of animal by-product (in particular slurry) produced. This increase in animal by-product has been shown to negatively impact the environment and more specifically watercourses. Under RED II, grass silage is viewed as a sustainable biomass and animal by-products such as manure are also viewed as sustainable feedstocks. Therefore, biogas produced through AD of both

[28] SEAI – Sustainability Criteria Options and Impact for Irish Bioenergy Resources
[29] Recast Renewable Energy Directive

grass silage and manure fulfils the sustainability criteria of RED II ~~and is deemed~~ sustainable with the added benefit of the reduction in environmental impact of Irish agriculture from land spreading of raw manure.

2.4.4 Feedstock Catchment Zone

This section of the EIAR provides information in relation to the Feedstock Catchment Zone (FCZ) for the proposed biogas plant. When considering the development of a biogas plant, one of the key criteria in selecting a feedstock source is the actual location of the plant and what feedstock can be sourced in the immediate surroundings.

The proposed development is located close to the town of Gort in Co Galway. Figure 2.4 below shows the 10km, 20km and 30km radius around the propose site location. As can be seen, the Feedstock Catchment Zone for the proposed plant at a 30km radius extends to Lisdoonvarna in the West, Claregalway in the North, Tynagh in the East and Ennis in the South. Essentially the 30km FCZ shown covers South Galway and North Clare.

Figure 2.4 Feedstock Catchment Zone (10km, 20km & 30km radius)

In this part of the country, the predominant industry is agriculture and therefore the feedstocks that will be most available will be agriculturally based such as energy crops and residues from the agri-food sector. While the majority of the feedstock will be drawn from

the agricultural sector within this zone, this feedstock can be supplemented with a small percentage of other feedstock which will be sourced from the wider catchment zone such as organic residues from the agri-food sector.

2.4.5 Profile of Agriculture in Feedstock Catchment Zone

As outlined above, the predominant industry in the FCZ is agriculture and therefore, the proposed biogas plant will draw the majority of its feedstocks from the surrounding farms and agri-food businesses. The predominant farming type in both Galway & Clare is beef farming, followed by dairy & sheep farming with tillage and other operations making up the balance.[30] [31]

Livestock farming in Ireland is predominately a grass-based system and this is no different in the counties of Galway & Clare. With this in mind, the feedstocks with the greatest potential to source in this area is grass silage and animal slurry. In addition, the site in question is located close to the M18 & M6 motorways that provides direct access to the wider regional catchment.

GRASS SILAGE

Grassland is the dominant biomass resource in Ireland. Grassland accounts for up to 92% of agricultural land area in Ireland and has some of the highest yields of grass per hectare in Europe. Teagasc have concluded from recent research that under existing practices in Ireland there is an estimated surplus of 1.7 million tonnes per annum of dry matter available in excess of livestock requirements. If grassland management techniques were improved there is the potential to generate an average resource of 12 million tonnes per annum of dry matter in excess of livestock requirements. This additional resource could be diverted to the production of biogas through anaerobic digestion without having any adverse effects on livestock requirements[32]. This additional grass growth potential provides significant opportunity to farmers in areas where a high concentration of beef and sheep farming exists such as Galway and Clare to generate additional revenues. While the FCZ extends to a 30km radius out from the proposed site, only a portion of this land is suitable for grass growing (for the purposes of harvesting silage). Figures 2.5 below highlights the FCZ along with areas that are not suitable for grass cultivation. Figure 2.6 shows the FCZ the and boundaries of protected areas with ecological designations (SPAs, SACs, NHAs, Nature Reserves and National Parks).

---

[30] *The Value of Agriculture at County Level – Irish Farmers Association 2016*
[31] *Crops & Livestock Survey June 2016 – Central Statistics Office*
[32] *Teagasc – How much grassland biomass is available in Ireland in excess of livestock requirements 2013*

Figure 2.5 Unsuitable areas in FCZ

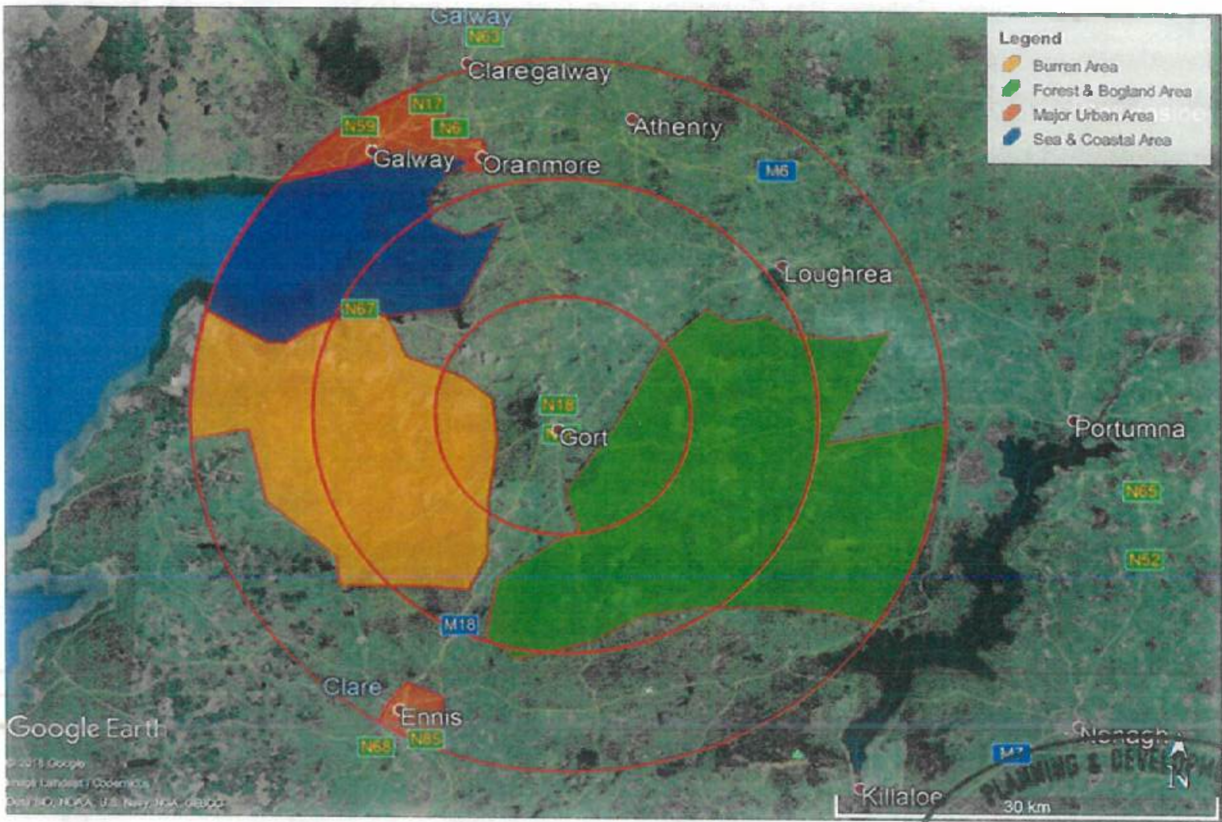
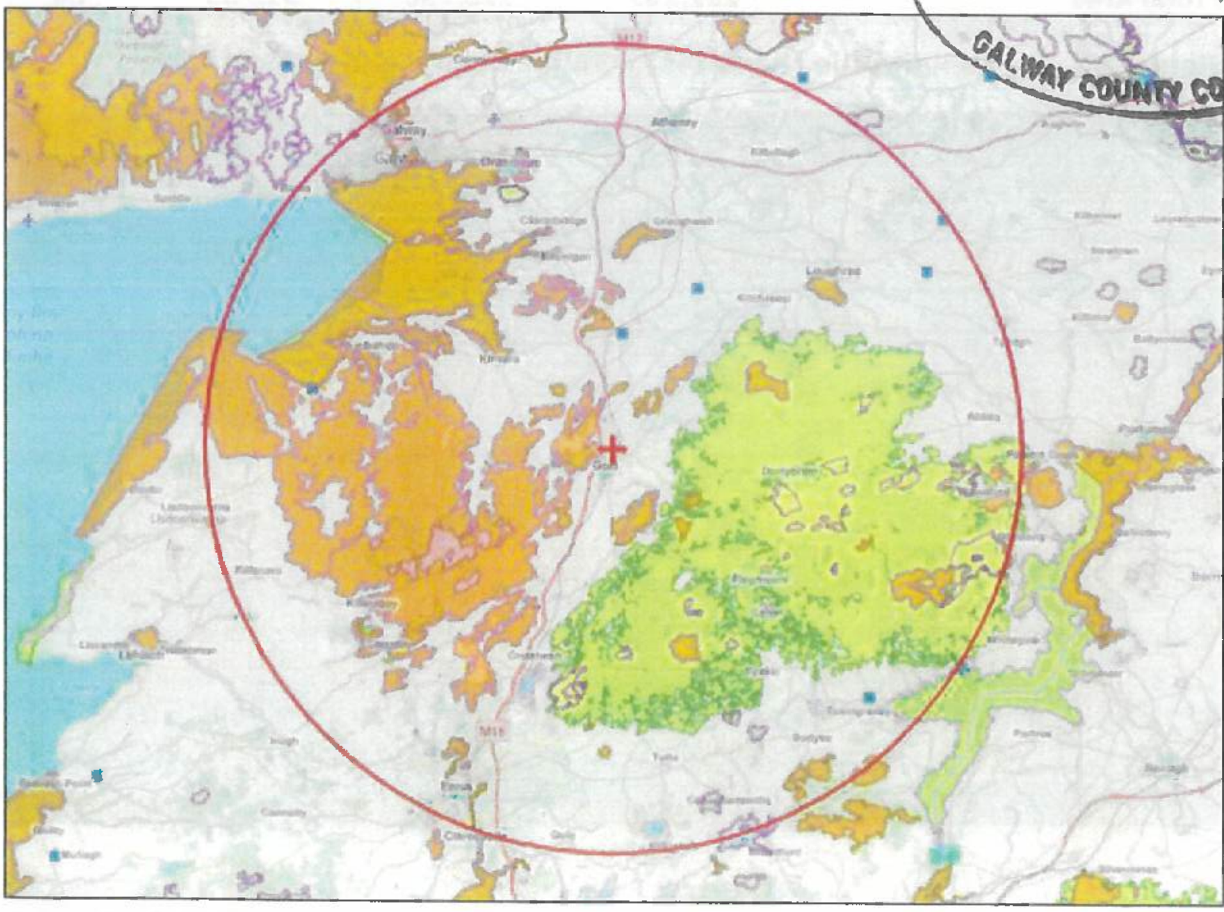


Figure 2.6 Unsuitable areas in FCZ (ecological designations)

