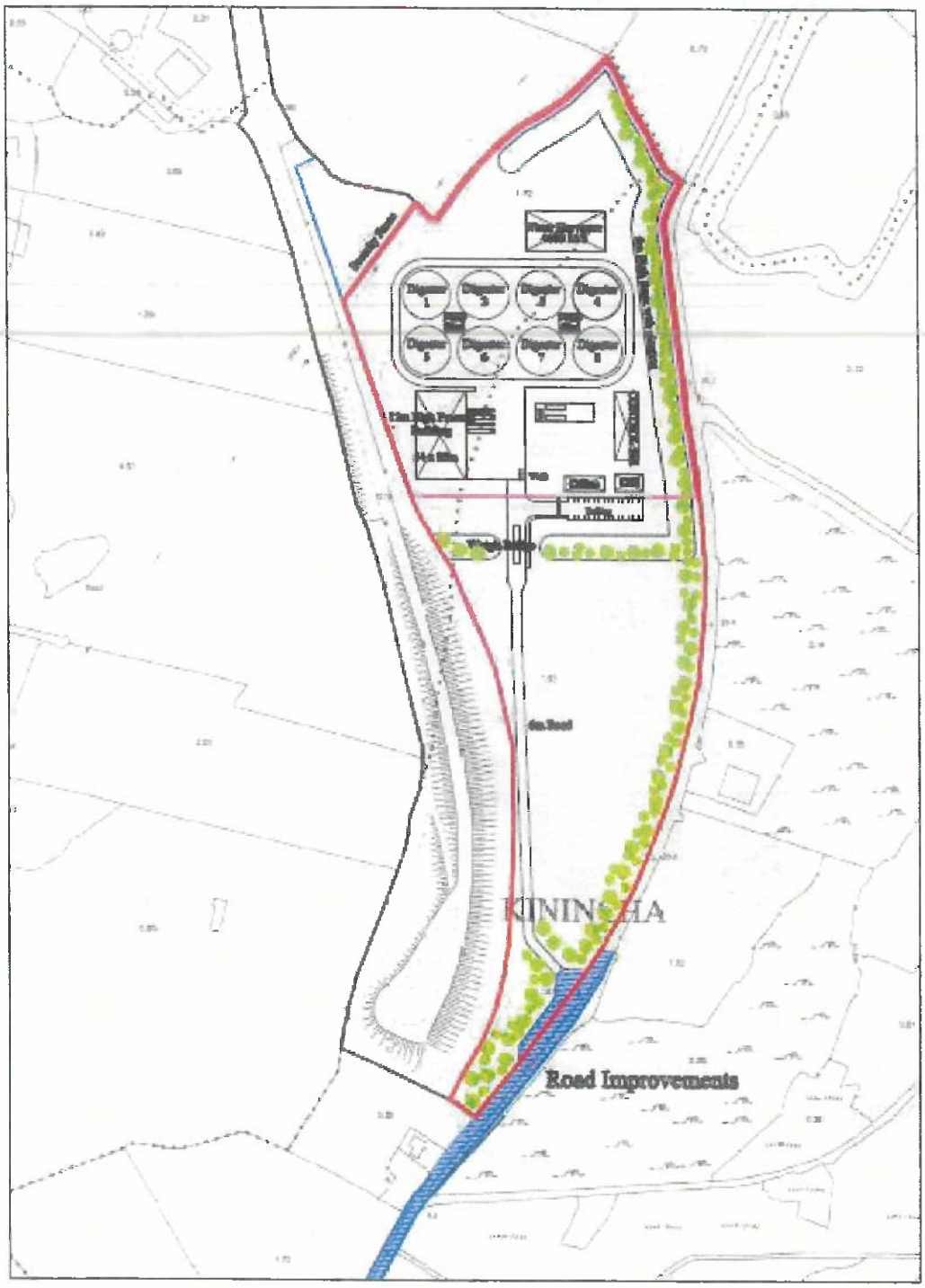
2.13.3 Alternative Layouts

Once the preferred site was selected, the design team focused on suitably positioning a proposal within the site that is sympathetic and one which integrates into the landscape and surrounding environment. Baseline surveys were carried out and suggested mitigation measures were incorporated into the scheme. An example of an early iteration of the scheme in the design process is shown in Figures 2.12 and 2.13 below.

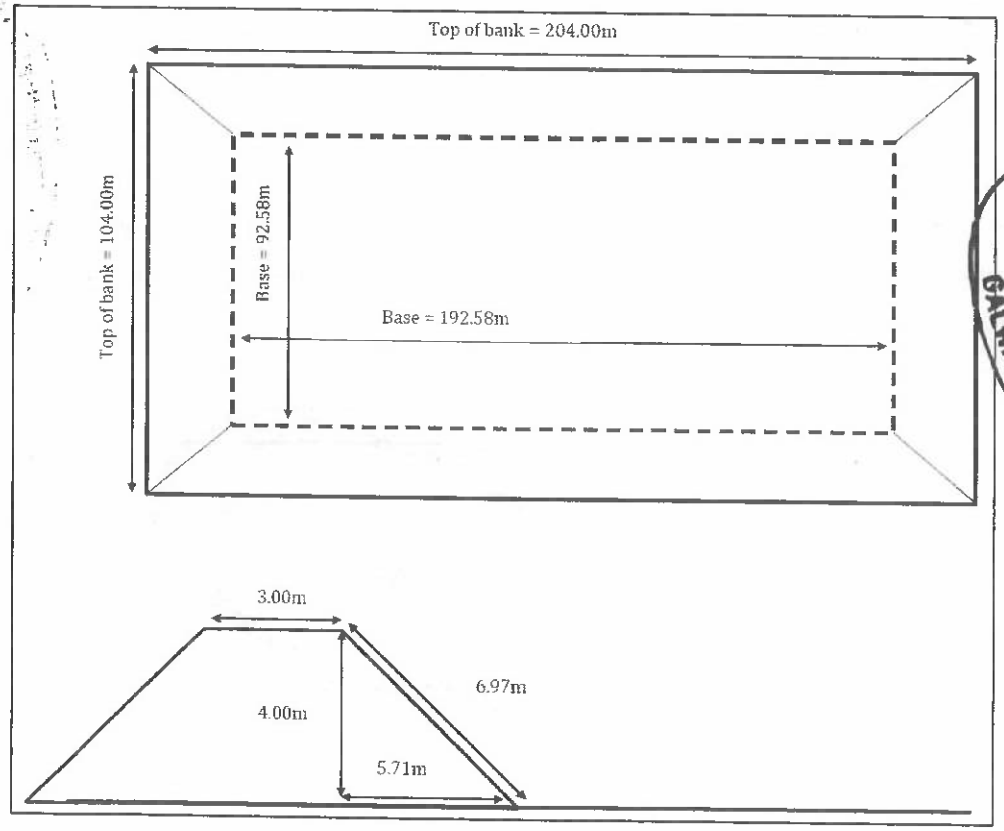
Figure 2.12 Proposed Development Iteration Example 1



and considered in the southern area of the site for storage purposes. This proposal was not chosen on the basis of landscape and visual impact, engineering constraints (including bunding), and adoption of DAFM requirements as prescribed in CN11; i.e. HACCP, incorrect process flow and assigned "dirty area" versus "clean area".

Digestate storage alternatives also examined construction of a digestate storage lagoon in the southern area of the site. The lagoon was designed with an overall capacity of circa, 25,000m^3, of which up to 4,500m^3 allowance was incorporated as freeboard (spare capacity in accordance with best practice and the Good Agricultural Practice for the Protection of Waters Regulations 2014). The proposed plan area of the lagoon structure including embankment, access, mixing station, etc. was 100m x 80m requiring an area of c. 2 acres within the site. A lagoon depth of 2-3m was considered using the removed spoil to form a berm around the excavation. The resulting depth of the lagoon structure was up to 4m[54]. The proposed lagoon consisted of a 2.0/2.5mm polyethylene fully sealed, reinforced, resilient base liner and a 1.0/1.5mm HDPE floating cover. An illustration of the lagoon type structure considered is shown in Figure 2.14 below.

Figure 2.14 Typical Digestate Lagoon Layout



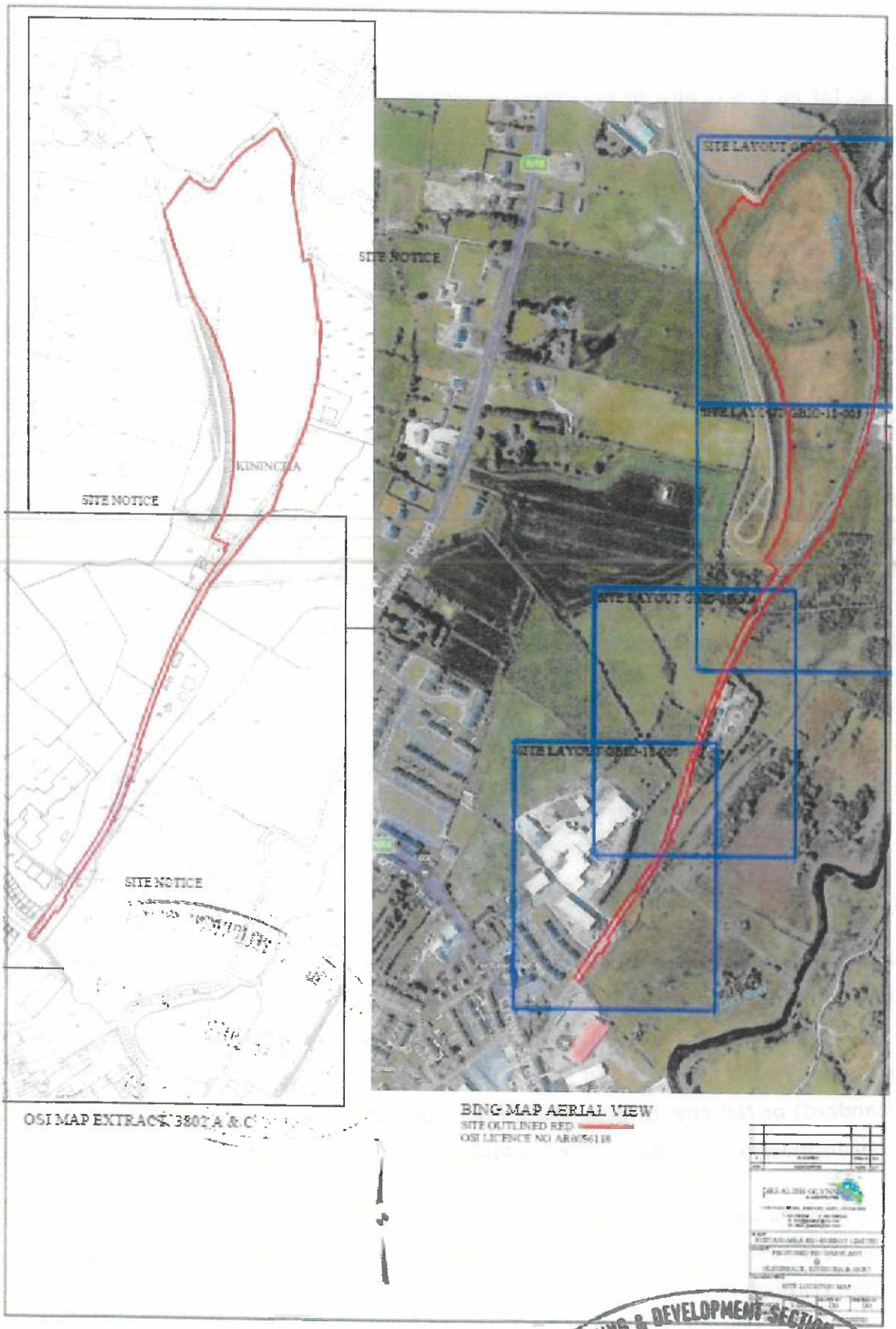
[54] *Overall depth would be determined by investigation of ground conditions at the stie*

This digestate lagoon storage proposal was not chosen and incorporated into the scheme due to potential impacts associated with geology, waters and air quality (odour).

Instead a layout which includes for digestate storage vessels was chosen. It is proposed to construct storage vessels (tanks) within the tank farm will be fitted with gas collection domes to mitigate release of fugitive odours. The digestate storage vessels and digesters will be positioned as a complete tank farm with a concrete bund designed in accordance with best practice. To further mitigate potential for release of effluents to soils /groundwater, an outer concrete bund is incorporated within the design as an additional containment measure, thereby removing any *"pathway"* which may exist to sensitive receptors, e.g. bedrock aquifer or surface water bodies.

Significant consideration has been undertaken by the applicant in relation to devising suitable access to the proposed Biogas Plant and mitigating potential impacts to nearby receivers. This proposed planning application includes for construction of a new entrance and access lane which will serve the Biogas Plant from the N18 /R458. An earlier iteration of the scheme developed in 2017 included improvement works (widening and resurfacing of the carriageway) to the public road (Kinincha Road). This route provided for access to the biogas plant site from Crowe Street (the Kinincha Road routes north-east from its junction with Crowe Street, north of Gort town centre) – ref Figure 2.15. However following lodgement of a planning application in April 2019 and upon receipt of a further information request from the planning authority, Sustainable Bio-Energy Limited decided to withdraw the planning application to allow for re-appraisal of the proposed development, including aspects related to the proposed sources of feedstock and access /egress to the site.

Figure 2.15 Proposed Development Iteration Example 3 - Access



2.13.4 Alternative Designs

A number of alterative designs were investigated and considered. The final design has sought as far as practicable to minimise visual intrusion. The base elevation of the tank farm was set at 17m AOD to reduce the overall height of the development within its setting whilst carefully considering and assessing the potential for groundwater ingress or flooding. The design uses the naturally higher elevated lands to the west and the provision of a planted berm along the eastern boundary minimises any potential adverse visual impacts of the development. The office and feedstock reception buildings are purposely placed to provide screening to proposed structures further north within the site (e.g. gas clean up plant and tank farm).

Air modelling undertaken as part of the Air Quality assessment informed the final height of the combined heat and power and odour control unit stacks at 22m to ensure sufficient dispersion of exhaust air. The final design also includes an air lock lobby on the feedstock reception building. This was incorporated as a mitigation measure to further mitigate the potential of fugitive odours escaping from the building and impacting on receivers.