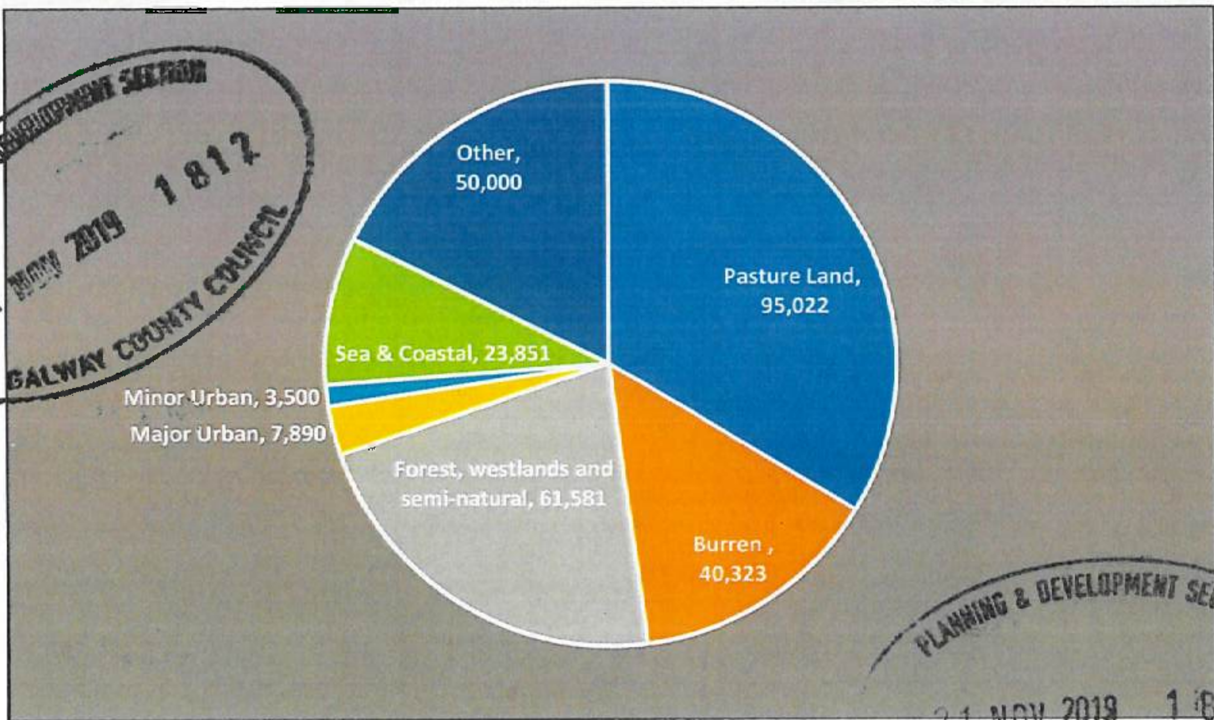


As can be seen above, a large portion of the area in the 30km radius is accounted for by the Burren Complex, Galway Bay Complex and Galway City to the west and a large area of wetlands and forest/semi natural area to the east. The unsuitable areas for harvesting grass silage conservatively estimated and shown in Figure 2.5. This is largely complimented by the unsuitable areas due to ecological designations shown in Figure 2.6. Other areas which are not shown in the Figures 2.5 and 2.6 as being unsuitable are landuse types such as small urban centres, road networks, watercourses, hedgerows, residential properties and industrial areas. These further reduce the overall land area available for harvesting grass silage in the catchment. The general landuse types within a 10km, 20km and 30km radius of the site are presented in Table 2.2 below. The landuses types within a 30km radius is illustrated in Figure 2.7.

Table 2.2 General Landuse Types

Description	30km radius	20km radius	10km radius	Unit
Pasture Land	95,022	39,000	10,121	ha
Burren	40,323	25,320	3,852	ha
Forest, wetlands and semi natural	61,581	40,346	7,780	ha
Major Urban	7,890	0	0	ha
Minor Urban	3,500	2,500	1,500	ha
Sea & Coastal	23,851	6,564	0	ha
Other	50,000	12,000	8,450	ha
Total Area	**282,167**	**125,730**	**31,703**	**ha**

Figure 2.7 Land Profile (hectares) - 30km Radius of the Site



-2-34
-2-83

process and output yields. Once documentation presented by the fe
accepted by the plant operator, drivers will be directed to the entrance ar
feedstock reception building.

Vehicles will enter and exit the feedstock reception building via a purposely designed air lock lobby located at the front of the feedstock reception building. Once the vehicle has reversed into the air lock lobby, the high-speed roller shutter doors will close in front of the vehicle. A second door will then open at the rear of the vehicle allowing the vehicle to reverse into the feedstock reception hall. The building will operate under negative pressure to ensure any fugitive emissions are contained within the confines of the process building. The feedstock reception building will include a building ventilation system and odour control (abatement) system that maintains the building under negative air pressure to minimise fugitive odour releases from the building. The combination of the air lock lobby, high-speed roller shutter doors, building ventilation and odour abatement system will prevents fugitive emissions leaving the building.

Delivery vehicles will dispatch solid feedstocks to one of the four concrete bunkers (tipping bays). Liquid feedstocks will be piped from delivery tankers directly into reception tanks within the reception hall. The reception area is designed to hold approximately 3-4 days equivalent of feedstock delivery to cover weekends and bank holiday periods. This figure has been determined upon review of licensing requirement and to prevent organic material remaining in the reception area for long periods and thus preventing odour generation.

A feedstock inspection area and quarantine area will be provided and maintained within the feedstock reception building. The inspection area is suitably sized to provide for the inspection of material and quarantine for subsequent off-site disposal in accordance with environmental legislative requirements. Feedstocks will only be sourced from known, verified waste producers or from new waste producers subject to initial waste profiling and basic characterisation off-site (sampling and analysis).

It is considered good practice, and it is a requirement of DAFM in the approval of a Biogas plant, that the plant should be laid out so that there is a one-way flow of material from intake of feedstock to removal of the digestate products. Procedures will be put in place to ensure that unprocessed feedstock does not cross-contaminate the digestate products either directly or via personnel or equipment. Therefore, the proposed biogas facility has been designed in accordance with the requirements of DAFM CN11: Conditions Document for Biogas Plants.

2.5.2 Reception Building

The reception is designed to be sufficiently sized to provide for acceptance of the range of feedstocks types and quantities proposed. The building envelope is designed to contain and prevent uncontrolled release of emissions to the receiving environment; such as odours, dust and noise. As described above, the building includes an air-lock lobby located at the front of the feedstock reception building. The main feedstock reception hall is an enclosed building maintained under negative air pressure and fitted with an odour abatement system. Internal air and odorous air vented from process tanks will be extracted and treated using a purposely designed odour abatement system comprising a series of scrubbers and adsorption bed. Once treated and abated, air will be discharged to atmosphere via a 22m high stack. The building ventilation system will supply fresh air to operatives (occupants) and ensure that the air is changed sufficiently (2-3 times per hour) to remove and treat odours and airborne contaminants.

Floors within the feedstock reception hall where loading, preparation and processing feedstocks occur will be impermeable and constructed to accommodate all of the static and dynamic loads imposed by vehicles, plant and machinery housed within the hall and HGVs delivering feedstocks. Process effluents generated from activities within the feedstock reception building will be recovered to the process via two (2 no.) below ground storage tanks. Process effluents (dirty water generated within the site – e.g. wash down within the feedstock reception building) will be collected by floor /ground gullies and conveyed by enclosed pipework to an underground process effluent tank (capacity 488m^3). A second underground process effluent storage tank is included to provide additional capacity (488m^3) for containment of process effluents arising from non-routine activities e.g. spillages within the feedstock reception building. The process effluent tanks will receive effluents from process drainage pipework for recovery to the AD process. No process effluents will be discharged to ground or to the public sewer. Solid wastes will be stored in concrete bunkers and loaded to mixing plant via a mechanical loading shovel and /or overhead grab bucket running on an overhead gantry.

A designated vehicle/container cleaning area is located indoors within the reception hall within the feedstock reception building. The area will contain facilities for saturated steam cleaning and delivery vehicles. In general disinfectants must be used although saturated steam cleaning may be used as an alternative. Washwater will be recovered to the process via the process drainage system.

The feedstock reception building is designed to provide for segregation of incoming wastes and to ensure that waste is in storage for the least time possible. A first-in-first-out (FIFO) procedure will apply. Feedstocks will be processed within 72 hours of their acceptance to reduce potential for odours being generated. Feedstock bays will be completely emptied at least weekly to prevent a build-up of older feedstock and to allow for the bunker to be cleaned down. Liquid feedstock will also be received in the feedstock reception hall. Liquid feedstocks will either be unloaded into one of the $50m^3$ intake tanks for mixing with solid feedstock or forward fed directly to the primary digesters via enclosed pipework running from the feedstock reception building to the digesters.

For pumping and mixing, feedstocks below 10% DM are required, with 5-8% considered as optimum for mesophilic digestion. It is proposed to supply liquor to the feedstock mixing process from a number of sources on site:

1. Process effluents will be recovered and reused for mixing of feedstocks;
2. Liquor digestate from secondary digesters can be recirculated for process optimisation and efficient use of liquid resources;
3. Stormwater harvested from roof, bund and hardstanding around the site will be stored for use in the process.

The mixing process will involve machinery (from a supplier such as Vogelsang) purposely designed to mash, macerate and mix solids with liquids delivering high-viscous, homogenous suspensions in the primary digesters which result in higher gas yields.

2.5.3 Anaerobic Digestion

The development proposal includes for four primary and four secondary digesters (i.e. two stage digestion) each with a capacity of $5,500m^3$ and a working volume of $5,100m^3$. The primary digesters will be fed by enclosed pipelines directly from the feedstock mixing and process area within the feedstock reception building. The digesters will be constructed in concrete (8m high wall) and the walls will be fitted with insulated cladding. The digesters will be heated (38°C to 42°C) and continuously stirred /mixed.

Anaerobic digestion (AD) is a natural process in which microorganisms break down organic matter, in the absence of oxygen, into biogas [a mixture of carbon dioxide (CO_2) and methane (CH_4)] and digestate (a nitrogen-rich fertiliser). The biogas is further upgraded and used in the same way as natural gas. The microbial consortia responsible for AD comprise several groups and each performs a specific function in the digestion process. Together they achieve the conversion of organic matter into biogas through a sequence of stages. The main stages within an AD process are:

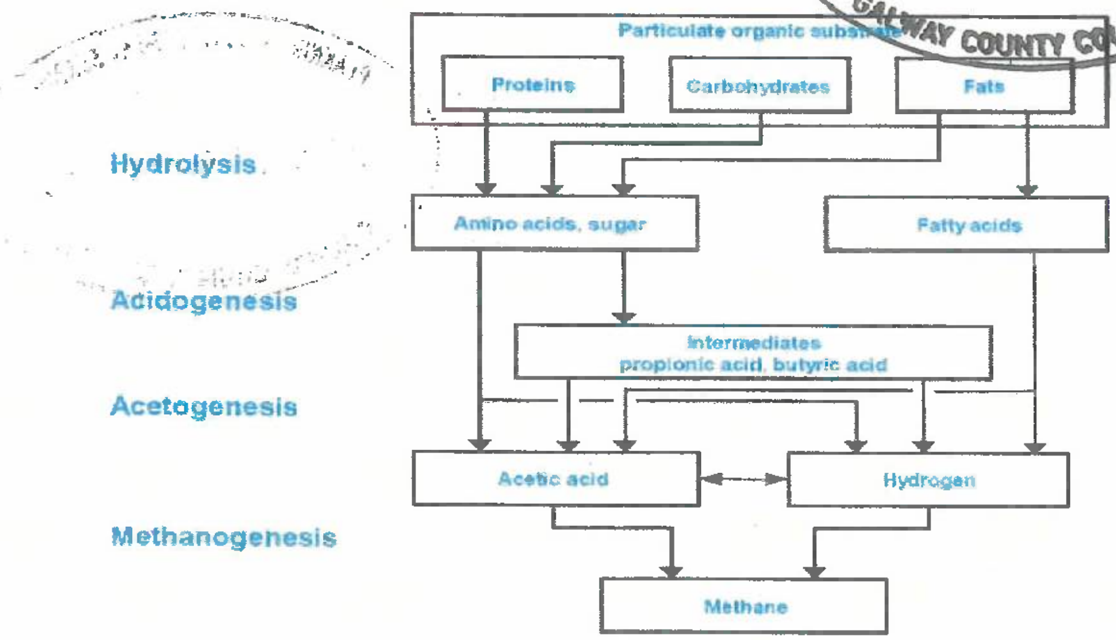
- Hydrolysis

- Acidogenesis
- Acetogenesis
- Methanogenesis

During the initial stages, short chain amino acids, simple sugars and fatty acids are generated from the breakdown of proteins, carbohydrates and fats. Acetate and hydrogen produced in the first stages can be used directly by methanogens.

In the second stage, acidogenic bacteria (fermenters) transform the products of the first reaction into short and long chain volatile fatty acids (VFAs), ketones, alcohols, hydrogen and carbon dioxide. In the third stage of the AD process, propionic, butyric and higher chain acids and alcohols are transformed by acetogenic bacteria into hydrogen, carbon dioxide and acetic acid. The fourth and final stage of the process is the biological process of methanogenesis (methane formation). Microorganisms convert the hydrogen and acetic acid formed by the acid formers to methane and carbon dioxide. The bacteria responsible for this conversion are called methanogens which are strict anaerobes. Stabilisation of material is accomplished when methane and carbon dioxide are produced. The AD process is illustrated in Figure 2.8 below:

Figure 2.8 AD Process



The proposed plant is designed to operate in the mesophilic range. 'Mesophilic' digestion occurs when the temperature range in the vessels varies between 30°C and 40°C. This is the most common temperature range of AD for the treatment of organic feedstocks and there is considerably more operational experience of mesophilic plants than other types.

Each digester will be covered with an airtight gas membrane to recover and store raw biogas (each with capacity to hold circa 1,400m^3) produced from the AD process and a second membrane will overlie the gas membrane as a weather proof protection. Primary and secondary digesters (and quality digestate storage vessels) will be located with a concrete bund structure. The bund capacity is 15,553m^3, i.e. capable of managing at least 110% of the volume of the largest vessel (in this case 5,610m^3) or 25% of the total tankage volume (in this case 15,300m^3), whichever is the greater. The bund will be regularly inspected to ensure that rainwater is not accumulating and all connections and fill points will be designed to be within the bunded area with no pipework penetrating the bund wall.

The capacity of a given digester to degrade the organic feedstock depends primarily on the amount of viable (living) biomass within the digester. Where the carbon feedstock (and nutrients) are not limited, the bacterial population within the digester responds to feeding resulting in an increase in microbial population.

The Hydraulic Retention Time (HRT) is defined as the working volume of the digester divided by the rate of feeding as volume per unit time and is expressed in days. The HRT of digestate in the digester vessels is dependent on the volume of feedstock consumed per year (designed to accept 90,000 tonnes of non-hazardous biodegradable wastes) plus the additional volume of liquor which must be added for mixing.

2.6 Pasteurisation

The process of pasteurisation at Biogas plants in Ireland may take place before or after the digestion phase. In the context of wet biogas plants (in the case of the proposed Biogas Plant), a biogas pasteurisation unit is defined as a pasteurisation vessel in which the transformation parameters are met. Pasteurisation at the plant requires transformation of feedstock in accordance with EU transformation parameters. EU transformation parameters requires that all the material within the biogas pasteurisation be simultaneously held at 70°C or above for 60 continuous minutes. The particle size of the ABP material must also be reduced to 12 mm or less before entering the biogas pasteurisation unit.

Pasteurisation is designed to minimise the risks from microbiological hazards. The EU pasteurisation standard uses indicator organisms to; (1) verify that pasteurisation had the required reductive effect on pathogens and (2) verify that no cross contamination between fresh feedstock and digestate product occurs. A common misconception is that pasteurisation is equivalent to sterilisation, in other words that it completely eliminates microorganisms, while in fact it actually only reduces the microbial load by several logs.

The use of pasteurisation processes at the plant reduce the numbers of any pathogens to levels in which they do not pose a hazard. It will also ensure that all end products produced (such as carbon dioxide, digestate and biomethane) are safe to handle and use.

Pasteurisation plant and associated equipment will be located in the feedstock reception hall (clean side) and comprise the following items:

- 4 no. 50m^3 vessel
- Heating equipment – heat exchanger (served by the CHP /standby boiler)
- Macerators (12mm) including duty and standby
- 2 no. 100m^3 test tanks to allow for E. coli sampling and analysis

Digestate from secondary digester vessels will be fed using enclosed pipework via macerators to the pasteurisation vessels (back-end). The macerators will reduce the particle size of the feedstock to less than 12mm to material entering the pasteurisation unit. The Material (at temperature of ~40°C) being supplied from secondary digesters through a heat exchanger which will raise the temperature to greater than 70°C. The material will circulate through the pasteurisation system until an optimal temperature above 70°C is attained. The heating process will cease once the desired process temperature is achieved but material will continue to be agitated within the pasteurisation vessel. The pasteurisation unit will be equipped with sufficient temperature probes to provide evidence to regulatory authorities that all the material is kept above the minimum temperature (70°C) for the required period of time (60 minutes). Temperature probes will be located at sufficient distance away from the pasteurisation unit wall/heat source to ensure that representative feedstock temperatures are recorded during the pasteurisation period. The pasteurisation process will be equipped with recording equipment that will allow a live, real-time thermograph to be produced from the temperature probe readings. The recording system and the thermographs produced will be tamperproof. Pasteurisation and test tank vessels will be sourced from certified sources. The GRP (Glass reinforced plastic) vessels will be capable of withstanding temperatures up to 90°C and are extremely strong and robust and the material is a natural insulator and can be fitted with polystyrene insulation to ensure maximum efficiency. Vessels will be fitted with ultrasonic level indicators and access ladders and platforms to allow for maintenance activities.

2.7 Digestate (Organic Fertiliser)

Digestate refers to the material produced by the process of anaerobically digesting biodegradable materials. Digestate consists of a mix of microbial biomass (produced by the digestion process) and undigested material.

Once successfully pasteurised, material will be forward fed to test /hold tanks for *E. coli* testing or one of four (4 no.) concrete storage vessels positioned within the tank farm to the north of the feedstock reception building. Batch testing of digestate for presence of *E. coli* will be undertaken using test /holding tanks positioned within the feedstock reception building. The EU pasteurisation standard uses indicator organisms to (1) verify that pasteurisation had the required reductive effect on pathogens and (2) verify that no cross contamination between fresh feedstock and digestate occurs. *E. coli* is the accepted indicator organism for verification of pasteurisation and operational regulatory authorities require periodic frequent testing of material. Testing of digestate for other quality criteria to demonstrate conformance with a quality standard will be undertaken on material held in the 4 no. storage vessels. Parameters will include:

- Nutrient composition:
  - Nitrogen
  - Phosphorous
  - Potassium
  - Ammonium
  - Nitrate
  - pH
  - Dry matter
- Effective Processing
  - Stability
  - Metals
  - Salmonella -to demonstrate no cross contamination between feedstock and digestate
  - Impurities - stones
  - Organic matter
  - Maturity – viable weed seeds

Production of digestate as organic fertiliser requires quality management and quality control throughout the whole closed cycle the AD process. The main factor in digestate quality management is to ensure high feedstock quality. The materials used as feedstock should not only be easily digestible, but they must not be contaminated with unwanted materials and compounds of chemical (organic and inorganic), physical or biological nature. Effective management of the quality of feedstocks is supported in legislation by obligations on producers and AD operators to accurately classify, describe, verify evaluate and document wastes (feedstocks) being sent for recycling /disposal.

Sustainable Bio-Energy Ltd. intend to adopt additional quality criteria provided within other international standards such as PAS110:2014 to provide confidence to end-users that the digestates are of consistent quality and fit for purpose. Such international standards specify further controls on input materials and the management system for the process of AD and associated technologies. Further measures which will be implemented to ensure that a high-quality fertiliser is produced include:

- Quality management system; the QMS (accredited to ISO 9001:2015) will encompass all aspects of the facility including the process of producing digestate;
- Hazard analysis and critical control point (HACCP) planning- to ensure that digestates are safe and fit for purpose.
- Input materials - feedstock supplier audits, inspections, sampling and quality assurance, written supply agreements, carrier performance contract.
- Process management, separation and storage – optimisation of process parameters including feedstock mix, hydraulic retention time, organic loading rate (OLR), etc. Accurate recording and logging of processing activities.
- Process equipment – the management system will identify all equipment required to maintain and monitor the process. A preventative maintenance programme will be implemented and contingency arrangement will be provided in the event of equipment failure (e.g. standby plant).
- Process monitoring - Monitoring is a planned sequence of observations or measurements of control parameters to assess whether a critical control point (CCP) is under control. Effective monitoring minimises potential for emissions, variation in digestate quality and consistency.
- Sampling of digestate – A comprehensive suite of digestate test parameters will be undertaken to demonstrate conformance with assigned digestate quality standards and to demonstrate product benefits to end-users
- Validation – of plant processes with regulatory bodies

The volume of digestate produced at the proposed plant will be governed by the nature and composition of the feedstock mix. The front-end mixing process will require addition of liquid and solids to optimise dry matter content (<10%) and create homogenous pumpable feedstock for forward feeding to digesters. The amount of digestate arising from processed feedstock reduce by 5-10% (OM) due to losses during breakdown of material within the digester vessels. The plant is designed to allow recirculation of digestate (liquid) to the feedstock mixing area for efficient use of liquid resources. This will increase solids and nutrient concentrations of digestate. The volume of digestate which could be recirculated is dependent on feedstocks but indicatively is limited to up c. 45-50% of total digestate produced. Considering the above and based on proposed annual feedstock acceptance amounts, it is estimated that the plant will produce up to 150,000 tonnes of whole digestate per annum (7-9% DM content) once fully commissioned.

In terms of storage capacity, the volume of storage should be guided and sufficiently sized to cater for digestate production between the period mid-October to mid-January (approximately 20 weeks depending on location within the country and weather conditions). The plant includes on-site storage capacity of a working volume capacity of circa 15,300m^3. In addition, additional storage is provided in the form of four secondary digesters vessels (20,400m^3). It is proposed that digester (primary and secondary) volumes will be managed in the months approaching the closed spreading season and volumes within digesters will be reduced to provide for additional capacity for the closed spreading season. The plant can also recirculate digestate from secondary digesters to reduce the overall fresh mixing liquid inputs during this period. Planned annual maintenance programmes to the plant will be carried out in the early part of the closed spreading season period when livestock animals will start to be housed. Planned annual maintenance will be carried out over a two-week period once the plant is fully commissioned and operating at the designed acceptance capacity. The annual maintenance programme will coincide with times when farm-based animal slurry storage tanks are empty, thereby having sufficient storage capacity available at feedstock generation sites. The overall plant design and processing capabilities /flexibilities of the plant will ensure that digestate volumes produced during the closed spreading season are managed in an accordance with legislation requirements and in an environmentally sustainable manner.

2.7.1 Digestate Use

The exact composition of digestate is determined by composition of feedstock processed at a particular biogas plant However, some typical values for nutrients[36] are:

- Nitrogen: 2.3 - 4.2 kg/tonne
- Phosphorous: 0.2 - 1.5 kg/tonne
- Potassium: 1.3 - 5.2 kg/tonne

The nutrients that were contained in the feedstock remain in the digestate. Only carbon, hydrogen and in marginal quantities nitrogen, sulphur and oxygen can leave the process during gas phase. Therefore, the used feedstocks determine directly the composition of

[36] *http://www.biogas-info.co.uk/about/digestate/*

the generated digestate. The relevant nutrients are predominantly nitrogen, phosphorus, potassium and the organic carbon content.

Digestate can compete and be substituted for several categories of mineral fertiliser and presents an environmentally friendly alternative to the agriculture, landscaping and horticulture industries.

Development of the Sustainable Bio-Energy Limited Biogas Plant at Gort will result in the production of nutrient-rich digestate which will be used as organic fertiliser and a substitute for chemical fertiliser on agricultural lands. It is proposed to provide digestate to farmers in the general area of the site, particularly those who are providing grass silage feedstock (ref. Figure 2.5); thereby providing for a circular economy.

DIGESTATE AS A FERTILISER

A significant body of work has been undertaken across Europe regarding the use and benefit of digestate in soils and agriculture and a summary of the most relevant in the UK and Ireland is presented below.

United Kingdom

In 2010 the DC-Agri project[37] was commissioned in the UK by WRAP to investigate and assess the use of digestate and compost (produced from food waste) on crop yields. This comprehensive study ran across three growing seasons, with supplementary research completed in 2015. The trials were underpinned by robust scientific methodologies and were carried out at 22 sites throughout Wales, Scotland and England. A final report for the project was published in 2016. The project demonstrated use of digestate can produce higher crop yields of equal quality to crops grown with bagged chemical fertilisers combined with fertiliser cost savings leading to improved financial returns. The project outputs include guidance[38] for farmers, growers, advisors and agricultural contractors in relation to the use of digestate and compost and its integration into nutrient management plans.