2.13.5 Alternative Processes

There are several different process configurations were considered as part of the design process. Factors which were considered included the following:

- Type of feedstock and fulfilling sustainability criteria (as laid down in RED II)
- Batch or Continuous feed system
- Single Stage or "Multi-Stage" process
- Type of tank, its sizing and arrangement
- Mesophilic or Thermophilic AD temperatures
- Front-end pasteurisation or Back-end pasteurisation
- Type 1 Plant Type; EU transformation parameters (70°C for 60mins to remove pathogens such as *E. coli* and *Salmonella* and reduce particle size to 12mm or less standard) or National transformation parameters (Type 2 Plant Type) /alternative transformation parameters (Type 5 Plant Type)

The chosen process design is a continuously feed system with multi-stage process (primary and secondary digesters). Multi-stage systems are designed to take advantage of the fact that different portions of the overall biochemical process have different optimal conditions. By optimising each stage separately, the overall rate can be increased. Typically, two-stage processes attempt to optimise the hydrolysis and fermentative acidification reactions

in the first stage where the rate is limited but they can generally pass through the digestion tanks without affecting conversion of the biomass components.

The proposed plant is designed as a Type 1 Plant (EU Transformation parameters) and the AD process operates at mesophilic temperatures. 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. The plant includes the pasteurisation process (to fulfil DAFM requirements) post digestion. This was chosen following consideration of

- Reduced volumes requiring pasteurisation due to natural losses in the AD process;
- Reduced risk of cross contamination of digestate; and
- Increased energy efficiency pasteurising at the back-end when the feedstock temperature has been raised by the digestion process.

A number of possible solutions and options for dealing with the biogas generated and collected from the anaerobic digestion process were considered. These are listed as follows:

- Flaring,
- Generating electricity in a spark ignition engine, with no heat recovery,
- Generating electricity in a gas turbine, with no heat recovery,
- Combusting in a spark ignition based combined heat and power plant (CHP),
- Combusting in a gas turbine based combined heat and power plant (CHP),
- Injection into gas grid /transport to central injection point,
- Use as biofuel for transport.

The preferred and finalised scheme includes an enclosed standby gas flare which will only be used in emergency situations, e.g. when the CHP is unavailable. It was concluded that the Best Available Technique (BAT) for serving the house load (parasitic load), is providing an on-site CHP. The vast majority of biomethane produced at the site will be exported of site and used as an alternative flexible fuel in the heat and transport sectors. The finalised design and feedstocks was chosen to ensure that the Biogas Plant will assist with reducing greenhouse gas emissions and positively contributing to renewable energy, agricultural and waste targets.

3 PLANNING AND POLICY

3.1 Introduction

This Chapter provides an overview of national, regional and local policy associated with the proposed development of a biogas plant at Kinincha Road, Gort, Co. Galway. The proposed development is examined in the context of the policies and objectives set out within each of these plans.

The development is reviewed in the context of the following:

- National Policy; including the National Development Plan 2018-2027 and Energy, Climate Change and Waste Policy
- Regional Policy; including the Connacht Ulster Waste Management Plan 2015-2021 and Regional Planning Guidelines for the West Region, 2010-2022
- County and Local Policy; including the Galway CDP 2015-2021 and Gort LAP 2013-2023
- Planning History of the Site

3.2 National Policy Context[55]

3.2.1 National Development Plan 2018-2027

The National Development Plan (NDP) sets out the investment priorities that will underpin the successful implementation of the new National Planning Framework (NPF). The plan was prepared to guide national, regional and local planning and investment decisions in Ireland over the next two decades, to cater for an expected population increase of over 1 million people.

The National Development Plan commits a total investment estimated at €116 billion over the period by Government. This represents a very substantial commitment of resources and is expected to move Ireland close to the top of the international league table for public investment.

This level of capital spending will ensure ongoing employment maintenance and creation with appropriate regional development. It will also provide clarity to the construction

[55] *Summary details of relevant national waste management legislation identified in Figure 1.1 is not included in this Section but is available at www.epa.ie and www.dccae.gov.ie*

- 2 - 35
- 2 - 84
- 3 - 1

2.5.2 Reception Building

The reception is designed to be sufficiently ... ance of the range of feedstocks types and quantities proposed ... designed to contain and prevent uncontrolled release of emissions ... vironment; 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:

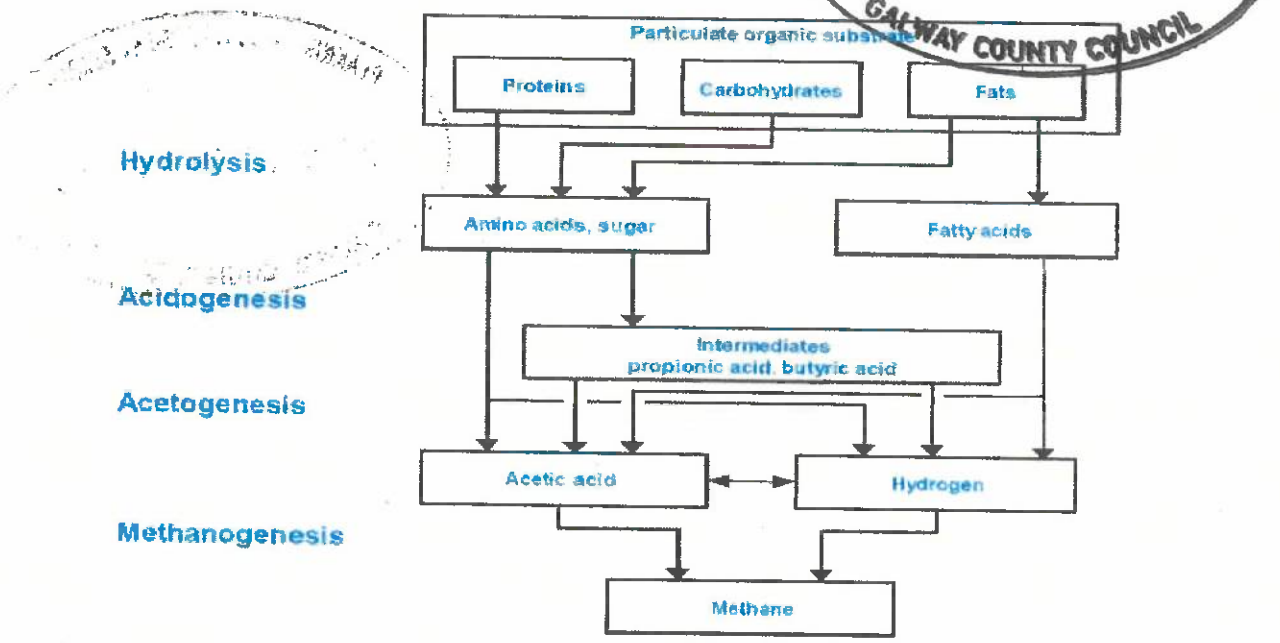
- Hydrolysis

- 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 waste) 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(s) 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.

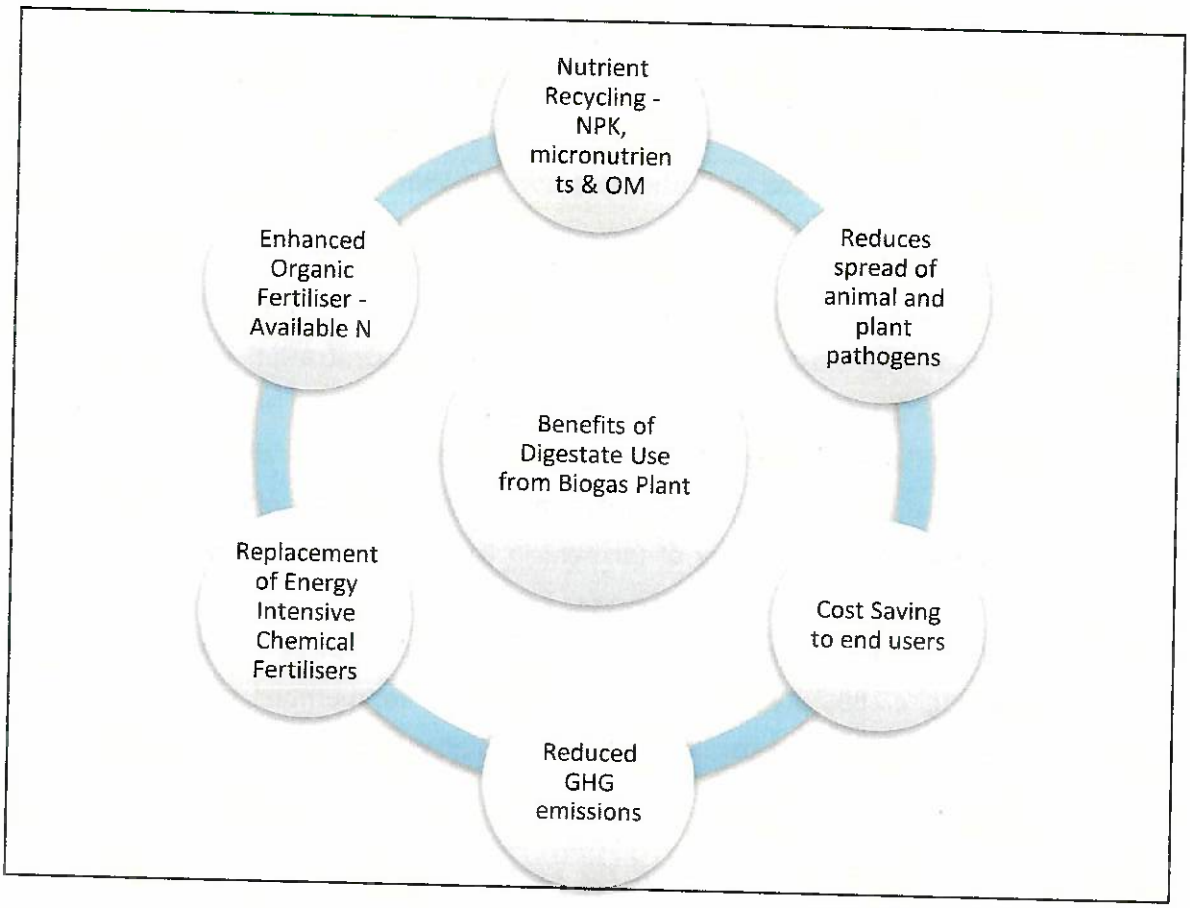
It should also be noted that use of digestate as a fertiliser is permitted under the Organic Food and Farming Standards in Ireland with certain restrictions and for digestate produced from source separated food waste, limits are set for the concentration of some trace elements. Work in the EU project 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 to remove 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

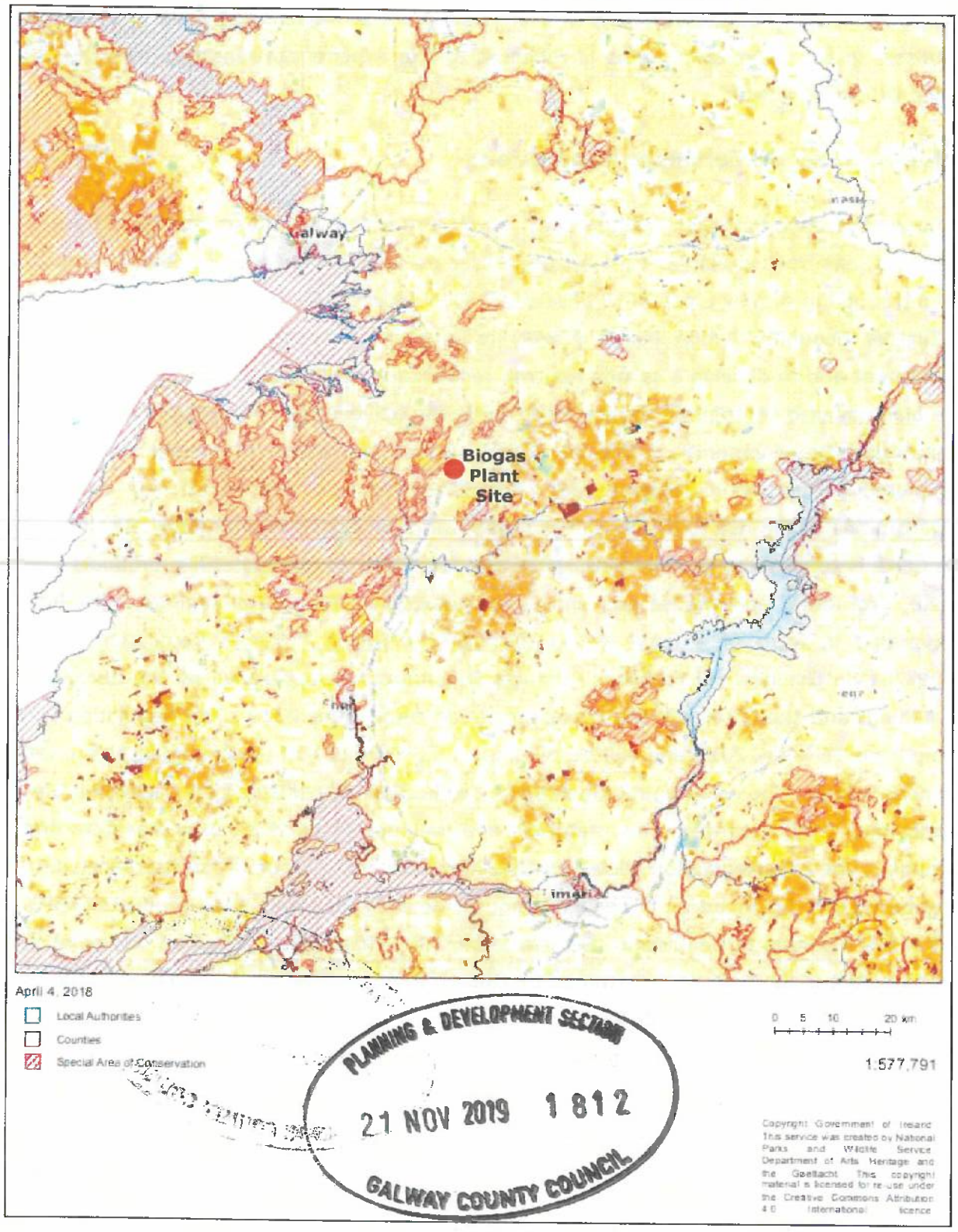
[43] *End date specified applies to Zone B which includes Counties Clare, Galway, Kerry, Limerick, Longford, Louth, Mayo, Meath, Roscommon, Sligo and Westmeath. Earlier end dates apply to Zones A (12th January) which includes Carlow, Cork, Dublin, Kildare, Kilkenny, Laois, Offaly, Tipperary, Waterford, 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 25-40m³/ha (~16m³/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 40m³/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.