In the UK, the Biofertiliser Certification Scheme (BCS) was created for the purpose of certifying biogas plants in England, Wales and Northern Ireland against the PAS110 and Quality Protocol (QP) for the production and use of Quality Outputs from the anaerobic digestion of source-separated biodegradable waste. Biogas plants in Scotland will be certified against the PAS110 standard only (not QP). The Biofertiliser Certification Scheme

[37] *http://www.wrap.org.uk/content/digestate-and-compost-agriculture-dc-agri-reports*
[38] *http://www.wrap.org.uk/content/digestate-and-compost-good-practice-guidance*

(BCS) provides assurance to consumers, farmers, food producers and retailers that digestate produced from anaerobic digestion is safe for human, animal and plant health.

Ireland

In Ireland, a three-year study was undertaken by rx3 which was published in 2014[Note 39]. The rx3 report presents findings from demonstration crop trials undertaken over three growing seasons (2010, 2011 and 2012) on five sites located in different regions in Ireland. At the commencement of the trials, each of the five sites had been under the same cropping regime for more than five years. The trials examined and compared the performance of four different fertiliser products in a commercial farming environment. The products were compost, slurry, artificial fertiliser and digestate. Digestate was used as either whole digestate, digestate fibre or digestate liquor. Each type of digestate product is best suited to a particular use, because each type of digestate product has a different level and ratio of available nitrogen and phosphorus. The digestate used in 2010 and 2011 was sourced from digesters licensed to process ABP in the UK and in 2012 the digestate used was sourced from an Irish non-ABP AD plant. Studies on the bioavailability of nutrients in separated liquor and fibre indicate that the more soluble forms of nutrients are partitioned into the liquor and the recalcitrant forms are retained in the fibre.

The study found that on arable crops, digestate gave consistent positive crop growth benefits and grain yield responses. The study found that digestate products are a valuable alternative nutrient source which can replace substantial chemical fertiliser inputs in crop production and its use may increase soil organic matter (SOM), worm populations and provide other beneficial soil qualities. The trials found that on grassland although the nitrogen in digestate is readily plant available it stimulates the grass/clover sward, rather than causing inhibition as with the readily available nitrogen in artificial fertiliser form. The dry matter crop yield from the digestate plots was consistently over 20% higher than when the crop is treated with artificial fertiliser only. The study also found that the major and minor mineral uptake by the grass/clover (per tonne of dry matter) is increased with digestate.

It is accepted that current markets for digestates in Ireland are immature. However, due to growth in development of biogas plants and the costs, resource and environmental pressures (water quality and catchment susceptibility) associated with the use of conventional inorganic fertilisers and raw unprocessed animal manures, new markets are fast emerging. Using digestate instead of synthetic fertilisers derived from fossil fuels can positively contribute to climate change issues by reducing carbon dioxide emissions and

39 *rX3 report, 3 Year Report on Crop Trials Demonstrating the Use of Compost and Digestate in Irish Agriculture, 2014*

losses of nitrogen associated with availability. The Anaerobic Digestion and Bioresources Association (ADBA)[40] report that one tonne of artificial fertiliser replaced with digestate saves one tonne of oil, 108 tonnes of water and seven tonnes of carbon dioxide emissions.

Development and construction of the Sustainable Bio-Energy Limited biogas plant will positively contribute to further developing quality standards in Ireland and change perceptions associated with the conversion of waste into products. Sustainable Bio-Energy Limited intend to positively contribute and provide and improve information available to farmers on the benefits of digestate and other organic fertilisers.

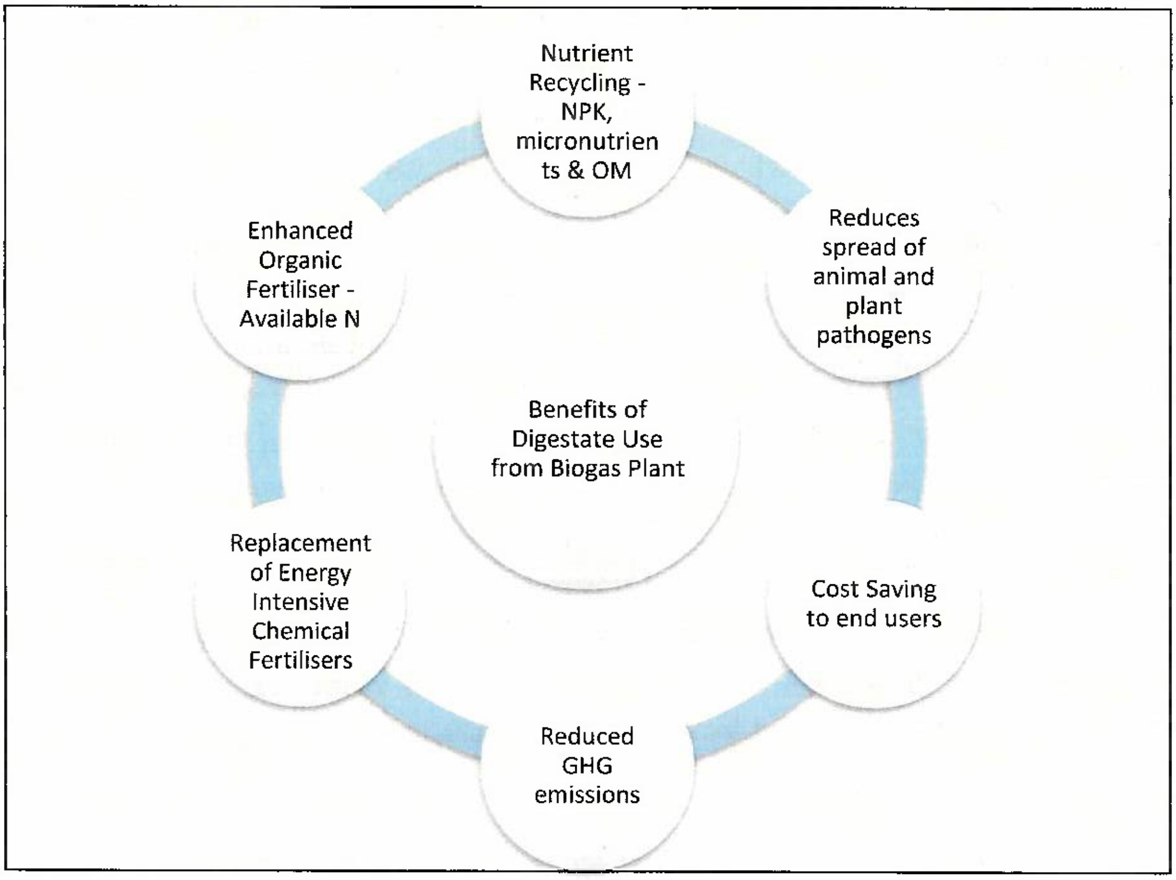
It should also be noted that use of digestate as a fertiliser is permitted under the Organic Food and Farming Standards in Ireland with certain restrictions and for digestate produced from source separated food waste, limits are set for the concentration of some trace elements. Work in the EU project BIOFARM II reports[41] that there are currently 180 organic biogas plants in Germany and 1 to 5 plants in a number of other EU countries. The project claims that biogas plants on organic farms have improved the yields and quality of crops, and this is supported by a survey of farmers in Germany where yield increases in the range 15% to 30% were reported[42]. Eurostat figures from 2015 state that less than 2% of land is used for organic farming in Ireland. This figure is the second lowest in Europe (average being c. 6%), where organic production in member states such as Austria, Italy Sweden each account for over 10% of available land. Under Section 11.3.4 of the Galway CDP 2015-2021 it states that

> *There is a big increase in the demand for organic and speciality foods. This has presented an opportunity for farmers to obtain an attractive premium for organic beef, lamb, venison, milk, fruit and vegetables as well as other locally produced food. There is undoubtedly a large potential for more farmers to switch to organic farming within County Galway. In order to promote farm diversification into areas such as organic food production and food processing, the Council will promote the provision of regularised farmers markets in appropriate locations, including the traditional market towns such as Tuam, Ballinasloe, Loughrea, Oranmore, Gort, Athenry, Kinvara and Clifden, which have evolved as centres of agricultural trade, outlets for quality, local produce and economic viability of local agriculture.*

[40] *www.adbioresources.org*
[41] *Small scale organic biogas plants, Bioenergy Farm Small scale biogas conference, Brussels February 2016*
[42] *7 Sustainable biogas production; a handbook for organic farmers. Sustaingas 2013. http://www.ecofys.com/files/files/ecofys-2014- sustaingas_handbook.pdf*

The production of fertiliser by the proposed biogas plant which conforms to the organic food and farming standards will positively contribute and assist with growing the organic farming sector in the County and throughout the Region.

Figure 2.9 Benefits of Digestate



In order to use digestate as a fertiliser, certain regulatory requirements, both on national and European level, must be met.

As there is currently no specific digestate quality standard in Ireland, the quality criteria and proposed end-use status of digestate is considered on a case by case basis and typically prescribed by the EPA and DAFM within licenses and approvals associated with operation of the plant. The proposed Biogas Plant and its feedstock and digestate management systems are designed to ensure the plant produces digestate which will conform with recognised European, UK and Irish legislation and quality criteria, including PAS 110 and the European ABP pasteurisation standards (70°C for 60mins ... pathogens such as *E. coli* and *Salmonella* and reduce particle size to 12mm or less).

2.7.2 Use of Digestate as a Fertiliser

The Nitrates Directive has been in place since 1991. It aims to protect water quality from pollution by agricultural sources and to promote the use of good farming practice. Similar to other organic fertilisers such as livestock slurries, digestates can pollute surface water if applications are not managed carefully. In particular, digestate should not be spread on frozen, snow-covered or waterlogged ground, or within 10 metres of a watercourse. Additional good practice guidance for the application of livestock manures and slurries should be followed when applying digestate. Digestate should only applied during the growing season in order to ensure the optimum uptake of the plant nutrients and to avoid pollution of ground water.

Fertiliser applications should match crop requirements to minimise any unintended negative impact to the environment. The European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2014 (S.I. 31 of 2014), which replaced S.I. 610 of 2010, prescribes conditions relating to the application of fertiliser to lands.

In Ireland there is a defined period when the spreading of organic fertiliser is prohibited and this occurs over the Winter period. This restriction applies to ensure compliance with the European Union's Nitrates Directive and the protection of groundwater and surface water, including drinking water. The prohibition application periods for fertilisers in Ireland for organic fertiliser extends from 15th October to 15st January[43]. It should be noted that digestate as a fertiliser is not specifically mentioned in application legislation and therefore there is no specified level of availability (amount of nutrients contained in 1 tonne of organic fertiliser). However, where digestate feedstock contains any manure, the DAFM considers all the digestate to be manure and therefore requires the level of nutrient availability specified in legislation for manure to be applied to the digestate. Under the Nitrates Action Programme (NAP) an application rate of 170kg N/ha/year is prescribed for manure. A derogation was agreed in 2014 which allows application rates of 250kg N/ha subject to conditions and strict rules and an extension to this was granted to Ireland until the end of 2021. With cognisance of this, use of digestate generated by the proposed biogas plant should be integrated into a fertiliser plan/ nutrient management plan (NMP) which should be prepared for the lands to which the digestate is applied to. This will

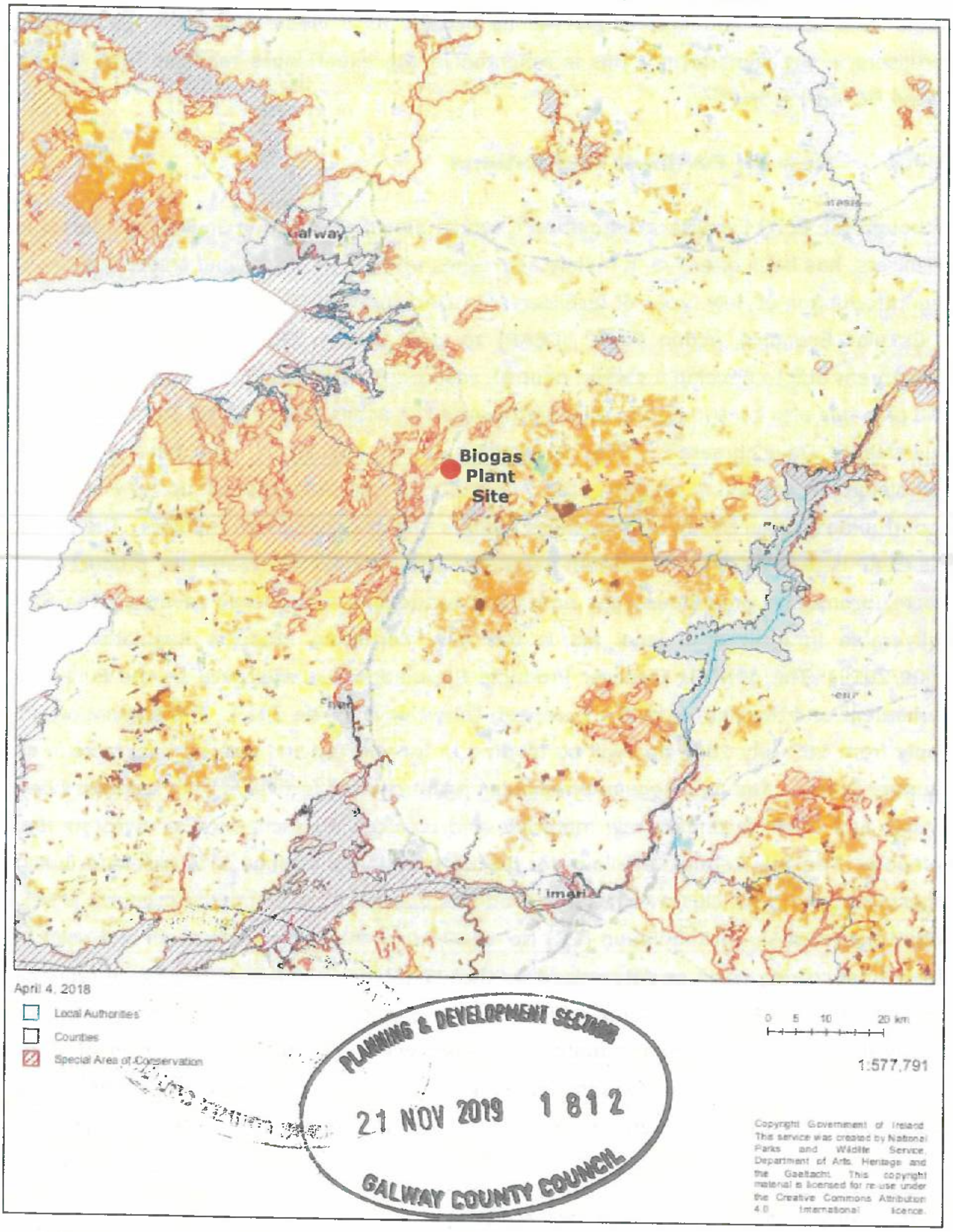
[43] End date specified applies to Zone B which includes Counties Clare, Galway, Kerry, Limerick, Longford, Louth, Mayo, Meath, Roscommon, Sligo and Westmeath. Earlier end dates apply to Zones A (12th January) which includes Carlow, Cork, Dublin, Kildare, Kilkenny, Laois, Offaly, Tipperary, Waterford, Wexford and Wicklow and later end dates (31st January) apply to Zone C which includes Donegal, Leitrim, Cavan and Monaghan

establish the most suitable and sustainable digestate application rate for the digestate product.

In the absence of a specific land bank and associated nutrient management plans due to the project being at the planning application stage in its development, reference is made to figures provided in the 2014 rx3 report[44] and industry knowledge relating to spreading of organic fertilisers. Indicatively[45] digestate application rates of 25-40m^3/ha (~16m^3/acre or 3,500 gallons per acre) apply to the spreading digestate on managed agricultural lands (grassland and arable lands). Whole digestate should be applied using precision application equipment such as shallow injectors or, where appropriate, be incorporated rapidly into the soil (e.g. on arable lands and prior to ploughing /sowing). This will significantly increase the amount of nitrogen available for crop uptake and reduce the amount lost as ammonia. Based on spreading rates of 40m^3/ha and the projected annual digestate volume being produced, a landbank of 3,750 hectares will be required for spreading of digestate; based on a single application event to a landbank. Typically, grassland crop is harvested two and possibly three times for intensive agricultural activities resulting in 2-3 fertiliser associated applications. The overall required landbank would therefore be reduced in accordance with this (i.e. 50% less (1,875ha / 4,633 acres) based on two fertiliser application events). Figure 2.10 below graphically illustrates agricultural (crop type and forestry) and NPWS designated sites within an approximate 40km radius of the site. The SEAI map[46] shows that grassland (shown as yellow areas) is the predominant crop type in the hinterland of the Sustainable Bio-Energy Limited Biogas Plant.

[44] *Rx3 2015, 3-Year Report on Crop Trials Demonstrating the Use of Compost and Digestate in Irish Agriculture*
[45] *Spreading rates should be determined by nutrient management planning of the landbank*
[46] *http://maps.seai.ie/bioenergy/*

Figure 2.10 Agricultural Datasets and NPWS Designated Sites



Given that current legislation and good practice guidance in the area of agriculture have the purpose of protecting the environment whilst maximising crop productivity and farm incomes, it is logical to suggest that they will not form a barrier to the application of digestate to lands. Digestate offers an attractive opportunity to farmers /growers for potential fertiliser cost savings, improvements in sustainability and improvements in soil health and quality and accordingly will be viewed as a viable alternative to chemical fertilisers in the short-term. This is reflected in the experiences reported from the UK based DC-Agri project[47].

2.7.3 New EU Fertiliser Regulations

Although the 2003 Fertilisers Regulation[48], which aimed at ensuring an internal market in fertilisers, has been effective, it mainly addresses mineral fertilisers and creates barrier to the introduction of new types of fertilisers. In December 2015, the Commission adopted a Circular Economy Action Plan[49] (CEAP) to give a new boost to jobs, growth and investment and to develop a carbon neutral, resource-efficient and competitive economy. The plan has also contributed to moving towards the achievement of the 2030 Agenda for Sustainable Development[50]. The 54 actions under the action plan have now been completed or are being implemented. Circularity has also opened up new business opportunities, given rise to new business models and developed new markets. The aim of the CEAP is to extract the maximum value and use from all raw materials, products and waste, promoting greenhouse gas emissions reductions and energy savings. The first deliverable in form of a legal act is the new Fertilising Products Regulation ((EU) 1009/2019). The new EU Fertiliser Products Regulation was approved by the European Parliament and the Council of the European Union on 5th June 2019. The Regulation will apply from 16th July 2022 and will be binding in its entirety and directly applicable in all Member States. The new Regulation enables production of fertilisers from recovered bio-wastes and other secondary raw materials and includes products such as digestate and compost. The new Regulation allows for the CE marking of a range of fertilisers including digestates, and the inclusion of certain products derived from animal by-products (ABP), within the meaning of Regulation (EC) No 1069/2009 that have reached an end point in the manufacturing chain as determined by that regulation. The new Regulation replaces Regulation (EC) No 2003/2003 which exclusively covers fertilisers from mined or chemically produced, inorganic materials. This will boost domestic sourcing of plant nutrients which are essential for sustainable agriculture, including the critical raw material phosphorus. It also contributes to a better implementation of the waste hierarchy, by

[47] *http://www.wrap.org.uk/content/dc-agri-action*

[48] *Regulation (EC) No 2003/2003 of the European Parliament and of the Council of 13 October 2003 relating to fertilisers*

[49] *COM (2015) 614*

[50] *e.g. SDG 2 (promoting water reuse and organic fertilisers, ...), SDG 8 and 9 (boosting innovation, jobs and added value), SDG 12 (supporting waste prevention and responsible management of waste....) and SDG 13 (potential of material efficiency to reduce CO_2 emissions)*

minimising landfilling or energy recovery of bio-wastes, and hence to solving related waste management problems. A shift towards fertiliser production from organic or secondary raw materials reduces CO_2 emissions, hence contributing towards a low carbon economy and the sustainability of the fertilisers sector.

It is expected that this measure will advance markets for digestate products; creating value in derivatives from organic non-hazardous wastes converted to higher forms of biobased fertilising products. The regulation is not compulsory and only if a company wishes to "CE" mark the fertiliser product (allowing free trade within the EU) that the requirements of the regulation would apply.

The Fertiliser product that Digestate would be sold under is (Product Function Category 1 PFC1) Organic fertiliser and thresholds will be prescribed for certain contaminants including; metals (As, Cd, Cr, Hg, Ni, Pb, Cu, Zn), biuret (absence), microbial pathogens (salmonella *spp.*, *Escherichia coli,* Enterococcaceae.

Solid organic fertilisers, (PFC 1(A)(I); the product shall declare at least one of the primary nutrients, nitrogen(N), phosphorous pentoxide (P_2O_5) and potassium oxide (K_2O). Where the product contains only one declared primary nutrient, minimum mass quantities requirements of 2.5% for N, or 2% for P_2O_5 or 2% K_2O shall apply. Where the product contains more than one declared primary nutrient, then a minimum of 1% N, or 1% P_2O_5 or 1% K_2O shall be present, along with 4% total sum of nutrients. The product shall also contain at least 15% (by mass) of organic carbon.

Liquid organic fertilisers, PFC 1(A)(II); the product shall declare at least one of the primary nutrients, nitrogen(N), phosphorous pentoxide (P_2O_5) and potassium oxide (K_2O). Where the product contains only one declared primary nutrient, minimum mass quantities requirements of 2% for N, or 1% for P_2O_5 or 2% K_2O shall apply. Where the product contains more than one primary nutrient, then a minimum of 1% N, or 1% P_2O_5 or 1% K_2O shall be present, along with 3% total sum of nutrients. The product shall also contain at least 5% (by mass) of organic carbon. The new Regulations also prescribe labelling requirements for the product and specification with regards to verification of declared conformity.

2.8 Biomethane

The gas clean-up plant recovers over 99.9% of the biomethane present in the raw biogas by separating the carbon dioxide from the biogas through a process of chemical adsorption. The selective organic chemicals used in this process are so efficient that the product gas can contain over 99% biomethane. The process is a closed system and adsorption chemicals are recycled and periodically replaced and removed from site. The biomethane gas produced is high quality and can be directly injected in to the gas grid, compressed to produce bio-CNG or liquefied for bio-LNG. The process also provides for capture of the CO2 from raw biogas, to

Biogas Treatment will primarily consist of the following processes

- Dewatering;
- Removal of H_2S (potentially corrosive to engines);
- Removal of oxygen and nitrogen (where present);
- Removal of ammonia;
- Removal of siloxanes (if present);
- Removal of particulates;
- Removal of CO_2 (for upgrading to biomethane);
- Gas bottling.

The techniques used in biogas treatment to remove these different elements are outlined below

- Dewatering

Biogas leaving the digester is saturated with water and this may condense in gas pipelines. The condensate will be contaminated and may cause corrosion. It is important that wet gas transmission pipes and storage vessels can be drained to prevent them from becoming flooded with condensate.

Water removal techniques include:

- Cooling / Condensation;
- Compression;
- Adsorption; and
- Absorption

PLANNING & DEVELOPMENT SECTION
21 NOV 2019 1812
GALWAY COUNTY COUNCIL

For small scale AD-plants water removal techniques such as moisture traps or water taps at low point in the gas line are commonly used and are sufficient for using biogas in gas-

engines. Due to high capital and operational costs, water removal based on drying methods are rarely considered economical unless the biogas is intended to be upgraded to biomethane.

- Desulphurisation

The main sulphur compound in biogas is hydrogen sulphide (H_2S). H_2S is formed during microbial reduction of sulphur containing compounds (sulphates, peptides, amino acids). It is reactive with most metals and the reactivity is enhanced by concentration and pressure, the presence of water and elevated temperatures.

H_2S can cause corrosion problems in gas engines. H_2S has an energy value and burns readily. When combusted, it forms SO_2 leading to acidic conditions in the presence of moisture formed when methane is burned. The presence of H_2S in the gas may also result in more frequent oil changes being required. Gas engine manufacturers set limits on H_2S tolerances (typically below 500ppm). H_2S concentrations in the biogas can be decreased by precipitation in the digester or by treating the gas either as a stand-alone treatment or as part of carbon dioxide removal.