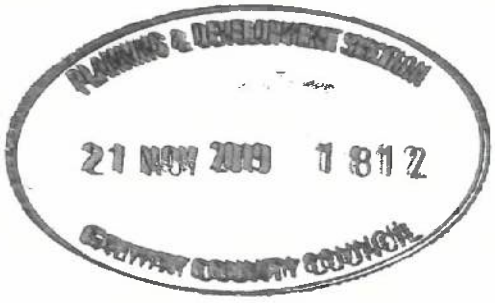
The techniques used in biogas treatment to remove these different elements are outlined below

- 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



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

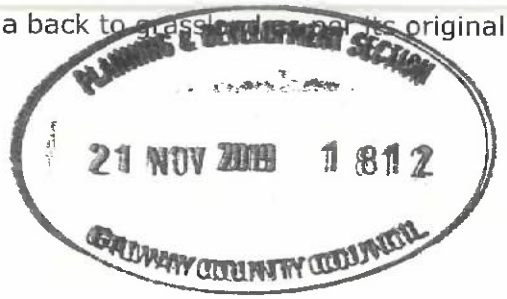
Depending on the future use of the site, the internal hardstands and roadways may or may not be demolished. If required, all internal hardstanding's and roadways will be broken up with concrete and hardcore material recovered for onsite crushing and recover for further use as filling material elsewhere. 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 post 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 being supplied 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	GWB IE 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 (GA127-016) 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 (1,400 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 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**

2.13.3 Alternative Layouts

Once the preferred site was selected, the design team focused on suitably positioning a proposal within the site that is sympathetic and one which integrates into the landscape and surrounding environment. Baseline surveys were carried out and suggested mitigation measures were incorporated into the scheme. An example of an early iteration of the scheme in the design process is shown in Figures 2.12 and 2.13 below.

Figure 2.12 Proposed Development Iteration Example 1

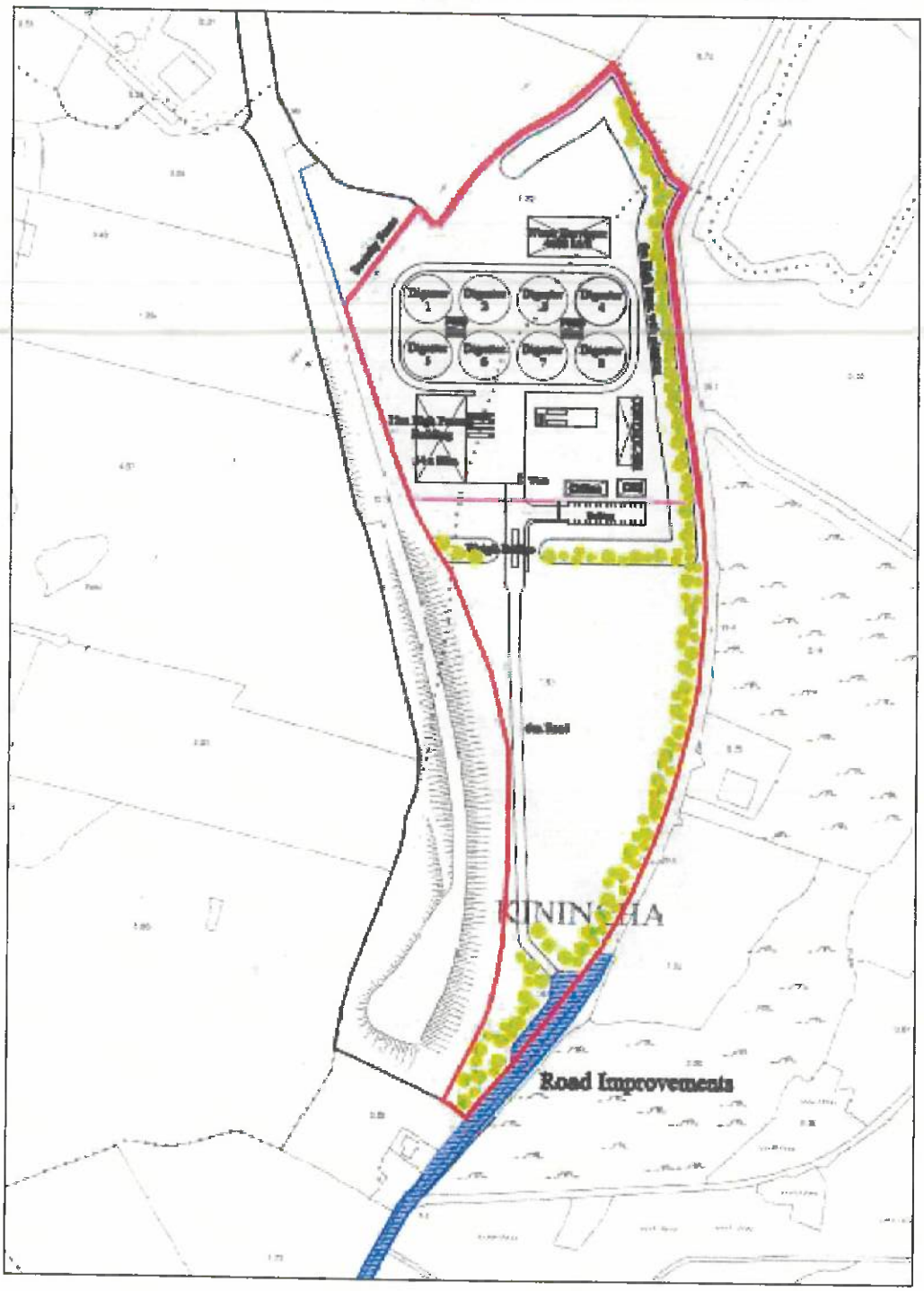
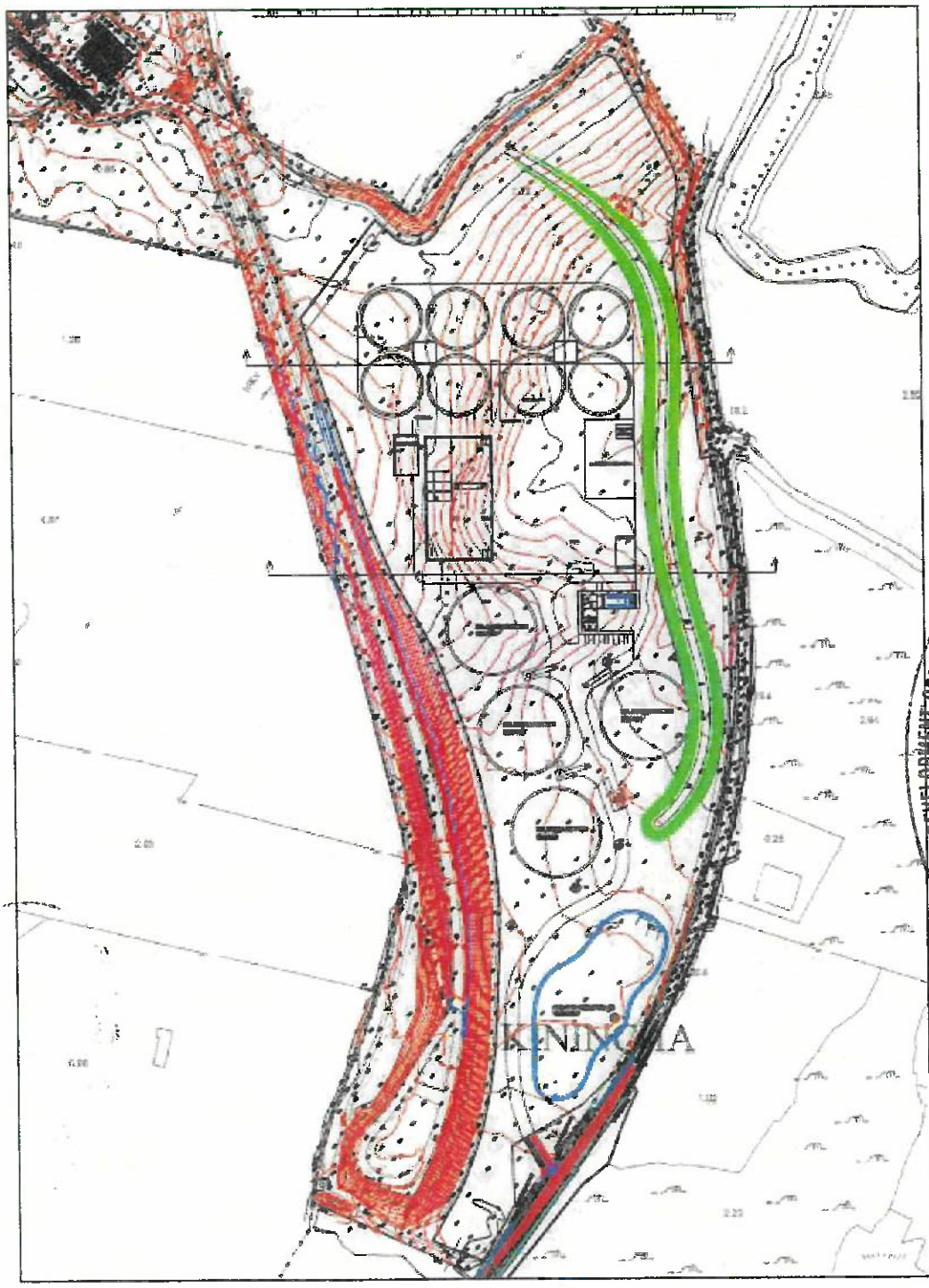


Figure 2.13 Proposed Development Iteration Example 2



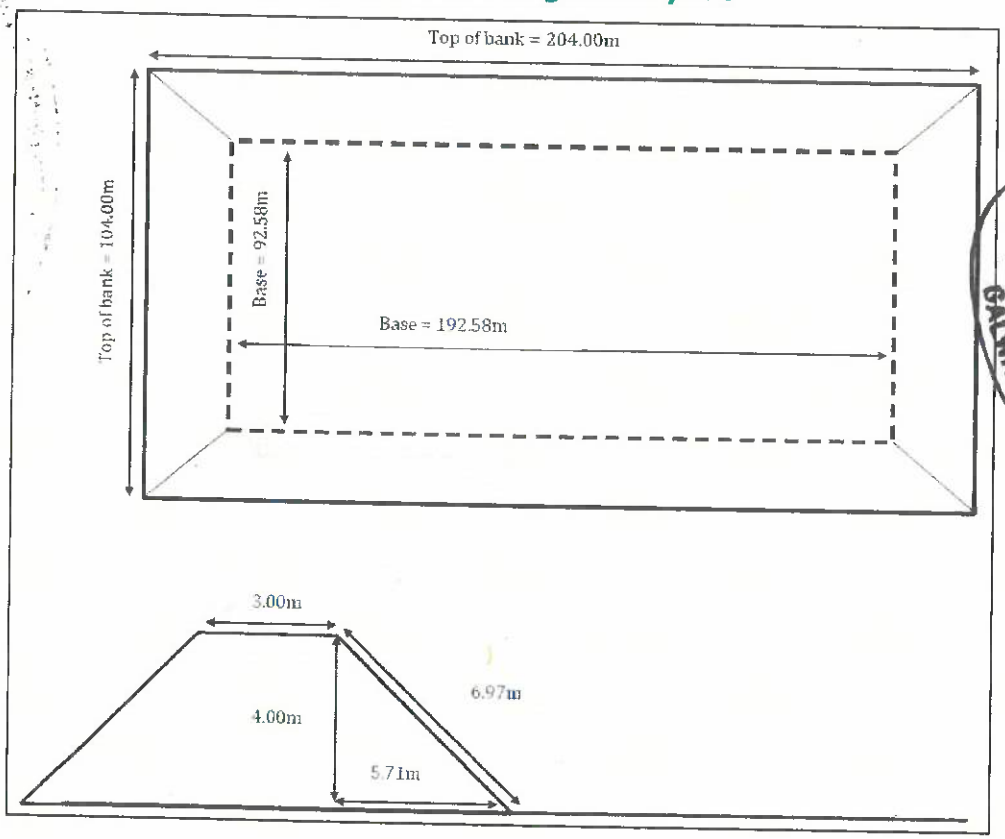
The plant itself was designed to provide maximum buffer distance to potential sensitive receivers. Incorporating digestate storage facilities into the overall scheme was considered a key aspect of the development. Earlier iterations of the scheme (such as than shown in Figure 2.12) didn't consider digestate storage.

A number of alterative digestate storage options were subsequently examined along with their positioning within the site. As can be seen in Figure 2.13, four tanks were positioned

and considered in the southern area of the site for storage purposes. This proposal was not chosen on the basis of landscape and visual impact, engineering constraints (including bunding), and adoption of DAFM requirements as prescribed in CN11; i.e. HACCP, incorrect process flow and assigned "dirty area" versus "clean area".

Digestate storage alternatives also examined construction of a digestate storage lagoon in the southern area of the site. The lagoon was designed with an overall capacity of circa, 25,000m^3, of which up to 4,500m^3 allowance was incorporated as freeboard (spare capacity in accordance with best practice and the Good Agricultural Practice for the Protection of Waters Regulations 2014). The proposed plan area of the lagoon structure including embankment, access, mixing station, etc. was 100m x 80m requiring an area of c. 2 acres within the site. A lagoon depth of 2-3m was considered using the removed spoil to form a berm around the excavation. The resulting depth of the lagoon structure was up to 4m[54]. The proposed lagoon consisted of a 2.0/2.5mm polyethylene fully sealed, reinforced, resilient base liner and a 1.0/1.5mm HDPE floating cover. An illustration of the lagoon type structure considered is shown in Figure 2.14 below.