At the Sustainable Bio-Energy Limited plant, desulphurisation will be undertaken by absorbing H_2S on inner surfaces of engineered activated carbon with defined pore sizes. The addition of oxygen (in the presence of water) oxidises H_2S to elemental sulphur that binds to the surface. Activated carbon is either impregnated or doped with permanganate or potassium iodide (KI), potassium carbonate, or zinc oxide (ZnO) as catalysers. Due to limits on oxygen levels in biomethane, oxidisation of sulphur is not a suitable technique where the gas is intended for grid injection or use as vehicle fuel. Use of KI-doped carbon or permanganate impregnated carbon is used to effect oxidation without the need for oxygen. ZnO impregnated carbon is expensive but extremely efficient. H_2S concentrations of less than 1 ppm can be achieved.

- Oxygen and Nitrogen

Oxygen is not normally present in biogas as it will be consumed by facultative aerobic microorganisms in the digester. If air is present in the digester then nitrogen will also be present in biogas. Oxygen and nitrogen can be removed with activated carbon, molecular sieves or membranes.

These gases will be removed to some extent in a desulphurisation process or in some upgrading techniques. Both gases are difficult (expensive) to remove, and their presence should be avoided if the gas is to be upgraded. The presence of oxygen and nitrogen is less of a concern if the gas is used for CHP or boilers as air is added to the gas during the combustion process.

- Ammonia

Levels of ammonia present in biogas depend on the digester substrate composition and pH within the digester. High concentrations of ammonia are a problem for gas engines and are often limited by manufacturers (typically up to 100 mg/Nm^{-3}). The combustion of ammonia leads to the formation of nitrous oxide (NOx) in the exhaust. Ammonia is usually separated when the biogas is dried by cooling, as its solubility in water is high, and most upgrading technologies are also selective for the removal of ammonia, therefore a separate removal step is not normally required.

- Siloxanes

Siloxanes form a highly abrasive white powder of silicon oxide when burned, which can create problems in gas engines. Silicaceous deposits on valves, cylinder walls and liners are the cause of extensive damage by erosion or blockage. Silicon compounds may also reach the lubrication oil requiring more frequent oil changes.

Siloxanes can be removed by gas cooling, and adsorption on activated carbon. This method is very effective but can be expensive since spent carbon needs to be replaced. Another method for removing the compounds is absorption in a liquid mixture of hydrocarbons, activated aluminium or silica gel, or by absorption in liquid mixtures of hydrocarbons. Siloxanes may also be removed during a hydrogen sulphide removal process.

- Particulates

Particulates may be present in biogas and can cause mechanical wear in gas engines and turbines. All biogas plants must be equipped with some kind of filter and/or cyclone for reduction of the amounts of particles in the biogas. Filters not only remove particulates but also remove droplets of water or oil. Filters with a 2–5 micron mesh size are normally regarded as appropriate for most downstream applications.

- Gas Bottling Plant

The compression of the gas greatly reduces the volume of gas and reduces the number of road movements required to ship it. The gas will be pumped into a standard containerised 5,500Nm^3 container for transportation to the customers identified.

2.9 Carbon Dioxide

Carbon dioxide (CO_2) will be recovered from raw biogas along with biomethane. It is proposed to use proprietary technology for the removal of carbon dioxide. Separation of CO_2 from biogas is performed by a chemical absorption process as CO_2 reacts with the absorption liquid (amine). The amine solution is mixed with 50% high purity water and is re-circulated in a completely closed system. The CO_2 removal unit consists of two absorption columns and a stripper column.

The raw-gas enters the absorption column from the bottom and flows upwards. The amine solution enters the column from the top and flows downwards and meets raw-gas. The column is filled with surface enlarging packing to give a large contact surface between raw-gas and amine solution.

The chemical absorption process takes place as the raw-gas meets the amine solution in the counter current adsorption column. The upgraded biogas leaves the column from the top and the CO_2 enriched amine solution liquid at the bottom.

The enriched amine solution is pumped to the stripper column for desorption of the CO_2 by heating to the boiling point, >105 °C depending on stripper pressure design. The amine solution enters the stripper column from the top and flows downwards through surface enlarging packages. The boiling of the liquid takes place in the lower part of the column and the rising gas phase strips CO_2 from the amine solution.

The enriched amine solution entering the stripper column is pre-heated by the hot returning lean liquid stream. The remaining energy to raise the temperature above the boiling point is transferred directly from steam or hot water to the lower part of the stripper.

The CO_2 leaves the stripper column at the top after being cooled in a condenser. CO2 is then sent to the recovery plant. The CO_2 recovery plant will comprise

- 1 no. process building containing raw gas treatment equipment including;
  - pipework, valves, condensate removal system, CO_2 gas water scrubber, CO_2 gas buffer balloon with controls,
  - Two compressors - Reciprocating dry non-lube, two-stage, two-cylinder
  - CO_2 gas H_2S removal system
  - CO_2 gas liquefaction and refrigeration System
  - CO_2 gas carbon purifier and drying packages
  - CO_2 gas stripping-/re-boiling system
  - MCC Electric and PLC control panel
  - Cooling tower system incl. cooling water pump
  - Liquid CO2 Truck loading pump station
- 4 no. 50m^3 carbon dioxide (CO_2) storage tanks (c.12m in height).

CO_2 recovery equipment will be contained within the building /outdoor enclosures and the equipment will purify and compress CO_2 to a class food grade 3 substance. The purified

CO_2 will be compressed and pumped into 4 no. insulated tanks. Bulk tankers will periodically remove the clean compressed CO_2 offsite for use elsewhere. The floor of the CO_2 compression building is sloped internally that any spillages will be collected by the drains built into the floor and directed to the process effluent tank and from here it can be returned to digester vessels.

The CO_2 recovery system uses water absorption for removal of residual methanol, ethanol, ammonia in the gas stream. H_2S will be removed using impregnated carbon thereby mitigating vented emissions.

2.10 CHP Unit and Boilers

Upgraded biogas (biomethane) will also be directed to an on-site unit to generate electricity and heat to provide for the site's parasitic load, including; heat for the AD tanks (mesophilic process), pasteurisation process (>70°C) and gas clean-up plant. Two. c.2MW standby dual fuel (gas and light oil) boilers will be provided with associated fuel storage (c. 5m^3). The boilers will be used during commissioning of the plant (as biomethane will be unavailable to serve the CHP) and during periods when the CHP is unavailable (e.g. planned maintenance events).

2.11 Description of Construction & Commissioning

This section details the construction works associated with the proposed facility and indicates the mitigation measures to be implemented to ensure that potential environmental impacts associated with construction are minimised.

The development of this site is likely to occur over an estimated 24-month period, during which time construction activities will have the potential to impact the existing environment. After the estimated 24-month construction period, it is expected that a fully operational power plant will be commissioned and capable of operating as designed. The specific details of the construction programme are not currently known as such this programme will be developed by the main contractor. It is therefore difficult to assess the staffing and delivery levels for the development. However, it is considered that the design and proposed layout of the facility has developed sufficiently to discuss the potential environmental impacts of proposed construction methods. An estimate of construction traffic volumes has been made for a site of this size and typical works associated with a development of this type are described.

The timing of the commencement of construction is subject to planning, design, tendering and ecological constraints. It would be expected, that any works associated with site clearance and removal of soils and boundary hedging would be seasonally limited to mitigate against any adverse ecological affects. The impact of construction activities on Biodiversity and Roads and Traffic are assessed in Chapters 5 and 11, respectively. An outline construction management plan has been prepared in support of the planning application. This will be further developed and implemented for the construction phase of the development. This document provides a framework under which construction activities which have potential for environmental impact (e.g. generation of dust, ecological impacts, surface water discharge, etc) will be managed. Mitigation measures as outlined in the EIAR are included within this plan.

Table 2.5 Typical Construction Timeframe

Phase	Details	Time
1	Site Evaluation	Up to 2 months
2	Site Preparation and Clearance	Up to 2 months
3	Civil and Structural Works	8 months
4	Mechanical and Electrical Installation	6 months
5	Commissioning and Testing	6 months

Equipment to be used during the construction of the facility will be typical for a project of this scale. In general, the following machinery will be used:

- Tracked excavators
- Vibrators Rollers
- Trucks
- Mobile Crane
- Backhoe
- Grader
- Breakers
- Generators /pumps
- Dump trucks /dumpers
- Hoists
- Concrete pump – lorry mounted
- Loaders
- Compressors
- Rollers
- Road surfacing plant
- Delivery vehicles for concrete, steel and other construction materials

Heavy vehicle movements to the site are expected to consist predominantly of plant and material deliveries. The majority of machinery associated with the construction phase is likely to remain onsite for the duration of the construction process. Therefore, the traffic associated with heavy plant will be limited to their delivery and removal, with the intervening period comprising internal movements within the site.

It has been estimated that during the course of an average day during construction, approximately 15 trucks will access the site to deliver materials. These will be spread over the course of the working day.

2.11.1 Duration and Phasing

PHASE 1: SITE EVALUATION

Prior to commencement of construction, geotechnical investigations such as trial pits and C.B.R. tests will be conducted to verify foundation designs and road construction. All investigations required prior to enabling works shall be carried out in accordance with BS 5930 (Code of Practice for Site Investigations).

PHASE 2 SITE PREPARATION AND CLEARANCE

It is proposed that proposed improvements to the Kinincha Road (as proposed as part of the overall scheme) be carried out prior to construction of the Biogas plant. In respect of the biogas plant site itself, there are no areas of land to be acquired prior to construction, as the applicant is in possession of the entire site. This phase of construction will not commence until the main construction contract is awarded and will initially comprise, fencing, excavation, re-grading and landscape berming and planting. The site clearance works will be undertaken in accordance with best practice. Removal of any bird habitats will be undertaken outside the bird breeding season to mitigate disturbance to birds. Mitigation measures to avoid and limit impact to biodiversity include; implementation of an environmental management plan which will address water run-off, noise and dust generation, implementation of a suitable landscaping strategy to compensate for habitat loss and to benefit the wildlife of the local area, retention of hedgerows and treelines along the boundary of the site, etc. Also, site clearance will proceed only after cognisance is made to the ecological mitigation measures as detailed in Chapter 5 of the EIAR (Biodiversity).

Where cutting or excavation is carried out, this material will then be reused as part of development of the site berm, in areas of the site where fill is needed or in areas requiring landscaping. If any additional material is required this will be imported into the site in a safe and controlled manner, so as to minimise the potential for nuisance and disturbance.

Sustainable Bio-Energy Limited are committed to ensuring that all the necessary mitigation measures are implemented. Haul roads, internal construction site roads, main drainage runs, temporary car-parking and staff facilities will also be constructed during this phase. Such site preparation works are expected to take approximately 2 months.

Site preparation works will also involve the site set up by the building contractor, which will include provision of the following items:

- Site Office,
- Site Facilities (canteen, toilets etc.),
- Office for Resident Engineer,
- Secure compound for the storage of all on site machinery and materials,
- Carparking,
- Permanent/temporary fencing,
- Site Security.

Construction traffic will enter the site via the existing site access road. A site compound will be installed near the site entrance to facilitate staff parking and site offices. Traffic related issues are further discussed in Chapter 11 of the EIAR.

PHASE 3: CIVIL AND STRUCTURAL WORKS

This phase will comprise the construction of the buildings, below ground pipework /conduits, tank farm vessels, bunds, roads completion, drainage and infrastructural works completion. The foundations will be designed to withstand vibrations from plant items. The feedstock reception building will be steel frame with a combination of masonry and metal cladding chosen to conform to safety requirements and minimise visual, odour (air quality) and noise impact. It is anticipated that these works will be undertaken over an approximately 8-month period. Large items of plant /equipment will be installed during this phase.

MECHANICAL AND ELECTRICAL INSTALLATION

Mechanical installation will include installation of processing plant and machinery, CHP, boilers, gas clean up plant and associated pipework. These components will be delivered to the site by the preferred supplier and will be installed in accordance with manufacturer requirements. All pipework and ducting will be assembled on site. The electrical installation will include transformers, wiring and cabling from the items of plant to MCCE rooms.