Figure 2.14 Typical Digestate Lagoon Layout



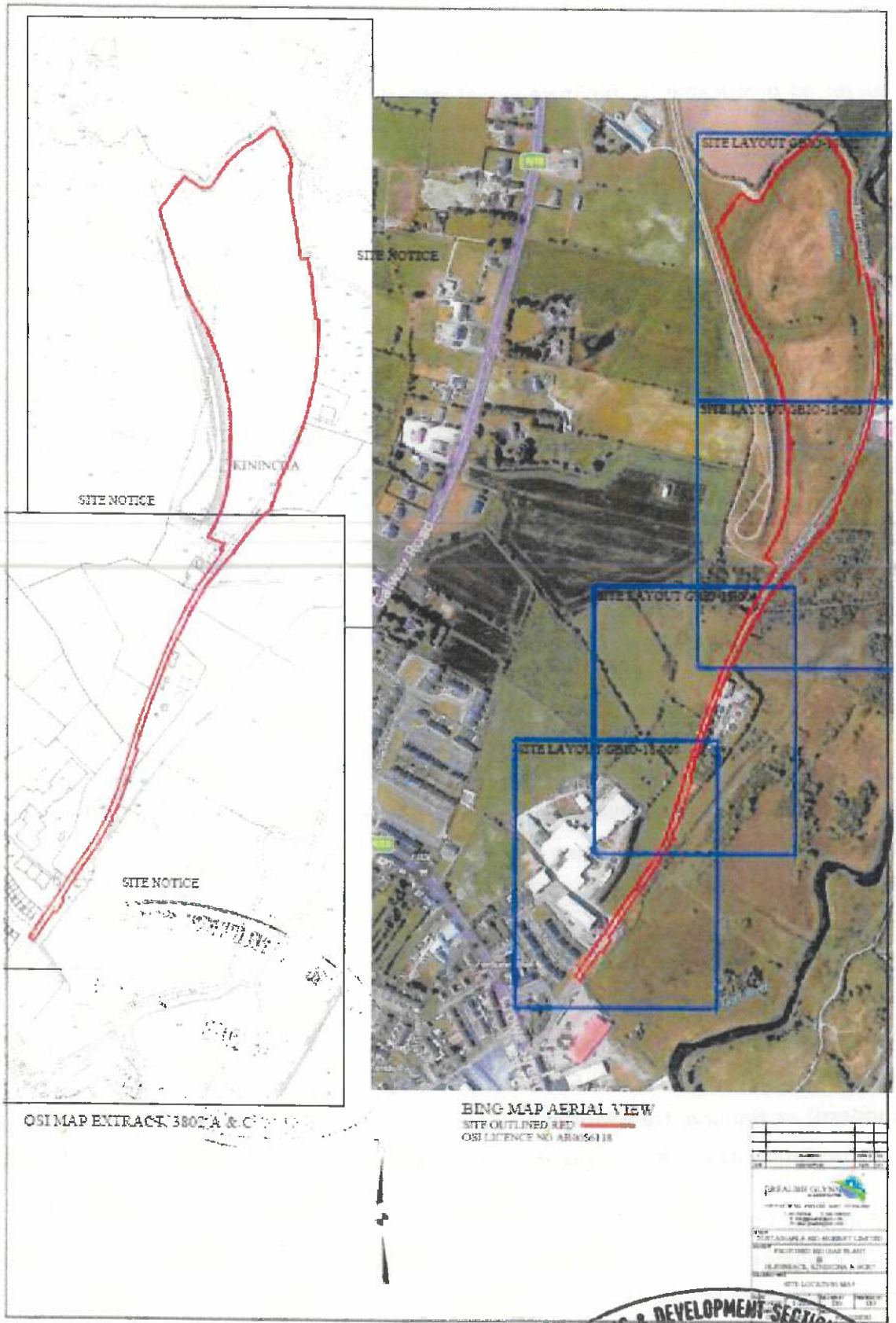
[54] *Overall depth would be determined by investigation of ground conditions at the stie*

This digestate lagoon storage proposal was not chosen and incorporated into the scheme due to potential impacts associated with geology, waters and air quality (odour).

Instead a layout which includes for digestate storage vessels was chosen. It is proposed to construct storage vessels (tanks) within the tank farm will be fitted with gas collection domes to mitigate release of fugitive odours. The digestate storage vessels and digesters will be positioned as a complete tank farm with a concrete bund designed in accordance with best practice. To further mitigate potential for release of effluents to soils /groundwater, an outer concrete bund is incorporated within the design as an additional containment measure, thereby removing any *"pathway"* which may exist to sensitive receptors, e.g. bedrock aquifer or surface water bodies.

Significant consideration has been undertaken by the applicant in relation to devising suitable access to the proposed Biogas Plant and mitigating potential impacts to nearby receivers. This proposed planning application includes for construction of a new entrance and access lane which will serve the Biogas Plant from the N18 /R458. An earlier iteration of the scheme developed in 2017 included improvement works (widening and resurfacing of the carriageway) to the public road (Kinincha Road). This route provided for access to the biogas plant site from Crowe Street (the Kinincha Road routes north-east from its junction with Crowe Street, north of Gort town centre) – ref Figure 2.15. However following lodgement of a planning application in April 2019 and upon receipt of a further information request from the planning authority, Sustainable Bio-Energy Limited decided to withdraw the planning application to allow for re-appraisal of the proposed development, including aspects related to the proposed sources of feedstock and access /egress to the site.

Figure 2.15 Proposed Development Iteration Example 3 - Access



2.13.4 Alternative Designs

A number of alterative designs were investigated and considered. The final design has sought as far as practicable to minimise visual intrusion. The base elevation of the tank farm was set at 17m AOD to reduce the overall height of the development within its setting whilst carefully considering and assessing the potential for groundwater ingress or flooding. The design uses the naturally higher elevated lands to the west and the provision of a planted berm along the eastern boundary minimises any potential adverse visual impacts of the development. The office and feedstock reception buildings are purposely placed to provide screening to proposed structures further north within the site (e.g. gas clean up plant and tank farm).

Air modelling undertaken as part of the Air Quality assessment informed the final height of the combined heat and power and odour control unit stacks at 22m to ensure sufficient dispersion of exhaust air. The final design also includes an air lock lobby on the feedstock reception building. This was incorporated as a mitigation measure to further mitigate the potential of fugitive odours escaping from the building and impacting on receivers.

2.13.5 Alternative Processes

There are several different process configurations were considered as part of the design process. Factors which were considered included the following:

- Type of feedstock and fulfilling sustainability criteria (as laid down in RED II)
- Batch or Continuous feed system
- Single Stage or "Multi-Stage" process
- Type of tank, its sizing and arrangement
- Mesophilic or Thermophilic AD temperatures
- Front-end pasteurisation or Back-end pasteurisation
- Type 1 Plant Type; EU transformation parameters (70°C for 60mins to remove pathogens such as *E. coli* and *Salmonella* and reduce particle size to 12mm or less standard) or National transformation parameters (Type 2 Plant Type) /alternative transformation parameters (Type 5 Plant Type)

The chosen process design is a continuously feed system with multi-stage process (primary and secondary digesters). Multi-stage systems are designed to take advantage of the fact that different portions of the overall biochemical process have different optimal conditions. By optimising each stage separately, the overall rate can be increased. Typically, two-stage processes attempt to optimise the hydrolysis and fermentative acidification reactions

in the first stage where the rate is limited but they can generally pass through the digestion tanks without affecting conversion of the biomass components.

The proposed plant is designed as a Type 1 Plant (EU Transformation parameters) and the AD process operates at mesophilic temperatures. 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. The plant includes the pasteurisation process (to fulfil DAFM requirements) post digestion. This was chosen following consideration of

- Reduced volumes requiring pasteurisation due to natural losses in the AD process;
- Reduced risk of cross contamination of digestate; and
- Increased energy efficiency pasteurising at the back-end when the feedstock temperature has been raised by the digestion process.

A number of possible solutions and options for dealing with the biogas generated and collected from the anaerobic digestion process were considered. These are listed as follows:

- Flaring,
- Generating electricity in a spark ignition engine, with no heat recovery,
- Generating electricity in a gas turbine, with no heat recovery,
- Combusting in a spark ignition based combined heat and power plant (CHP),
- Combusting in a gas turbine based combined heat and power plant (CHP),
- Injection into gas grid /transport to central injection point,
- Use as biofuel for transport.

The preferred and finalised scheme includes an enclosed standby gas flare which will only be used in emergency situations, e.g. when the CHP is unavailable. It was concluded that the Best Available Technique (BAT) for serving the house load (parasitic load), is providing an on-site CHP. The vast majority of biomethane produced at the site will be exported of site and used as an alternative flexible fuel in the heat and transport sectors. The finalised design and feedstocks was chosen to ensure that the Biogas Plant will assist with reducing greenhouse gas emissions and positively contributing to renewable energy, agricultural and waste targets.

3 PLANNING AND POLICY

3.1 Introduction

This Chapter provides an overview of national, regional and local policy associated with the proposed development of a biogas plant at Kinincha Road, Gort, Co. Galway. The proposed development is examined in the context of the policies and objectives set out within each of these plans.

The development is reviewed in the context of the following:

- National Policy; including the National Development Plan 2018-2027 and Energy, Climate Change and Waste Policy
- Regional Policy; including the Connacht Ulster Waste Management Plan 2015-2021 and Regional Planning Guidelines for the West Region, 2010-2022
- County and Local Policy; including the Galway CDP 2015-2021 and LAP 2013-2023
- Planning History of the Site

3.2 National Policy Context[55]

3.2.1 National Development Plan 2018-2027

The National Development Plan (NDP) sets out the investment priorities that will underpin the successful implementation of the new National Planning Framework (NPF). The plan was prepared to guide national, regional and local planning and investment decisions in Ireland over the next two decades, to cater for an expected population increase of over 1 million people.

The National Development Plan commits a total investment estimated at €116 billion over the period by Government. This represents a very substantial commitment of resources and is expected to move Ireland close to the top of the international league table for public investment.

This level of capital spending will ensure ongoing employment maintenance and creation with appropriate regional development. It will also provide clarity to the construction

[55] *Summary details of relevant national waste management legislation identified in Figure 1.1 is not included in this Section but is available at www.epa.ie and www.dccae.gov.ie*

sector, allowing the industry to provide the capacity and capability required to deliver Government's long-term investment plans.

The NDP prescribes 10 National Strategic Outcomes and Public Investment Priorities. Of particular relevance to development of the proposed biogas plant are the following:

- National Strategic Outcome 3. Strengthened Rural Economies and Communities
  - Investment in the agri-food sector is required to improve competitiveness, ensure the maintenance of Ireland's landscape, improve biodiversity and water quality, contribute to climate change goals and the development of our Fisheries Harbour Centres and research infrastructure. Public capital investments in the agri-food sector will seek to enable the sustainable development of the sector in accordance with the ambition in Food Wise 2025 and any successor strategy. These objectives will be supported by the EU Common Agricultural and Common Fisheries Policies operating after 2020 which are expected to focus on supporting these sectors in a way that delivers enhanced economic, environmental and social sustainability, with a particular emphasis on climate change mitigation and adaptation actions.
- National Strategic Outcome 8. Transition to a Low-Carbon and Climate-Resilient Society
  - New Renewable Electricity Support Scheme to support up to 4,500 megawatts of additional renewable electricity by 2030
  - Energy research funding to accelerate diversification away from fossil fuels to green energy, including wind, wave, solar, biomass, biofuels, biogas and hydrogen
  - Full roll-out of the new Support Scheme for Renewable Heat
  - Expand the refuelling network for alternately fuelled vehicles to address freight emissions
  - Development of gas infrastructure projects to support regional and rural development and the low-carbon transition
  - Town-scale pilots of food and agricultural waste to gas in agricultural catchments for local gas networks supply and biogas injection
- National Strategic Outcome 9. Sustainable Management of Water and other Environmental Resources
  - Investment in waste management infrastructure is critical to our environmental and economic well-being for a growing population and achieving circular economy and climate objectives. Capacity will continue to be built in waste facilities, including anaerobic digestion, hazardous waste

- treatment, plastics processing, recycling, waste to energy, and landfill and landfill remediation, to meet future waste objectives. The infrastructure to deliver waste management policy has been, to date, largely delivered through private investment with some public-sector investment. Significant infrastructure capacity development will be required to separate and process various waste streams at municipal and national levels to achieve new EU legally-binding targets and the additional investment may include a potential role for public investment.

3.2.2 National Spatial Strategy (NSS); 2002-2020

The National Spatial Strategy 2002-2020 provides a planning framework for delivering more balanced social, economic and physical development between the regions of Ireland. It proposes a more balanced pattern of spatial development throughout Ireland, with continued growth in Dublin but with significant improvement in the rate of development in nine 'Gateway' locations and nine 'Hub' towns which are considered critical to achieving balanced regional development. The NSS also states that the rural areas have a vital contribution to make to the achievement of balanced regional development by utilising and developing the economic resources of rural areas, particularly in agriculture and food, marine, tourism, forestry, renewable energy, enterprise and local services, while at the same time capitalising on and drawing strength from vibrant neighbouring urban areas. The NSS also supports the economic growth and revitalisation of areas in the west region, previously centred on agriculture, to diversify into alternative economies based on the sustainable use of natural resources such as scenic landscapes for tourism, the sea for fisheries and marine- based aquaculture, the land for agriculture, forestry, inland aquaculture (in rivers and lakes) and renewable energy.

3.2.3 Irelands National Renewable Energy Action Plan (NREAP), 2010

Article 4 of Directive 2009/28/EC on renewable energy requires each Member State to adopt a national renewable energy action plan (NREAP) to be submitted to the European Commission. The NREAP sets out the national targets for the share of energy from renewable sources to be consumed in transport, electricity and heating and cooling in 2020, and demonstrates how the Member State will meet its overall national target established under the Directive. Member States are required to submit a report on progress to the European Commission every two years with the final report to be submitted by 31st December 2021. The fourth and most recent report was submitted in February 2018 and reported that the contribution from renewables in Ireland has risen from the low

base of 2.3% in 1990 to 9.5% of Gross Final Consumption in 2016. A breakdown of the current share of renewable energy with respect to targets is presented in Table 3.1 below.

Table 3.1 NREAP RES Values

Renewable Energy	2016 Actual (%)	2020 Target (%)
RES-E (Share of renewable energy in electricity)	27.2	40
RES-T (Share of renewable energy in transport)	5.0	10
RES-H&C (Share of renewable energy in heating and cooling)	6.8	12
Overall RES Share	9.5	16

3.2.4 National Policy Statement on the Bioeconomy, February 2018

Development of the bioeconomy is consistent with Ireland's low carbon transition objective. Favouring renewable biological resources over fossil fuel-based ones through the expansion of the bioeconomy, whilst keeping sustainability concerns to the fore, has the potential to contribute towards meeting Ireland's climate change targets. The bioeconomy can assist in meeting challenges such as regional development and employment growth by introducing new business models in rural and coastal areas; driving energy security by boosting the supply of domestic clean energy sources; maintaining and enhancing natural capital and protecting the environment; applying chemical and physical technologies to produce value added bio-based products; and enabling a step change in the productivity of crops, animals and microbes through the application of biotechnology.

The purpose of the National Policy Statement on the Bioeconomy is to capitalise on the identified potential. It does so by elaborating on how the strategic development of the bioeconomy might be advanced through greater policy coherence across all relevant sectors and dealing with fundamental challenges to its commercial success and social development.

3.2.5 Climate Action and Low Carbon Development Act 2015

The enactment of the Climate Action and Low Carbon Development Act 2015 was a landmark national milestone in the evolution of climate change policy in Ireland. The Act provides the statutory basis for the national transition objective laid out in the national policy position. As provided for in the 2015 Act, in order to pursue and achieve the national

transition objective, the Minister for Communications, Climate Action and Environment must make and submit to Government a series of successive National Mitigation Plans (NMPs) and National Adaptation Frameworks (NAFs). When considering these plans and frameworks, Government must ensure that the national transition objective is achieved by the implementation of measures that are cost-effective. Summary details of Ireland's first NMP and NAF are outlined below:

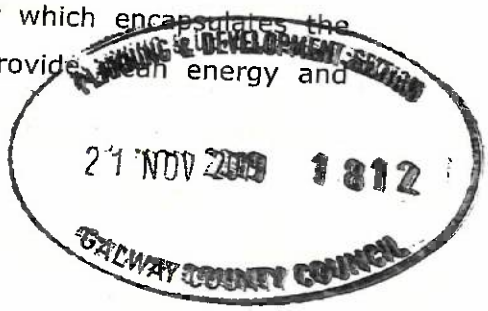
- National Mitigation Plan, July 2017
  Ireland's first National Mitigation Plan sets out this Government's shared approach to reducing Ireland's greenhouse gas emissions. The plan includes a number of actions related to further developing the bioenergy and biogas sectors.
- National Adaptation Framework; Planning for a Climate Resilient Ireland, January 2018
  The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. The role of key sectors (under four themes; Natural and Cultural Capital, Critical Infrastructure, Water Resource and Flood Risk Management and Public Health) is set out in the context of how Ireland can develop climate resilience while also recognising the need to ensure coordination of adaptation actions across sectors and Government Departments and Agencies.