PHASE 4 INSTALLATIONS AND COMMISSIONING

This phase will comprise the installation and testing of mechanical and electrical equipment. It is anticipated that the duration for the installation and testing works will take approximately four months. During this phase final completion and finishing works will be carried out in anticipation of handover of the project to the client.

It should be noted that the above is indicative only and may be subject to variations on consent from the planning authority and also to final schedule agreement with the main contractor.

2.11.2 Employment

Employment levels across the project will vary depending on the construction programme and the extent of activities occurring on the site. It is expected that during peak activities, there will be up to 80 construction workers at the site. It is anticipated that during peak construction periods, approximately 40 vehicles will enter the site in the morning and leave the site in the evening. This is based on vehicle occupancy of two. An assessment of the likely traffic volumes which may arise during the construction and operational phase are discussed in Chapter 11 of the EIAR.

2.11.3 Accommodation/Facilities

The relevant statutory requirements will be provided for all workers on the construction site including:

- Canteen facilities and drinking water supply
- Toilet, wash up and locker facilities and hot water
- Drying room
- Car parking for workers
- First Aid Office
- Site Engineers & Resident Engineers offices
- Site offices for Contractors
- Secure site compounds

2.11.4 Construction Operation Hours

Subject to agreement with the planning authority, it is anticipated that the following times will constitute the standard working hours on the construction site.

- Monday to Friday 07:00 to 19:00

- Saturdays 08:00 to 16:00 pm
- Site closed on Sundays
- Site open on Bank Holidays as per Saturdays

Working hours may vary slightly depending on weather conditions and daylight hours during winter months. Heavy construction activities will be avoided where possible outside the normal working hours outlined above.

2.11.5 Construction Techniques

The construction techniques used will be standard and similar to those that would normally be associated with a large industrial project of this nature with both a building and technology installation element and a large civil engineering element.

2.11.6 Materials

In so far as possible, construction materials will be from local sources to support the local economy and minimise environmental impact associated with vehicle emissions. All imported material that will be used on site will be retrieved from approved sources.

The construction of surface water systems will be an important element of the project. Temporary settlement ponds and interceptors will be constructed during the initial stages of the contract mitigating against adverse impacts on the existing drainage network.

2.11.7 Extension of Infrastructure

Services such as ESB and Telecom will be brought to the dedicated construction compound from the nearest available point. Potable water for the development will be supplied from the public supply located at the front of the site. Temporary sanitary accommodation will be provided on site until a permanent connection to the municipal sewer is connected. All domestic effluent generated on site will be discharged to temporary sewage containment facilities prior to transport and treatment off site.

2.11.8 Waste Management

During the construction phase both solid and liquid waste will be produced at the facility. Waste oils, solvents and paints will be stored in a temporary bunded area prior to transport off site by a licensed contractor. All wastes arising from construction of the proposed development will be managed in accordance with the Waste Management Acts 1996, as amended.

It is not envisaged that there will be any spoil materials arising from construction, as all the excavated soil will be re-used as part of the construction process (formation of berm). All other solid waste generated during the construction phase will be adequately segregated and stored prior to transfer to an authorised facility for recovery/recycling/disposal.

2.11.9 Fencing and Security

Temporary fencing will be erected around the site compound. All on site machinery and materials will also be stored within the fenced compound.

2.11.10 Noise, Vibration and Dust

Dust emissions during the construction period have been detailed under temporary environmental protection measures. A construction management plan will be prepared and put in place for the construction of the development. This will include measures and trigger values to mitigate any potential impacts to nearby receptors. In addition, noisy construction works will be limited to 8am to 6pm weekdays with Saturday working from 8am to 1pm. Baseline and proposed noise emission levels have been presented in Chapter 8 and 9 of the EIAR.

2.11.11 Temporary Environmental Protection Measures

During the construction stage site construction roads will be sprayed with water during dry periods to mitigate against the formation of dry dust particles. Excavated materials stored or moved on site could lead to the formation of airborne dust particles during dry weather periods. Water suppressants will be used during these dry weather conditions.

The landscaping areas proposed for the facility will be constructed and planted at the earliest opportunity thus limiting the potential for off-site migration of airborne dust. Where temporary stockpiles are required the material will be stored in designated areas and will be covered with tarpaulins and/ or regularly dampened during dry weather periods.

All potentially polluting substances such as oils, chemicals and paints used during construction will be stored in designated storage areas. These will be bunded to a volume of 110% capacity of the largest tank/container within the bunded area with all filling and draw-off points fully located within the bunded area. Drainage for the bunded area will be diverted for dedicated collection and safe disposal.

As stated above all domestic effluent generated on site will be discharged to temporary sewage containment facilities prior to transport and treatment off site.

Temporary settlement ponds and interceptors will be constructed as necessary during the early stages of construction mitigating against silt laden run-off to the existing drainage network.

Prior to commencement of development a construction quality assurance plan (CQA) will be jointly prepared by the contractor and developer. Written approval of the CQA will be sought from the planning authority prior to site development.

Good housekeeping and facility management during the construction period will ensure that there will be no negative environmental impacts from the construction of the proposed facility.

As stated previously in this section, the majority of machinery associated with the construction phase is likely to be onsite for extended periods of time. The traffic associated with these will therefore be limited to their delivery and removal, with the intervening period involving internal movements within the site. The impact of these on the surrounding road network is therefore expected to be minimal and infrequent.

2.12 Decommissioning

Decommissioning of the site will be subject to the requirements of the EPA Industrial Emissions (IE) Licence. At the end of the useful life of the facility, the IE Licence will require that the site be returned to its pre-development status. In line with implementing the Environmental Liability Directive (2004/35/EC), which provides a framework of environmental liability based on the *"polluter pays"* principle, the proposed development will include a condition under a *"Statement of Measures"* condition as outlined below:

"The licensee shall as part of the AER provide an annual statement as to the measures taken or adopted at the site in relation to the prevention of environmental damage, and the measures in place in relation to the underwriting of costs for remedial actions following anticipated events (including closure) or accidents/incidents, as may be associated with the carrying on of the activity."

The following section outlines the anticipated decommissioning methodology for the facility; prior to preparation of a Closure Plan, Environmental Liabilities Risk Assessment (ELRA) and Financial Provision (FP) which will be informed by detailed design phase works.

2.12.1 Drain Down Plant

The shutting down of the plant will occur on a phased basis. When the time comes to close the facility, it will first begin by no longer accepting feedstock. Once the plant has digested the last feedstock, the primary and secondary digester tanks will be drained down into the digestate storage tanks. The digestate will then be removed from site in the usual manner.

Once all tanks have been drained down and all digestate removed from site, the plant will be flushed with water to clean down the system before dismantling occurs. The flush water will again be collected in a single digestate storage tanks and removed from site in accordance with regulatory requirements.

Any residual gas left in the system will be collected in the usual manner and flared-off. Once all feedstock, digestate and gas have been evacuated from the system the plant can be shut down in preparation for dismantling and demolition.

2.12.2 Disconnection of Services

On completion of the plant drain down, the services connected to the site will be terminated. These will include:

- Power
- Water
- Storm and Foul Sewers
- Communications
- Gas

Once all services are terminated the plant will be ready for dismantling and demolition on a phased basis.

2.12.3 Removal of Equipment

The biogas plant will contain a significant amount of mechanical and electrical process equipment which will have been maintained and serviced throughout the lifetime of the plant and may have some useful life left. In advance of the decommissioning of the plant, an audit will be conducted to assess which equipment can be sold second hand and which equipment will be scrapped or recycled. The following is a list of the primary equipment that will be removed as part of the decommissioning process:

- CHP Unit

- Biomethane upgrading plant and ancillary equipment
- Flare
- CO_2 processing equipment
- Mixing Units
- Pumps
- Valves
- Mixers and macerators
- Pipework
- Pasteurisation Tanks
- PLC Units and Control Systems
- Gas Storage Hoods
- Compressors
- Laboratory Equipment

2.12.4 Removal of Cabling & Pipework

Once all primary equipment has been disconnected and removed, all connecting cabling and pipework will be removed and recycled as required.

2.12.5 Removal of Miscellaneous Metalwork

Following the removal of all primary equipment and associated cabling and pipework all supporting miscellaneous metalwork will be removed for recycling or repurposing. These items will include:

- Cable trays
- Pipe racks
- Access stairs
- Gantries
- Walkways
- Upstands
- Skids
- Lighting poles

2.12.6 Demolition of Process Tanks

At this point, the process tanks will be fully stripped down and ready for demolition. The tanks, which will be reinforced concrete will be demolished by excavator and breaker. The concrete will be crushed onsite and removed for use as filling material elsewhere. The recovered reinforcing steel will also be removed offsite for further recycling.

2.12.7 Removal of Ground Infrastructure

Prior to breaking out bunded areas, roadways and hardstands, any items that are salvageable will be removed. The following items are potentially of use again:

- Manhole covers
- Oil/water Interceptors
- Underground cables

2.12.8 Demolition of Bunded Area

As per the demolition of the process tanks, the bunded area will be broken up by excavator and breaker. Material will be separated on site. Any salvaged concrete will be crushed and used elsewhere as filling and any reinforcement will be recycled.

2.12.9 Demolition of the Reception Building

Once all equipment has been removed from the reception building the process of dismantling and demolition can occur. Firstly, the building cladding, rainwater goods and doors will be removed and depending on condition may be recycled. Secondly the structural steelwork will be removed and removed off-site for further recycling.

Once the building frame and cladding is removed the concrete building shell will be demolished with the concrete crushed and recycled offsite and the steel reinforcement recycled as per previous steps.

2.12.10 Demolition of Office Building

The following sequence of works will be involved in demolishing the office building:

- Removal of all furniture and fixings
- Stripping out of all services (electrical, communications, mechanical
- Removal of all second fix joinery
- Demolition of all internal walls and partitions
- Removal of external windows, doors and rainwater goods
- Removal of roof structure
- Demolition of external walls and foundations

During the demolition process, all materials will be segregated onsite into dedicated skips. Segregated material will be removed offsite for further processing offsite by recycling where possible.

2.12.11 Internal Hardstands and Roadways

Depending on the future use of the site, the internal hardstands and roadways may or may not be demolished. If required, all internal hardstanding's and roadways will be broken up with concrete and hardcore material recovered for onsite crushing and recover for further use as filling material elsewhere. Any steel within these areas will be recovered for recycling.

2.12.12 Removal of Site Fencing & Gates

Again, depending on the future use of the site, the site fencing and gates may or may not be removed. If they are removed, they will be removed carefully and depending on condition will be reused elsewhere.

2.12.13 Landscaping & Reprofiling

On completion of full demolition, the site will be re-profiled and contoured to match the surround areas. Grass will be sown to return the area back to grassland as per its original use prior to completion.

2.13 Alternatives

2.13.1 Do Nothing Alternative

The development proposal involves the production of biomethane, carbon dioxide and digestate by processing feedstocks using anaerobic digestion technology. Development of the proposed biogas plant will result in benefits to a number of sectors including the renewable energy sector and the agri-food sector. The proposal conforms to a number of national, regional and local policy objectives (refer to Chapter 3, Planning and Policy).

Digestate is considered a valuable organic fertiliser and can compete and be substituted for several categories of mineral (chemical) fertiliser. Digestate is an environmentally friendly alternative fertiliser for use in agriculture, landscaping and horticulture industries. The Anaerobic Digestion and Bioresources Association (ADBA) report that one tonne of artificial fertiliser replaced with digestate saves one tonne of oil, 108 tonnes of water and seven tonnes of carbon dioxide emissions. Biomethane may be utilised as an advanced biofuel[51] and carbon dioxide will be recovered from the process and sold as a product to end users.

[51] *'advanced biofuels' means biofuels that are produced from the feedstock listed in Part A of Annex IX;*

A do-nothing scenario will result in higher levels of pollutants and greenhouse gas emissions and further deterioration in quality of groundwater and surface water bodies and impede Ireland's commitment to meet its EU and national emissions targets.