3.2.6 Ireland's Transition to a Low Carbon Energy Future 2015-2030 (Energy White Paper), December 2015

The Irish Government's Energy White Paper, published in December 2015, presents a long-term strategic vision that is intended to guide the direction of Irish energy policy from now until 2030. At its heart is a commitment to transform Ireland into a low carbon society and economy by 2050 and reduce the country's fossil fuel dependency. This ambitious vision for Ireland's energy system envisages a reduction in greenhouse gas emissions from that sector by 80-95% relative to 1990 levels by 2050.

3.2.7 Draft Bioenergy Plan 2014

This draft plan articulates a vision for the bioenergy sector which encapsulates the important economic and social potential of the sector to provide [illegible] energy and employment in rural and urban settings.



3.2.8 Changing our Ways Waste Report, 1998

This was the first in a series of comprehensive government policy documents on the management of waste in Ireland. It endorsed the integrated waste management approach, based on the internationally adopted hierarchy of options which places greatest emphasis on waste prevention, followed by minimisation, re-use, recycling, energy recovery and finally, the environmentally sustainable disposal of residual waste.

When the report was published in 1998, Ireland were almost exclusively reliant on a network of small landfills for dealing with our waste and had just introduced, through the Waste management act 1996, a modern regulatory regime to govern waste management activities. the policy document set out what was then an ambitious policy agenda for modernising our approach to waste management over a 15-year period, under which a suite of modern waste infrastructure alternatives would be developed so that we could significantly reduce our reliance on landfill, and to the extent that landfill was used it would be based on a much smaller network of modern, well-regulated facilities. the policy context developed further over the intervening period of time, with the publication of preventing and recycling Waste: Delivering change in 2002 and a national biodegradable waste management strategy in 2006.

3.2.9 A Resource Opportunity – Waste Management Policy in Ireland; 2012

The policy is predicated on the EU waste hierarchy and encompasses a range of measures across all 5 tiers namely, prevention and minimisation, reuse, recycling, recovery and disposal. it sets out how the higher tiers can reduce our reliance on finite resources, virtually eliminate our reliance on landfill and minimise the impact on our environment. The policy recognises the importance of waste as an energy resource opportunity in terms of recovery, and the need to develop efficient ways to harness that resource. the introduction of household food waste regulations in driving the rollout of the *"brown bin"* will for example assist in the diversion of food waste towards more productive uses, such as the production of compost and the generation of electricity through anaerobic digestion. The policy encompasses measures covering the full spectrum of waste management planning, compliance and enforcement. there will be rationalisation of waste management regions to ensure better planning, which in turn will free up resources for other priority areas.

3.3 Regional Policy Context

3.3.1 Regional Planning Guidelines for the West Region 2010-2022 (RPGs)

The Regional Planning Guidelines for the West Region 2010-2022 (RPG's) sets out a framework for the long term strategic development of counties Mayo, Galway and Roscommon (the West Region). In relation to energy provision, upgrading the energy supply and energy network infrastructure and support renewable energy are identified as two of the key investment priorities required to support the sustainable development of the west region. The RPG's also identify the Region's natural assets for renewable energy production as one of the strengths of the Region and lists the opportunities this strength provides i.e. promote sustainable renewable energy developments in appropriate locations; develop associated 'green enterprise', pilot other forms of renewable energy production; become a leader in sustainable renewable energy and spin off green industries and green economy. The RPG's indicate that there is potential to produce renewable energy from wind and wood sources in the short term, and wave energy in the long term. This is supported by a number of policies and objectives.

3.3.2 Draft Regional Spatial and Economic Strategy for the Northern and Western Regional Assembly

The Northern and Western Regional Assembly is in the process of preparing and adopting a Regional Spatial and Economic Strategy for the Region. A Draft Regional Spatial and Economic Strategy has been prepared, which was subject to public consultation

The Draft RSES provides a high-level development framework for the Northern and Western Region, which supports the implementation of the National Planning Framework (NPF) and economic policies and objectives of Government. It provides a 12-year strategy with a vision to 2040 and it provides a solid foundation to deliver transformational change that is necessary to achieve the objectives of the NPF. It provides a framework for investment to better manage regional planning and economic development throughout the Region.

Under Chapter 4 (*Growth Ambition: Economy and Employment – Vibrant Region*), the strategy sets policy objectives with regard to the various sectors. Section 4.5.2 [illegible] RSES deals with *Renewable Energy and Low Carbon Future* and includes [illegible] regional policy objectives (39-48), including the following relevant to the development proposal:

- *39 "coordinate the identification of the potential renewable energy sites of scale in collaboration with Local Authorities and other Stakeholders within three years of the adoption of the RSES"*
- *40 "To position the region to avail of the emerging global market in renewable energy..."*
- *41 "Encourage the development of the transmission and distribution grids to facilitate the development of renewable energy projects and the effective utilization of energy generated from renewable sources having regard to the future potential of the region over the lifetime of the Strategy and beyond"*
- *42 "Support the development of secure, reliable and safe supplies of renewable energy, in order to maximise their value, maintain inward investment, support indigenous industry and create jobs."*
- *44 "Support and encourage the development of the bio¬ energy sector and facilitate its development for energy production, heat storage and distribution."*
- *46 "Facilitate the delivery and expansion of natural gas infrastructure"*
- *47 "Encourage and support innovative partnerships extending the gas network in the region."*

The Agri-food sector is discussed in Section 4.5.3. It states that the agri-food sector accounts for 7.5% of total numbers of persons employed in the region and acknowledges that is *"entering into a period of radical transformation underpinned by smart farming practices, growth in global demand and consumer sophistication"*. In accordance with national policy, the Draft RSES recognises that one of the bigger challenges for the region during the life of the strategy is the management and reduction of greenhouse gases (GHG) from agriculture productions. This is heightened by the production in growth planned through Foodwise 2025 and Food Harvest 2020. It says that if agriculture is to join into the low carbon economy to which the region aspires, it will have to radically change and manage its operational practices. The section details seven regional policy objectives associated with the agri-food sector (49-55) including specific reference to policies which are designed to encourage and support the bioeconomy in accordance with national policy. Specifically, regional policy objectives

- *52 To support the growth of the Region's Agri-Food Sector, and to enable sectoral growth in rural area's*
- *53 To support the Bio-Economy and to review the RSES upon the introduction of a Bio-economy strategy for Ireland, and assist in implementing measures to enable such a strategy.*

- *54 To support the potential creation of appropriately scaled local feedstock bio-refining hubs across the Region.*
- *55 To create a stronger and more resilient region by protecting and stimulating gastronomy as part of our cultural heritage and also by identifying new opportunities for economic development.*

3.3.3 Connacht-Ulster Region Waste Management Plan 2015 – 2021

For the purposes of waste management planning, Ireland is now divided into three regions: Southern, Eastern-Midlands and Connacht-Ulster. Waste management plans for the three regions were published in May 2015.

The Connacht Ulster Region is a new region in terms of managing wastes and merges a number of smaller historical waste regions. It is one of three regional groups of authorities assembled in the State for the purpose of managing wastes. The 2015 – 2021 plan is the first waste plan to cover the geographical area of the Connacht Ulster Region. The new region stretches from Galway in the west, to Donegal in the north and to Monaghan in the north east and in total consists of 9 local authorities; Cavan, Donegal, Galway City, Galway County, Leitrim, Mayo, Monaghan, Roscommon and Sligo. The region has appointed Mayo County Council, as the regional lead, to act on behalf of the other authorities with responsibility for the successful implementation of the plan.

3.4 County and Local Policy Context

3.4.1 Galway County Development Plan 2015-2021

The Galway County Development Plan 2015-2021 sets out an overall strategy for the proper planning and sustainable development of the functional area of Galway County Council. This plan builds on the strategies, policies and objectives of the Galway County Development Plan 2009-2015, taking into account recent key development trends and national, regional and local policy developments. County Galway is the second largest county in Ireland with an area of 6,148 square kilometres and a coastline of 689 kilometres with many off shore islands. It borders five counties and forms part of the area under the jurisdiction of the Northern and Western Regional Assembly.

Under Section 7.4 of the Plan, Renewable Energy, the CDP states the following:

"the Council shall promote energy hubs at Tuam, Athenry and Gort (including their environs) to take account of opportunities to develop sustainable enterprises

(including the manufacture/testing of niche renewable energy generating equipment) due to their proximity to energy and transmission networks."

"The Council also recognises the importance of developing renewable energy sources in the interest of delivering on the National Climate Change Strategy, of achieving a low carbon economy and security of energy supply. In order to ensure a secure and effective supply of energy, Galway County Council will facilitate the development of a range of sustainable forms of energy creation within the County. Galway County Council will strive to achieve a reduction in the carbon emission targets for public bodies through the implementation of energy efficient and energy management priorities."

Bio-Energy is further discussed under Section 7.4.5 of the CDP. It states the following:

"Bio-energy is derived from bio-fuels such as biodiesel, biogas and biomass through the use of a wide variety of technologies. These energy sources are considered to be "CO_2 Neutral", not adding to the carbon dioxide level in the atmosphere and are more reliable in terms of consistency in supply than many other renewable energy technologies. The Council will encourage the production of bio-crops and forestry for biomass in the generation of renewable energy as well as production units in appropriate locations. In addition to the "CO_2 Neutral" status of this energy source, the Council recognises that this sector also offers opportunities for farm diversification and rural employment.

The policy objectives with relevance to biogas development in the Galway County Council Development Plan 2015-2021, are set out in Table 3.2 below.

Table 3.2 Galway CDP Policy Objectives

Policy Objective	Description
Objective ER 1 – Electricity and Renewable Energy Infrastructure	Support the development and expansion of infrastructure for the generation, storage, transmission and distribution of electricity, renewable energy and other renewable energy proposals in suitable locations in County Galway.
Objective ER 2 – Priority Transmission Infrastructure Projects	Facilitate the progression of and implement improvements to the existing electricity networks and facilitate the development of new transmission infrastructure projects in accordance with EirGrid's Grid25 Strategy that might be brought forward during the lifetime of this plan, subject to relevant Irish planning and European environmental legislation including Article 6 of the Habitats Directive and/or other environmental assessment. Map ER1 outlines existing and proposed energy transmission infrastructure corridors.

Policy Objective	Description
Objective ER 3 – Low Carbon County	Promote County Galway as a low carbon County by 2020 having regard to the Climate Action and Low Carbon Development Bill when adopted. Encourage and favourably consider proposals for renewable energy developments and ancillary facilities in order to meet national, regional, county energy targets and to facilitate a reduction in CO_2 emissions.
Objective ER 4 – Renewable Energy	a) Support and facilitate the sustainable development and use of appropriate renewable energy resources and associated infrastructure within the County, including; • Wind Energy; • Wave/Tidal Energy; • Hydro-Power; • Solar Energy; • Bio-Energy; • Geo-Thermal; • Combined Heat Power (CHP); • Heat Energy Distribution (such as District Heating/Cooling Systems); and • Other renewable energy sources, as appropriate and in line with national guidelines for sustainable development. b) The Council shall commence a County Renewable Energy Strategy within the lifetime of the plan as resources permit. This document will also take micro generation options into account and will recognise that renewable energy projects are not just limited to large scale infrastructural projects.
Objective ER 8 – Promoting Energy Hubs	Galway County Council shall promote Tuam Hub Town, Athenry and Gort and their environs as energy hubs, to take account of opportunities to develop suitable sustainable enterprises due to their proximity to electricity and gas transmission networks and minimising environmental impact.
Objective CC 2 – Greenhouse Gas Emissions	Galway County Council shall implement measures which seek to establish a low carbon economy and society by 2050 and which seek to reduce greenhouse gas emissions including the adoption of sustainable planning strategies through integrating land use and transportation.
Objective AFF1 – Sustainable Agriculture	The Council shall support the sustainable development of agriculture, with an emphasis on a high quality, traceable primary production methods, the promotion of local food supply and agriculture diversification.
Objective AFF 2 – Rural Diversification	Galway County Council shall support those who live and work in agriculture and/or related activities in rural areas and who wish to remain on their land holding. Accordingly, the Council will favourably consider rural diversification intended to supplement farm income where the activity remains ancillary and compatible to the ongoing agricultural use of the farm and does not have an adverse impact on residential amenity:

Policy Objective	Description
	a) Specialist farming practices e.g. specialised animal breeding, equine facilities, poultry, mushroom growing, vegetable and fruit growing; b) Farm enterprises such as processing, animal pet farms/horse riding schools with an element of retail activity; c) The production of organic and speciality foods to meet the increase in demand for such products; d) The conversion of disused buildings/existing farm buildings for appropriate owner run, rural oriented, enterprises, as a way of supporting a viable rural community, subject to proper planning and sustainable development of the area; e) Support the development of appropriate agri-tourism activities and eco-tourism development proposals and promote the County as a green tourist destination.

The proposed development site is located within 1.5km of the M18 motorway network which is shown as the north /south aligned strategic development corridor (ref. Overall Spatial Strategy and Proposed Development Option Map of the Galway CDP). The proposed development site is located with an area defined as an "economic engine" (ref. EDT 1 map of the Galway CDP).