2.13.2 Alternative Locations

The proposal to locate a biogas plant in the vicinity of the town of Gort was informed by a high-level review of policy (refer to Chapter 3) and project related constraints developed from industry guidelines and geographic information system (GIS) datasets. The guidance employed for siting included

- The Methodology for Local Authority Energy Strategies'[52]
- Planning Guidance Recommendations for Bioenergy Projects in Ireland[53]

The SEAI Report (2013) and methodology consider some of the planning and development impacts associated with the development and operation of renewable energy technologies, including bioenergy projects. The following outlines the "*Key Land Use Interactions*" of bioenergy technology related to the proposed biogas project as outlined in the Local Authority Renewable Energy Strategies (LARES) methodology.

Location and Land Use

- Proximity to a sufficient supply of the raw materials necessary for energy production is desirable to remain efficient and sustainable;
- The proximity of the bioenergy facility to dwellings and other sensitive locations, such as schools and hospitals, should be assessed from a public safety perspective;

Landscape and Visual Impact

- The siting of a bioenergy facility with regard to the surrounding environment and the visual impact it would impose. If the bioenergy facility is located within an industrial development, it will have a different impact on the surrounding area than if it were located standalone on a greenfield site.

Site Conditions and Operation

- Feedstock:
  - Scale of a bioenergy facility – sufficient energy need and supply of feedstock;
- Pollution:
  - Gas emissions from combustion;

---

[52] *Sustainable Energy Authority of Ireland, 2013, 'Methodology for Local Authority Energy Strategies'*

[53] Irish Renewable Bioenergy Association (IRBEA), 2017, Planning Guidance Recommendations for Bioenergy Projects in Ireland

  - Noise pollution (potentially from operations/traffic);
  - Odour (potentially from anaerobic digestion storage and transport of and feedstock);
  - Light pollution (e.g. a 24/7 operation);
  - Potential for contaminants to enter soil and groundwater;
- Local authorities may need to consider provisions for:
  - Seepage from stored effluents;
  - Contamination of ground waters;

Infrastructure

- Transport considerations include:
  - Proximity to an adequate transport network;
  - HGV accessibility for feedstock inputs and end-product removal;
  - Road and junction capacity to cater for additional traffic;
  - Road network condition and maintenance;

The IrBEA Report (2017) outlines siting recommendations categorised under (a) forward planning, (b) development management and (c) miscellaneous recommendation. In addition to the recommendation by IrBEA that bioenergy development be recognised in national, regional and local policy and plans, the report recommends that planning applications include for the assessment of potential impacts from key aspects such as transport, landscape and visual, biodiversity and noise.

Guided by the above and supported by other relevant criteria, a simple rating system was used for the multi-criteria analysis - one of three categories of impact were applied to locational criteria under consideration; colour coded for ready identification.

High Impact	1
Medium Impact	2
Low Impact and	3

The following is a summary of the findings from the SOA study undertaken and attributed scoring to the four sites considered. Following completion of the SOA study it was determined that Site 4, located at in the townlands of Ballynamantan, Glenbrack and Kinincha, was the preferred site for the development proposal.

Figure 2.11 Site Options Appraisal Map

Table 2.6 Site Summary and Options Appraisal

Criteria	Site 1	Site 2	Site 3	Site 4
Townland	Rindifin	Kinincha	Lavally	Ballynamantan, Glenbrack, Kinincha
Size of site	3.8ha /9.39 acres Potential size constraint.	1.37ha / 3.38 acres Potential size constraint	9.85ha /24.3acres Sufficiently sized to accommodate proposal.	9 ha / 22acres Sufficiently sized to accommodate proposal.
Access	Directly from R458. Potential need for transport through Gort town centre to get access to motorway network.	Directly from Kinincha Road. Access to motorway without travelling through Gort town centre.	Directly from Loughrea Road, N60. Potential need for transport through Gort town centre to get access to motorway network.	Directly from N18 and Kinincha Road. Access to motorway without travelling through Gort town centre.
Zoning	Industrial Zoned	Industrial Zoned	Not Zoned – white lands	Not Zoned – white lands
Previous Landuse	Site with planning consent for industrial /commercial development.	Industrial – former Abattoir processing plant (abattoir).	Agricultural	Agricultural – lands associated with Kinincha Stables (Equine) which includes horse gallop and internal roads, horse riding stables and lunging ring.
Licences	None	EPA Licence Reg. No. P0808-01 which would be required to be surrendered to the satisfaction of the EPA.	None	None
Soils	Made Ground - Till derived chiefly from limestone.	Made Ground- possibility of ground contamination due to existence of former abattoir activity.	Deep well drained mineral (mainly basic) Grey Brown Podzolics, Brown Earths soils overlying moderately permeable subsoils	Deep well drained mineral (mainly basic) Grey Brown Podzolics, Brown Earths soils overlying moderately permeable subsoils described as till derived

Criteria	Site 1	Site 2	Site 3	Site 4
			described as till derived chiefly from limestone.	chiefly from limestone. Reports of former alterations to site contours and soils.
Bedrock	Tournaisian limestone - Waulsortian Limestones described as dominantly pale-grey, crudely bedded or massive limestone.	Visean limestone & calcareous shale. Tubber formation described as Crinoidal medium-grey packstones and wackestones, sometimes with shaly partings, cherts and dolomite.	Tournaisian limestone A bedrock fault runs in a north-east /south west direction through the centre of the site. Bedrock north of the fault is Ballysteen Formation described as dark muddy limestone, shale and Waulsortian Limestones, described as Massive unbedded lime-mudstone, are present south of the fault.	Visean limestone & calcareous shale. Tubber formation described as Crinoidal medium-grey packstones and wackestones, sometimes with shaly partings, cherts and dolomite. Karst features are present north of the site.
Groundwater Body	GWDTE-Caherglassaun Turlough (IE_WE_G_0091) which is described as being poorly productive bedrock and has "Poor" overall status.			
Bedrock Outcropping	None on site	None on site. Some NE of the site	None on site. Area beside railway line near NW corner of site	Area along eastern boundary of site
Aquifer	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Regionally Important Aquifer - Karstified (conduit)	Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones	Regionally Important Aquifer - Karstified (conduit)
Aquifer Vulnerability	High	High	High	Moderate to Extreme across the site

Criteria	Site 1	Site 2	Site 3	Site 4
Hydrogeological Setting	Moderate permeability subsoil overlain by well-drained soil	Moderate permeability subsoil overlain by well-drained soil	Moderate permeability subsoil overlain by well-drained soil	Moderate permeability subsoil overlain by well-drained soil
Ecology	There are no ecological designations at the site. The closest site with ecological status is the Coole-Garryland SAC Complex (000252) which is located approximately 2km west of the site at its closest point.	There are no ecological designations at the site. The closest site with ecological status is the Coole-Garryland SAC Complex (000252) which is located approximately 1km west of the site at its closest point.	There are no ecological designations at the site. The closest site with ecological status is the Coole-Garryland SAC Complex (000252) which is located approximately 1.5km west of the site at its closest point.	There are no ecological designations at the site. The closest site with ecological status is the Coole-Garryland SAC Complex (000252) which is located approximately 700m west of the site at its closest point.
Heritage	According to the NIAH and NMS, there are no records of protected sites within the curtilage of the development site	According to the NIAH and NMS, there are no records of protected sites within the curtilage of the development site	According to the NIAH and NMS, there are no records of protected sites within the curtilage of the development site	According to the NIAH, there are no records of protected sites within the curtilage of the development site. According to the NMS, a Ringfort – rath (GA122-016) is located beyond the site boundary to the north
Neighbouring residential sites and other surrounding	Residential areas to the south of the site are classed as medium density - residential densities between 30 and 50 dwellings per net hectare - Punchbowl Housing Estate. Further residential receivers north of the site. Site	Residential areas to the west of the site are classed as medium density; residential densities between 30 and 50 dwellings per net hectare. The closest residential receivers are located approximately 50m west of the site and within a	The site borders the eastern boundary of the Gort LAP Boundary. Residential areas to the west of the site are classed as medium density; residential densities between 30 and 50 dwellings per net hectare. The closest residential	Site located beyond Gort LAP Area Boundary (≤400 from the town boundary at its nearest point). The site is located in a rural setting. There are a number of once off-detached houses located along the N18 west of the site (200m west of

Criteria	Site 1	Site 2	Site 3	Site 4
	zoned for residential adjoins site to south.	housing estate, "The Grove"	receivers are detached once-off houses located along N66 Loughrea Road to the south of the site. Railway Line (Galway-Limerick) runs in a NE/SW direction close to NW corner of site.	the biogas plant area of the site)
Surface Water	The closest and most significant surface water body is the Cannahowna [Gort] River which flows north on the eastern side of Gort before it discharges to the Kilchreest River. Located in the Kilchreest subcatchment which is in the Galway Bay South East Catchment. This catchment includes the area drained by all streams entering tidal water in Galway Bay between Black Head and Renmore Point, Galway, draining a total area of 1,270km². The largest urban centre in the catchment is the eastern part of Galway City. The other main urban centres in this catchment are Athenry, Loughrea, Gort, and Oranmore. The total population of the catchment is approximately 74,365 with a population density of 59 people per km². This catchment is predominantly underlain by karstified limestone, including the northern part of the Burren in County Clare, and the groundwater and surface water systems in the area are closely interlinked. Only the south-eastern part of the catchment, which is underlain by old red sandstones, does not contain karst and the associated assemblage of springs, swallow holes and numerous caves that dominate the majority of the catchment. There is essentially no natural connected surface drainage network in this catchment west of a line running from Athenry to Craughwell to Gort. Surface drainage is entirely absent in the north Clare part of the catchment. In this area virtually all rainfall in the area enters the bedrock aquifer and makes its way underground a number of groundwater flow routes towards the coast at Ballyvaughan or Kinvara.			
				Ballynamantan Lough is located c. 300 NE of the site. Ballynamartan spring is also located beside the Lough.
Flooding	According to OPW Flood Mapping Data there is no record of flooding within the boundary of the proposed sites.			
Services (foul a and storm water)	We understand that the site has a connection to	We understand from our review of previous planning files for the site that the site	We are unaware if the site has a connection to the public sewer – unlikely.	The planning history of the site suggests that the site is not connected to the

Criteria	Site 1	Site 2	Site 3	Site 4
	the public sewer and public water mains.	has a connection to the public sewer and public water mains.		town sewerage system. However, the town WWTP plant is located along Kinincha road south of the site.
Engineering consideration of engineering or development constraints	Locating biogas infrastructure will likely be highly constrained by the proximity of the site to the urban landscape	Demolition works associated with former activity. Potential for ground contamination associated with former activity.	No obvious	No obvious
Traffic and Transport	Possibility transporting feedstock and dispatch products through Gort town centre and getting access to motorway network	Given the zoning and existence of the former activity at the site, no obvious preliminary issues identified.	Possibility transporting feedstock and dispatch products through Gort town centre and getting access to motorway network	Site can be accessed from Kinincha Road or the N18/R458. Site doesn't require HGVs to route through Gort town centre. Road improvements works likely to be required including entrance.
Noise - consideration of noise pollution	1	2	2	3
Air Quality and Odour consideration of air and odour pollution	1	2	2	3
Traffic and Transport – the consideration of impact on the road network and access to the site.	1	3	1	3

Criteria	Site 1	Site 2	Site 3	Site 4
Cultural Heritage - the consideration of existing archaeological and built heritage	3	3	3	3
Water – the consideration of impacts on the surface water environment	3	3	3	3
Landscape and visual – the consideration of landscape and visual impact.	2	2	2	3
Site history (Greenfield /Brownfield) – Change of landuse	2	3	2	2
Environmental Licences – consideration of terms of existing licences	3	1	3	3
People – the consideration of impacts on people	1	2	2	3
Planning – the consideration of planning and land use policy in relation to proposed works	3	3	3	3

Criteria	Site 1	Site 2	Site 3	Site 4
Soils, Geology and Hydrogeology – the consideration of impact on soils, geology and hydrogeology.	3	3	2	3
Ecology – the consideration of impact on animals, plants and their environment.	3	3	2	2
Engineering - the consideration of technical challenges associated with proposed works including size of site	2	1	3	3
Agronomy – the consideration of impact on land-based enterprise	3	3	2	2
Overall Ranking	31	34	32	**39**