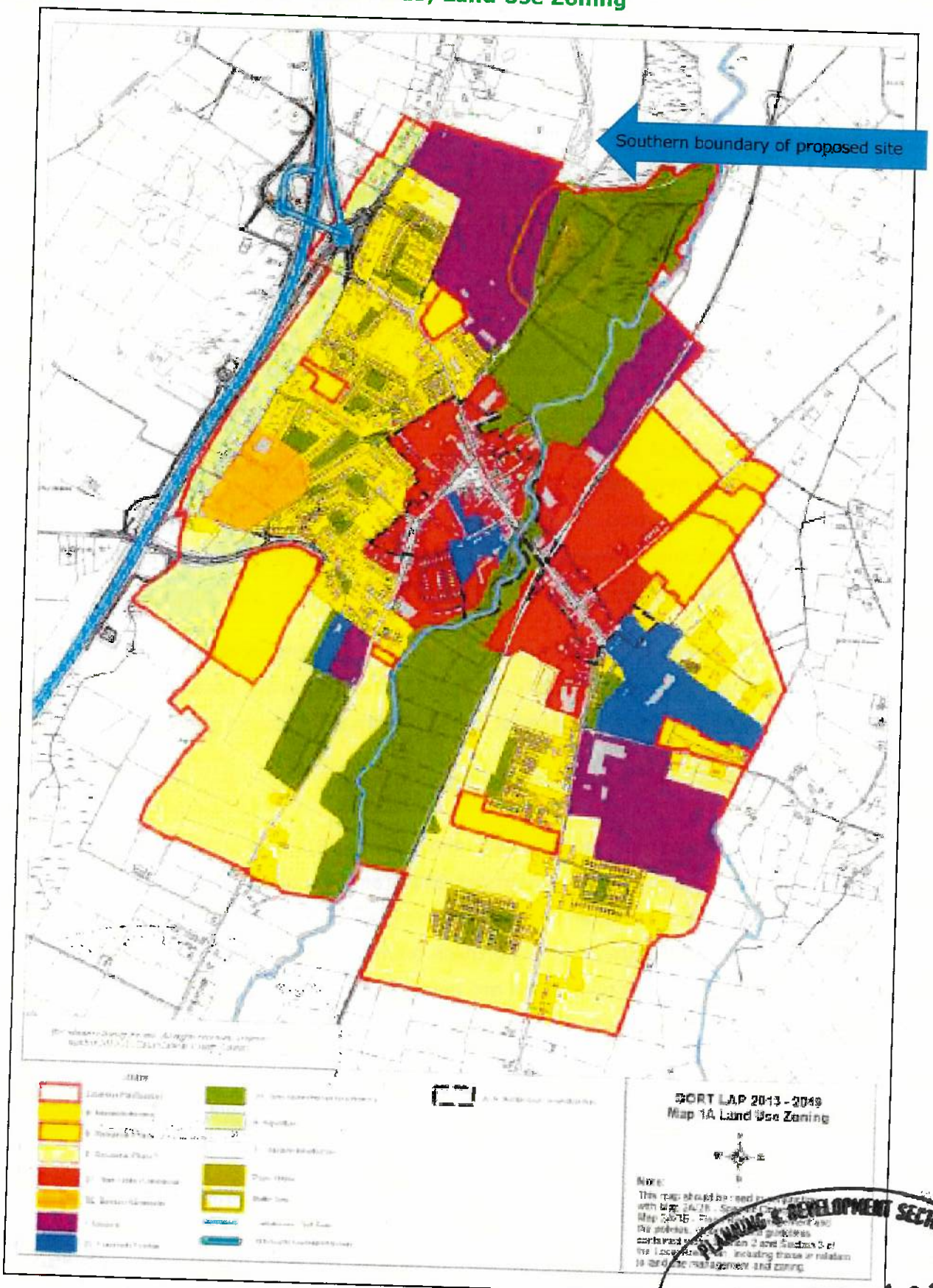
The Galway CDP does not contain detailed zoning for the settlements, as zoning for the various towns and villages is specifically addressed in the relevant Local Area Plans, as appropriate, which are generally in place for all towns with a population over 1500 persons.

3.4.2 Gort Local Area Plan (LAP) 2013-2023[56]

Galway County Council adopted the Gort Local Area Plan (LAP) 2013-2023 on the 22nd July 2013 under the Planning and Development Act 2000 (as amended). This Local Area Plan (LAP) is a land use plan and overall strategy for the development of Gort over the period 2013-2023[56]. The site is located on the northern boundary of Gort town plan. The lands on which the proposed biogas plant itself are beyond (refer to Figure 3.1) the Gort town (urban) boundary and accordingly are not zoned and are agricultural in character. Lands adjoining the site to the south west are zoned as industrial lands.

[56] *Deferred 25th June 2018 – lifespan of the Gort LAP 2013-2019 extended for a further 5 years*

Figure 3.1 **Gort LAP 2013-2023; Land Use Zoning**



The main aim of the Gort Local Area Plan 2013-2023 is for Gort to:

"be a sustainable, self-sufficient, vibrant, socially inclusive and innovative growth centre within the County, protecting and enhancing its attractive medieval character and natural environment, supporting an educated workforce, providing a range of supporting services/facilities/ amenities and with a high quality of life for the local community. This will be delivered through a managed and phased development strategy on appropriately zoned and serviced lands in a manner that is balanced and sustainable for Gort and the immediate environs that it serves."

This LAP identifies specific policies and objectives applicable to Gort in order to facilitate land use in a manner that will promote proper planning and sustainable development. Section 3.6.1 of the LAP provides context to the policy and objectives contained under *Utility and Environmental Infrastructure*. The LAP states

"The sustainable growth of Gort is dependent on the satisfactory provision of utility and environmental infrastructure, including water supply, wastewater disposal, surface water drainage and energy and communication networks. There is a need to ensure that there is adequate availability and delivery of utility and environmental infrastructure to support future development in a manner that is environmentally appropriate, cost effective and efficient and that protects public health. In accordance with the requirement of the Water Framework Directive, there is a Water Framework Directive Register of Protected Areas which consists of an inventory of protected area sites representing area categories to include waters used for the abstraction of drinking water, areas designated to protect economically significant aquatic species, recreational waters, nutrient sensitive areas, and areas designated for the protection of habitat and species."

The relevant policies associated with the proposed biogas plant development as detailed in the LAP are presented below.

POLICY UI4 – WATER QUALITY

"It is the policy of Galway County Council to protect and improve water quality in all waters, in conjunction with other agencies and stakeholders and in accordance with the EU Water Framework Directive (2006/60/EC), EU Groundwater Directive (2006/118/EC) and other relevant EU Directives, including associated national legislation and policy guidance, (including any superseding versions of same), and to support the implementation of the Western River Basin District Management Plan. Galway County Council will take account of the above requirements to protect and improve water quality when assessing new development proposals."

POLICY UI5 – WASTE MANAGEMENT

"It is the policy of Galway County Council to support sustainable waste management through the prevention, reduction and recycling of waste and by facilitating the provision of adequate waste infrastructure, such as bring banks, at locations that will not adversely affect residential amenities."

POLICY UI6 – ENERGY AND COMMUNICATIONS

"It is the policy of Galway County Council to support the provision of adequate energy and communications infrastructure to service developments, including gas, electricity, broadband and telephone services. In particular, the Council supports the increased development and use of renewable energy and the aims of sustainable energy use and conservation in building design and construction."

POLICY UI7– CLIMATE CHANGE AND AIR QUALITY

"It is the policy of Galway County Council to support and promote, in conjunction with other agencies, local, national and international initiatives for limiting/reducing emissions of greenhouse gases and encouraging the development of renewable energy in accordance with the National Climate Change Strategy 2007-2012, the EU Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) and the Air Quality Standards Regulations 2011 (SI No. 180 of 2011) (or any updated/ superseding documents)."

POLICY NH1 – NATURAL HERITAGE AND BIODIVERSITY

"It is the policy of Galway County Council to support the conservation and enhancement of natural heritage and biodiversity, including the protection of the integrity of European sites, that form part of the Natura 2000 network, the protection of Natural Heritage Areas and proposed Natural Heritage Areas and the promotion of the development of a green/ecological network within the Plan Area, in order to support ecological functioning and connectivity, create opportunities in suitable locations for active and passive recreation and to structure and provide visual relief from the built environment. The protection of natural heritage and biodiversity, including European sites that form part of the Natura 2000 network, will be implemented in accordance with relevant EU environmental directives and applicable national legislation, policies, plans and guidelines, including the following (and any updated/superseding documents):

- *EU Directives, including the Habitats Directive (92/43/EEC), the Birds Directive (2009/147/EC), the Environmental Impact Assessment Directive (85/337/EEC), the Water Framework Directive (2000/60/EC) and the Strategic Environmental Assessment Directive (2001/42/EC),*

- *National legislation, including the Wildlife Act 1976, the European Communities (Environmental Impact Assessment) Regulations 1989 (SI No. 349 of 1989) (as amended), the Wildlife (Amendment) Act 2000, the European Union (Water Policy) Regulations 2003 (as amended), the Planning and Development Act 200 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (SI No. 477 of 2011).*
- *National policy guidelines, including the Landscape and Landscape Assessment Draft Guidelines 2000, the Environmental Impact Assessment Sub-Threshold Development Guidelines 2003, Strategic Environmental Assessment Guidelines 2004 and the Appropriate Assessment Guidelines 2010.*
- *Catchment and water resource management plans, including the Western River Basin District Management Plan 2009-2015.*
- *Biodiversity plans and guidelines, including Actions for Biodiversity 2011-2016: Irelands National Biodiversity Plan, the Biodiversity Action Plan for County Galway 2008-2013 and the Biodiversity Guidelines produced by Galway County Council.*
- *Ireland's Environment 2012 (EPA, 2012), and to make provision where appropriate to address the reports goals and challenges."*

In terms of siting and in consideration of the nature of the development proposal (biogas plant which transforms waste feedstocks to renewable products using anaerobic digestion technology), development plan zoning objectives frequently exclude such uses. Proximity to residential dwellings is a key consideration in the selection of suitable sites for bioenergy developments. It should be noted that siting a biogas project is guided by the Department of Agriculture, Food and the Marine and associated animal by-product legislation during the first stage licensing phase of a project's development. Specific conditions including those related to safeguarding biosecurity (e.g. fencing and separation requirements) are detailed in DAFM's Condition Document CN11; Approval and Operation of Biogas Plants.

3.5 Planning History of the Site

The current site is described as improved grassland (pastures) used for agricultural (grazing) and equine related purposes. There are a number of previous planning applications associated with lands at the proposed development site; these are presented in Table 3.3 below.

4 POPULATION AND HUMAN HEALTH

4.1 Introduction

This Chapter presents an assessment of impacts on Population & Human Health. The recitals to the 1985 and 2011 Directives refer to *'Human Health'* and include 'Human Beings' as the corresponding environmental factor. The 2014 Directive changes the title of this factor to "Population and Human Health"

While there are a range of issues which may impact on human beings many of these have been considered within other disciplines within this EIAR, including landscape and visual (Chapter 10), traffic and transport (Chapter 11), noise and vibration (Chapter 9) and air quality (Chapter 8). This Chapter is therefore focused on potential impacts which have not been assessed elsewhere within the EIAR.

4.2 Assessment Methodology and Significance Criteria

4.2.1 Assessment Methodology

A desk study was undertaken to assess the potential impacts on population and human health. The desk study involved the assessment of data from the Central Statistics Office (CSO) and a review of the Galway County Development Plan (CDP) 2015-2021 and the Gort Local Area Plan (LAP) 2013-2023. Information was also obtained from the following list of websites:

- Environmental Protection Agency (www.epa.ie);
- Galway County Council (http://www.galway.ie/en/);
- Central Statistics Office (http://www.cso.ie);
- Geohive (http://map.geohive.ie/mapviewer.html)
- Health and Safety Authority (http://www.hsa.ie/eng/)
- European Biogas Association (european-biogas.eu/biogas)
- German Biogas (https://www.biogas.org)

4.2.2 Evaluation of Potential Effect

Once the identification of the baseline environment was undertaken, the available data is utilised to identify, categorise and assess potential impacts likely to have a significant impact on the population and human health as a result of the proposed EIA Development

Impacts are categorised as follows:

- Direct: where the existing baseline along or in close proximity to the proposed development is altered, in whole or in part.
- Indirect: where the baseline beyond the proposed development is altered by activities related to the construction or operation of the proposed development.
- No Impact: where the proposed has neither negative nor a positive impact upon the baseline.

MAGNITUTE

The magnitude of potential impacts has been defined in accordance with the criteria provided in the EPA guidelines

Table 4.1 Impact Assessment Criteria - Magnitude

Magnitude of Impact	Description
Profound	An impact which obliterates all previous sensitive characteristics.
Significant	An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Moderate	An impact that alters the character of the environment in a manner that is consistent with existing or emerging trends
Slight	An impact that alters the character of the environment without affecting its sensitivities
Imperceptible	An impact capable of measurement but without noticeable consequences

The significance of the potential impact of the proposed development has been classified by taking into account the sensitivity of receptors and the magnitude of the potential effect on them, combined with the likelihood of an impact occurring as defined in Table 4.2.

Table 4.2 Rating of Significant Impacts

Importance of Attribute	Magnitude of Impact			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant /Moderate	Profound /Significant	Profound
High	Imperceptible	Moderate /Slight	Significant /Moderate	Profound /Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight /Moderate

4.2.3 Desktop Study

This assessment comprised a desktop study and considered the potential impact of the development on population and human health and includes the following broad areas of investigation:

- Population and Settlement Patterns;
- Employment;
- Land Use; and
- Health and Safety[57];

4.2.4 Field Work

No field work was undertaken as part of this assessment.

[57] *It should be noted that the potential for effects on human health are dealt with in this EIAR under the more specific topics of the environmental factors by which they might be caused including air quality and noise*

4.3 Description of the Receiving Environment

4.3.1 Population and Settlement Patterns

The subject site is located in the townlands of Ballymantanan, Glenbrack and Kinincha, Co. Galway. According to the Central Statistics Office (CSO) the site is located in the electoral division of Gort as shown in Figure 4.1 and in an area where the population density is 82.14 per km^2 (see Figure 4.2).

Figure 4.1 Electoral Division

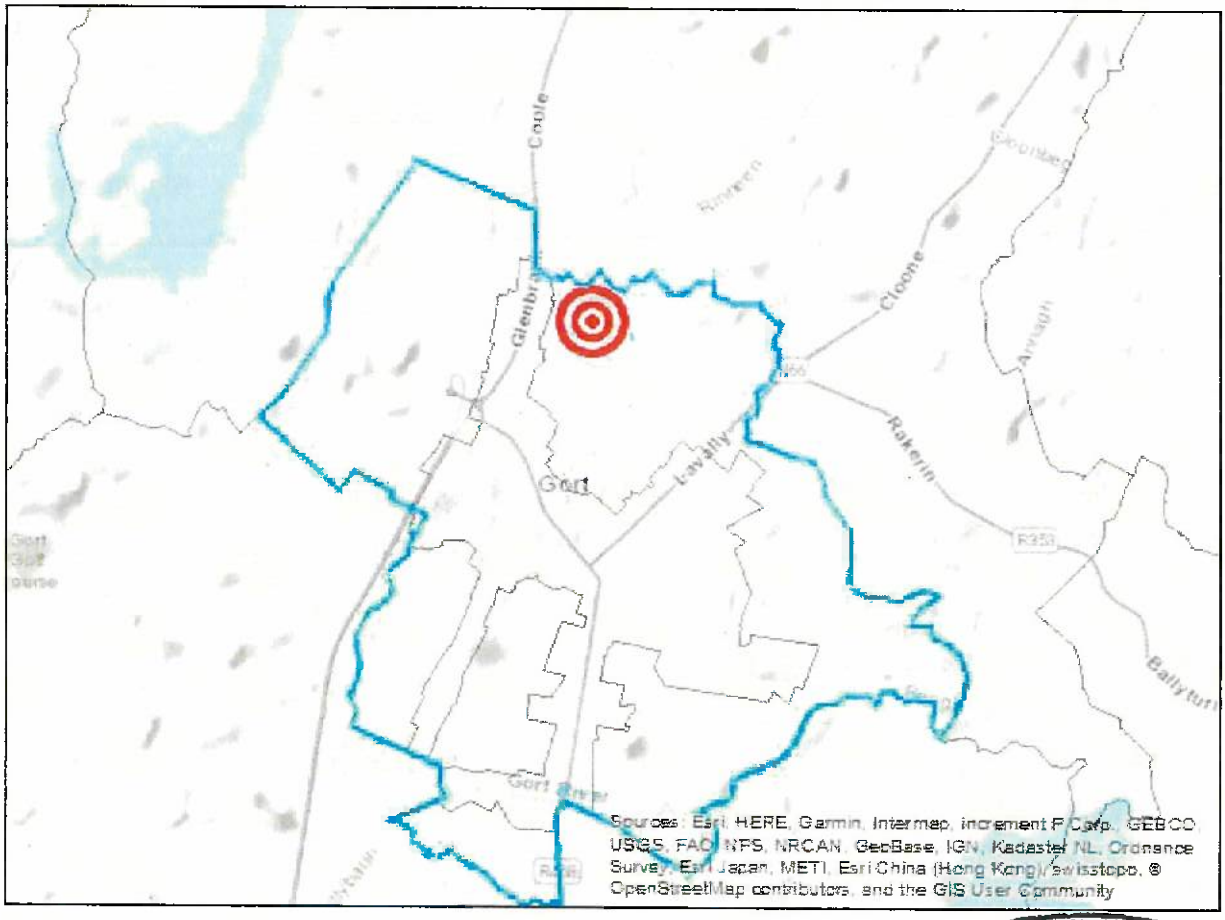
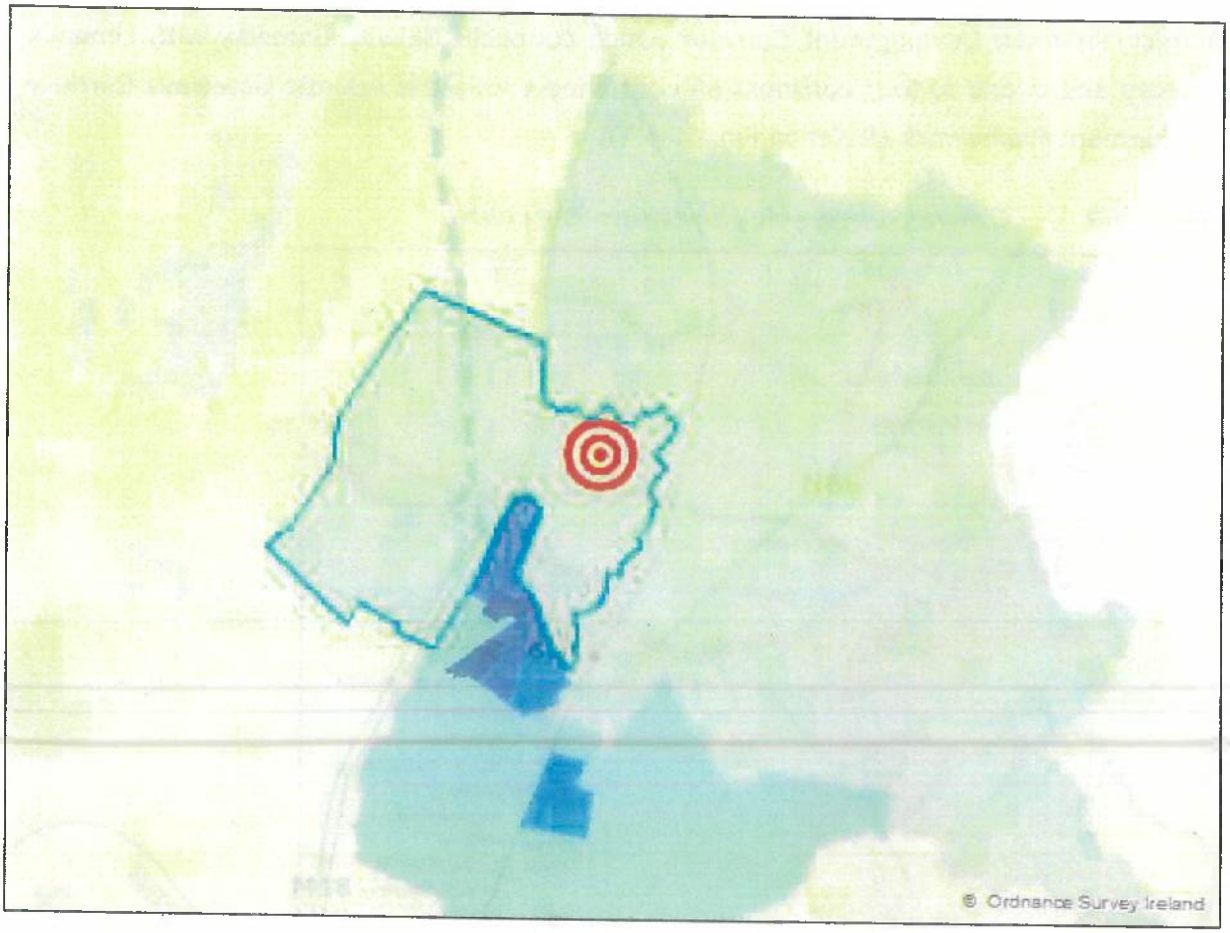


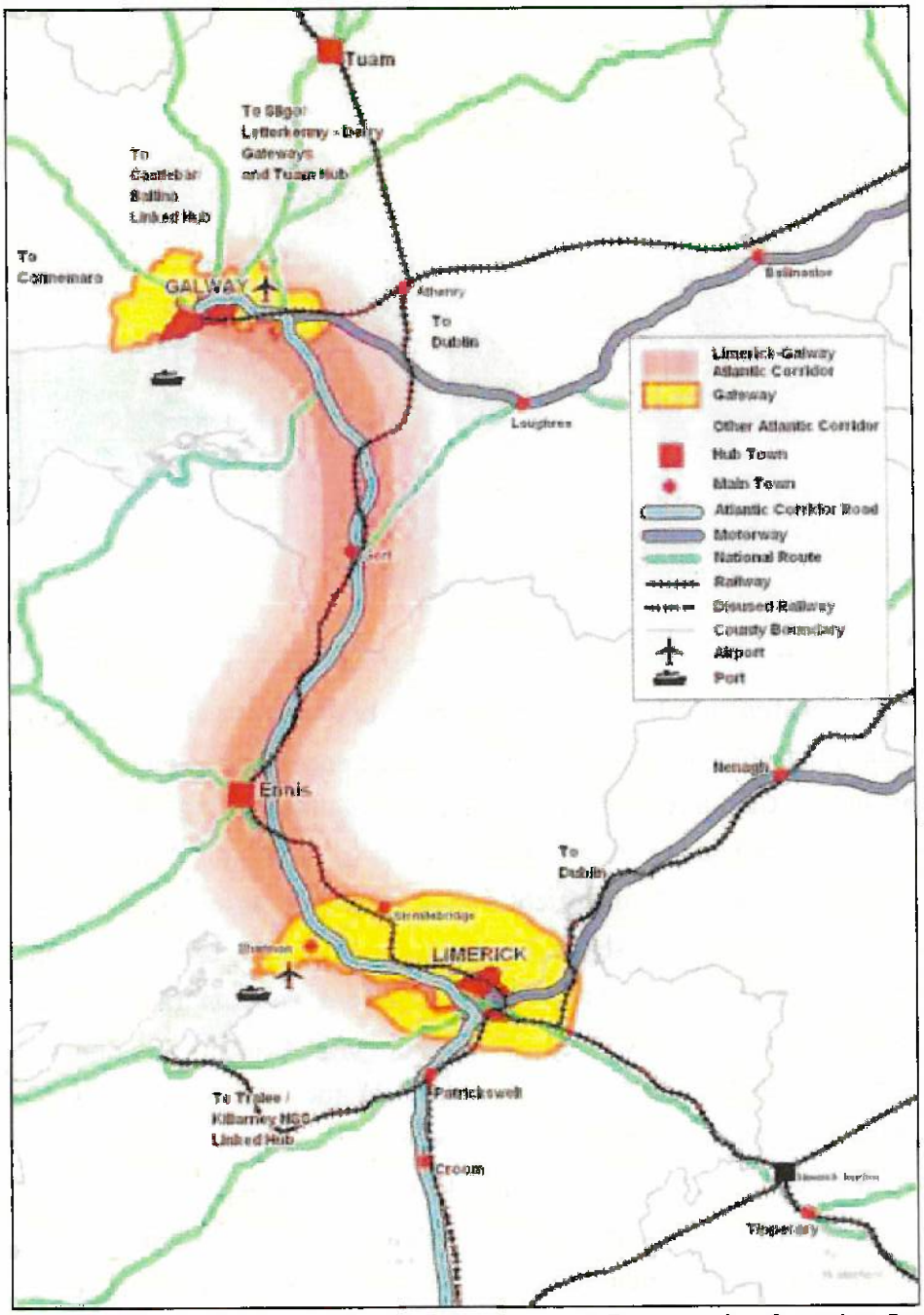
Figure 4.2 Population Density Per Km²



The Gort town boundary is located just beyond the southern boundary of the proposed Biogas Plant. The strategic geographical location of Gort makes it accessible to most major towns and tourist attractions in Connaught. Gort is located approximately 32 kilometres south of Galway Gateway and 64 kilometres north from Limerick Gateway on the M18 motorway. This motorway forms part of the Atlantic Road Corridor, as outlined under Transport 21, the Government's transport strategy. Gort is also connected to the M6 Galway to Dublin Motorway via the M18, the N18 at Oranmore and via the N66 at Loughrea. The town lies in close proximity to Shannon International Airport. The Ennis - Athenry portion of the Western Rail Corridor passes through Gort and links Galway City to Limerick City, thereby enhancing accessibility to and from the town. Gort also benefits from key energy infrastructure – the town is connected to the gas pipeline network (distribution system in the town) 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 LAP boundary. The town benefits from telecommunications infrastructure such as broadband (Metropolitan Area Networks) including co-location, which is considered key for industrial companies.

Gort is also identified as a main town/important urban settlement on the Galway-Limerick/Shannon Development Corridor which connects Galway Gateway with Limerick Gateway and is one of four corridors as contained within the Atlantic Gateways Corridor Development Framework (Refer to Figure 4.3).

Figure 4.3 Galway-Limerick /Shannon Corridor



Source: Atlantic Gateways Corridor Development Frameworks, Overview Report.

This Overview Report progresses the Atlantic Gateways Initiative (AGI) through an integrated approach to the development of the Gateway cities of Cork, Limerick- Shannon, Galway and Waterford and which forms a key implementation step of the National Spatial Strategy (NSS), the Government's overall policy framework to achieve more balanced

regional development. In order to develop the Atlantic Gateway Corridor, recommendations of the DoEHLG include: *"to accelerate the delivery of the Atlantic Corridor and Western Rail Corridor (both of which pass through Gort), the development of key settlements along the route (including Gort), the management of urban sprawl and the careful management of development pressures at major transportation interchanges".*

In terms of population trends, according to the most recent 2016 CSO figure, the population of Gort was recorded as 2,994 persons. This represents a population increase since the 2011 figures (increase of 350 persons). Population figures for Gort from 2002 are outlined in Table 4.3 below. Overall an increasing population trend is evident.

Table 4.3 Population Trend for Gort Town

2002	2006	2011	2016
1,776	2,734	2,644	2,994

The 2013-2023 LAP states that the Core Strategy of the Galway CDP has identified Gort as self-sufficient settlement and a *'Key Town'* in the settlement hierarchy. Presently Gort has 106.20ha of undeveloped residential zoned. In order to align the new Plan with the Core Strategy zoning requirement, a total of 23.66ha is required for new residential development.

The Galway CDP acknowledges the national action plant for jobs strategy which identifies that renewable energy, smart grid development, energy efficiency products and services as key sub sectors of the *'green economy'* and in the creation of jobs. Accordingly, the Galway CDP states that the Council wishes to promote an energy hub at Gort (including its environs) to take account of opportunities to develop sustainable enterprises (including the manufacture/testing of niche renewable energy generating equipment) due to their proximity to energy and transmission networks.

4.3.2 Employment

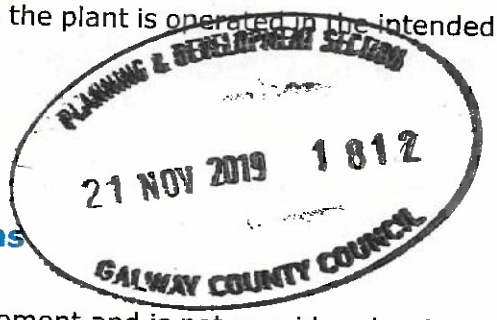
According to the CSO, in 2016 there was a 18.1% unemployment rate within the ED of Gort (280 persons) of a total labour force of 2,380. This compared with a national average employment rate of 12.9 per cent and a county (County Galway) unemployment rate of 11.7% in 2016. The daytime working population (resident and non-resident) of Gort was 1,099 with commerce and trade being the largest industry (18.7%). Agriculture forestry and fishing accounted for 2.6% (Galway County being 7.3%)

4.3.3 Landuse

Landuse and description of the existing site is described in Chapter 2 and assessed in the context of planning policy and material assets in Chapter 3.0 and Chapter 13 respectively.

4.3.4 Health and Safety

A biogas plant involves complex processing engineering and it is important that they are designed, constructed, commissioned and operated in a sustainable, efficient and reliable manner with safety being considered at both personnel and plant level. If the appropriate protective measures are taken, hazards in and around biogas plants can be limited and reduced to the extent that the risk is manageable and the plant is operated in the intended manner.



4.4 Impact Assessment

4.4.1 Population and Settlement Patterns

This project does not contain a housing or services element and is not considered to have any direct positive or negative impact on the local or regional population levels. However, the plant will attract employees who are not based in locally to relocate to the town to reduce commuting distances. During the construction phase there is the potential for limited impacts on the residential amenity of the local population. The overall impact is considered to be imperceptible in terms of population and an increase in traffic volume. These would be short-term impacts primarily relating to an increase in construction traffic causing noise, dust and an increase in traffic volume.

With the recommended traffic and transport mitigation measures in place, no significant adverse roads and traffic related environmental impacts are anticipated during the construction, operational or decommissioning phases of the proposed development. Transport and have been defined as slight negative impact in the construction and decommissioning phases of the project and imperceptible impact in the operational phase.

4.4.2 Landuse

Landuse and description of the existing site is described in Chapter 2 and assessed in the context of planning policy and material assets in Chapter 3 and Section 13 respectively. Overall, the predicted impact to landuse are long-term. direct and indirect slight/moderate positive.

4.4.3 Employment

The proposed plant will offer many positive benefits to the economy of the local area. The most significant positive impact will be the permanent employment opportunities that will result from the construction and operational phases. Indirect employment will also arise from the development in the form of hauliers and other contractors supplying services and goods to the plant.

Employment levels during construction will vary depending on the stage of 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 80 construction workers will be attending the site.

During operation, it is expected that the plant will employ 20 staff working over three pre-determined shifts as follows:

- 07:00-16:00 hours - 8 Staff
- 13:00-22:00 hours - 8 Staff
- 22:00-07:00 hours - 4 Staff

Personnel employed in a full-time capacity on site will include:

- Site Manager
- Operations Supervisor
- General Operatives
- Drivers
- Maintenance Engineer
- Laboratory Technician
- Administrative Personnel
- Weighbridge Operator
- Security

There is the likely benefit which would accrue to the local area and region in terms of the ability to provide employment through spin-off sectors; such as organic farming, etc. A renewable biogas plant producing green biomethane could also potentially be attractive for companies looking to establish in the Gort area and be provided with a clean sustainable energy source. Overall, there will be a significant positive direct and indirect impact to employment during construction and a moderate positive direct and indirect impact during construction and decommissioning.

4.4.4 Health and Safety

The primary legislation in Ireland is the Safety Health and Welfare at Work Act 2005. There are a number of amendments to the Act, as well as Regulations and Codes of Practice. Primary legislation can be referenced from the HSA website and the Act can be downloaded from the Irish Statue Book. Within the legislation responsibilities have been assigned to each party at the different stages of the development of a project. These apply to any construction project and are applicable to any biogas project. The developer, Sustainable Bio-Energy Limited, is considered the client under the 2005 Act.

At the start of the construction stage of the project, a Project Supervisor for the Design Process (PSDP) and a Project Supervisor for the Construction Stage (PSCS) will be appointed. The Safety, Health and Welfare at Work (Construction) Regulations 2013, as amended, place these and other duties on client.

The PSDP will be responsible for the compilation of the safety file for the client. The safety will be kept with the project from initial concept through to the demolition of the facility. The PSDP will compile the design risk assessment making sure that as many risks as possible are designed out and those that cannot will be communicated to the contractor and operator by way of a design risk register in the safety file.

The role of the PSCS will be to manage and co-ordinate health and safety matters during the construction stage. The PSCS will be appointed before the construction work begins and will remain in that position until all construction work on the project is completed.

Building and operating a biogas plant presents health and safety risks both during construction and operation. A key aspect in the carrying out of these roles and complying with legislation is the identification of hazards and quantifying the risks they pose. Such hazards can then be designed out during the planning phases or if that is not possible mitigation can be put in place to minimise the risk.

There are a number of hazards associated with the operation of a biogas, the process of anaerobic digestion, and biogas production. Typical hazards include the following:

- Environmental hazards;
- Health hazards;
- Hazardous substances;
- Biological agents;
- Hazards from electrical equipment;
- Mechanical hazards;

- Gas hazards;
- Explosion and fire hazards;
- Sources of danger from the surrounding environment;
- Hazards arising from inappropriate behaviour.

Many of the above hazards are not specific to biogas plants and exist at various types of industrial /manufacturing activities, but due to the complex process engineering involved at biogas plants, it is important that the activity is strictly operated in accordance with health and safety legislative requirements and international best practice.

ENVIRONMENTAL HAZARDS

The main hazards to the environment from a biogas plant are emissions of biogas, and escape of feedstocks/digestate from production /storage facilities. These emissions can arise from non-integral structures or from process failures

HEALTH HAZARDS

Due to the nature of the AD process, there are potential health hazards. These hazards could include exposure to hazardous substances, electrical hazards, mechanical hazards and explosion and fire hazards.

HAZARDOUS SUBSTANCES

Hazardous substances are substances that could be harmful to health. Due to the nature of the activity (biological breakdown of organic wastes) gases generated from the processes during operation of the plant can be harmful if not adequately controlled.

BIOLOGICAL AGENTS

A biological agent is any micro-organism, cell culture or human endoparasite which may cause an infection, allergy, toxicity or otherwise create a hazard to human health. These biological agents may be present in the feedstock, digestates and biogas condensates on an AD plant.

ELECTRICAL

As the plant includes for a higher degree of automation and control and the fact that it is designed to produce electricity from biomethane using an onsite CHP, the plant will contain electrical infrastructure on site which has the potential to be hazardous.

MECHANICAL HAZARDS

Biogas plants have a number of mechanical processes for the intake of feedstocks. Moving mechanical parts may pose hazards such as falling, impact, crushing, cutting, moving vehicles, etc. According to a 2012 German study[58] which looked at types of hazards related to accidents resulting in personal injury at biogas plant, the most common accidents are mechanical in nature; i.e. being struck by something, falling, getting cut, crushed etc., and also 50% occurred during maintenance activities.

GAS HAZARDS

One of the main activities at a biogas plant is to produce biogas from the feedstock. Biogas is a mixture of methane and carbon dioxide, with smaller quantities of trace gases such as hydrogen sulphide and ammonia.

EXPLOSION AND FIRE HAZARDS

As with all flammable substances, a fire can only occur if three factors apply simultaneously:

- Presence of a flammable substance at specific concentrations;
- Source of oxygen; and
- Source of ignition.

Depending on the circumstances, two types of explosion can take place in biogas plants: detonation and deflagration. The explosive range of biogas is between 6 and 22% v/v (concentration in the atmosphere). In the case of biomethane, the explosive range is between 4.4 and 16.5% v/v. Gas-air mixtures above or below the explosive range are not ignitable. In terms of accidents to personnel, the impact is predicted as direct slight/moderate negative. Accidents to infrastructure are predicted as direct slight negative.

4.5 Mitigation Measures

4.5.1 Construction

In order to control potential negative impacts during construction, an outline Construction Environmental Management Plan (CEMP) has been developed (Appendix 4.1). This will be further developed and implemented by the nominated Contractor during the construction phase of the project. Mitigation measures outlined within the various sections of the EIAR are incorporated into the CEMP. Post mitigation, impacts to population and human health

[58] *German Biogas Association Guidelines for the Safe Use of Biogas Technology 2017*

during the constructions (and decommissioning stages) are predicted as short-term direct and indirect slight positive short-term.

4.5.2 Operational

Given that no negative impacts have been identified to employment or population and settlement patterns, no mitigation measures are proposed.

A Supervisory Control and Data Acquisition ("SCADA") system will monitor the performance of the biogas plant. If a fault occurs then a message is automatically sent to the engineer preventing emergency situations. Warning signs and security infrastructure will be in place around the site in accordance with Health and Safety Legislation to protect workers, including visitors and contractors. To mitigate occurrence of accidents during the operational phase, hazards will be identified and risks will be quantified. The following controls are included within the design to reduce and control hazards:

- The plant will be operated in accordance with the requirements of an accredited safety management system, such as ISO 45001;
- The plant has been designed to reduce risks from hazards
- All infrastructure associated with the collection and storage of gas will installed and tested by competed engineers.
- An enclosed flare is included for use in emergency situations;
- Pressure relief valves will be fitted to gas domes;
- CHP unit is installed to combust biomethane produced resulting in electricity and heat being generated for process use;
- Annual routine maintenance will be carried at the plant
- Workers will be required to wear appropriate PPE and carry personal gas detection monitors when working in certain areas of the plant and when carrying out certain activities.

Other mitigation measures to ensure that adverse effects do not occur as a result of the operation include:

- Feedstocks will not be handled outside the main processing building;
- The feedstock building is totally enclosed with access to the feedstock reception area only possible through the air lock lobby using automated rapid open/shut doors;
- The extraction system and odour control unit serving the feedstock building will ensure that the inside of the building is maintained under negative pressure. This prevents uncontrolled fugitive odour emissions when access doors are opened;

- Air extracted from the feedstock reception building is treated using the odour control system before exhausting and dispersing to atmosphere;
- The digester and digestate storage vessels will be constructed in concrete (cast in situ) to ensure integrity of the structure. Integrity testing of all structures will be undertaken as part of commissioning works. The digester and digestate storage vessels will also be fitted with air tight covers to prevent uncontrolled releases of gases /odours;
- The design of the site includes for the construction of an outer concrete bund which will encompass and contain spillage associated with site activities. The tank farm (digesters and digestate storage vessels) will also be constructed within a purposely building concrete bund designed in accordance with best practice to contain 25% of the overall tank farm volume.
- Further mitigation in relation to the construction and operation of the plant is provided with Chapters 5 to 13 of the EIAR.

Post mitigation, impacts to population and human health during the operation stage of the development are predicted as being long-term, direct and indirect slight/moderate positive

4.6 Residual Impacts

It is anticipated that the proposed Sustainable Bio-Energy Limited Biogas Plant will realise significant positive overall benefit to the local community and wider region. No residual negative impacts are predicted.

4.7 Summary of Significant Impacts

The assessment has not identified any likely significant impacts from the development proposal which will negatively impact on population and human health.

4.8 Statement of Significance

This Chapter has assessed the significance of potential effects of the proposed EIA Development on population and human health. The development proposal has been assessed as having the potential to result in effects of a slight positive, long term impact overall.

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5 BIODIVERSITY

5.1 Introduction

5.1.1 Background

Woodrow Sustainable Solutions Ltd ("Woodrow") was engaged by Sustainable Bio-Energy Ltd to undertake an ecological survey on land situated in the townlands of Ballynamantan, Kinincha and Glenbrack approximately 0.8km north of Gort in Co. Galway (*"the Application Site"*) for a proposed Biogas Plant and associated infrastructure including an access road coming in from the north west ("the Proposed EIA Development"), and to assess its potential impact on habitats, species and the receiving environment. Full details of the proposed EIA Development are provided in Chapter 2: Project Description.

The Proposed EIA Development is proposed for lands in the townlands of Ballynamantan, Glenbrack and Kinincha approximately 0.8km north east of Gort in Co. Galway ("the Proposed Development Site") and is accessed via the N18/R458 to the north west of the Application Site.

This chapter of the Environmental Impact Assessment Report ("EIAR") evaluates the effects of the Proposed EIA Development on biodiversity and the receiving environment. The assessment details the methods used to establish the terrestrial biodiversity interest within the Application Site and hinterland area, and the process used to determine the nature conservation importance of the habitats, species and populations present. It then sets out the potential effects on local biodiversity during the construction, operation and decommissioning of the Proposed EIA Development and assesses the significance of these effects. Measures to mitigate any significant effects are then proposed. In addition, to considering potential impacts on flora and fauna, this chapter also considers impacts on designated sites.

This Biodiversity Chapter is supported by a Natura Impact Statement which is submitted in support of the planning application.

PLANNING & DEVELOPMENT SECTION
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5.1.2 Legislation and Guidance

This chapter has been undertaken with full account of legislation, policy and guidance relating to species and habitat protection, importance and survey protocol. The guiding legislation, policy and guidance includes the following:

LEGISLATION

EU Habitats Directive 92/43/EEC, European Communities (Natural Habitats) Regulations 1997, European Communities (Birds and Natural Habitats) Regulations 2011

The Habitats Directive provides the basis of protection for Natura 2000 sites, namely Special Protection Areas ("SPAs") and Special Areas of Conservation ("SACs"). Article 6 of the EU Habitats Directive requires that any proposal that may have a significant effect on a European Site/ Natura 2000 Site must be subject to an Appropriate Assessment. An Appropriate Assessment is required in order to ascertain the potential impact of a proposal on the reasons for which the Natura 2000 Site is designated, and thereby ascertain the potential for adverse impact on the integrity of the site. A proposal that may adversely impact the integrity of a Natura 2000 Site may not be consented except in the absence of Feasible Alternative Solutions and in the event of Overriding Public Interest. A Natura Impact Statement has been undertaken for the Proposed EIA Development. This concludes that the Proposed EIA Development will not result in an adverse impact on integrity of any European Site (Natura 2000 Site), either directly, indirectly or cumulatively.

The Habitats Directive also provides for the protection of species listed under Annex IV of the Directive wherever they occur. These species include otter and all bat species.

The Habitats Directive was transposed in to Irish law by the European Communities (Natural Habitats) Regulations 1997 and subsequently amended in the European Communities (Birds and Natural Habitats) Regulations 2011. Regulation 42 of the 2011 regulations requires that any proposal likely to have a significant effect on a European Site, alone or in combination with other operations or activities, needs to be assessed with respect to its potential impact in the Natura 2000 Site's conservation objectives (an Appropriate Assessment) and that the decision-making authority (competent authority) should be furnished with a Natura Impact Statement that incorporates a Screening Assessment and Appropriate Assessment as necessary.

Environmental Impact Assessment Directive (2011/92/EU)

European Union Directive 2011/92/EU ("the EIA Directive") considers the assessment of the effects of certain public and private projects on the environment. It has been

transposed to Irish legislation by the Planning and Development Act 2000 (as amended), and the Planning and Development Regulations (2000 – 2015) (hereafter referred to as the "2011 EIA Regulations").

The Planning and Development Act 2000 (as amended) Part X, Section 171A(1) requires that an EIA is carried out by the competent authority (i.e. the local planning authority or An Bord Pleanála):

"that shall identify, describe and assess in an appropriate manner, in light of each individual case and in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of a proposed development on the following:

(a) human beings, flora and fauna....,"

Environmental Impact Assessment Directive (2014/52/EU)

The requirements of the revised EIA Directive (2014/52/EU) ("the Revised EIA Directive"), which will be incorporated into Irish law, are taken into account by the observance of draft Revised Guidelines on the information to be contained in Environmental Impact Statements[59].

Annex IV of the Revised EIA Directive provides requirements for information to be included in the EIAR (as referred to in Article 5(1)(f). Additional emphasis has been placed on 'biodiversity' in the 2014 EIA Directive.

EU Birds Directive 79/409/EEC

EU Birds Directive 79/409/EEC ("the Birds Directive") establishes a system of general protection for all wild birds throughout the European Union. Annex I of the Birds Directive comprises 175 bird species that are rare, vulnerable to habitat changes or in danger of extinction within the European Union. Article 4 establishes clearly that wherever those species occur, they should be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in the area of distribution. Similar actions should be taken by Member States regarding migratory species, even if they are not listed in Annex I.

Bern and Bonn Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats. The Convention on the

[59] *Environmental Protection Agency. Revised Guidelines on the information to be contained in Environmental Impact Statements. Draft, September 2015. Available at: http://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes/*

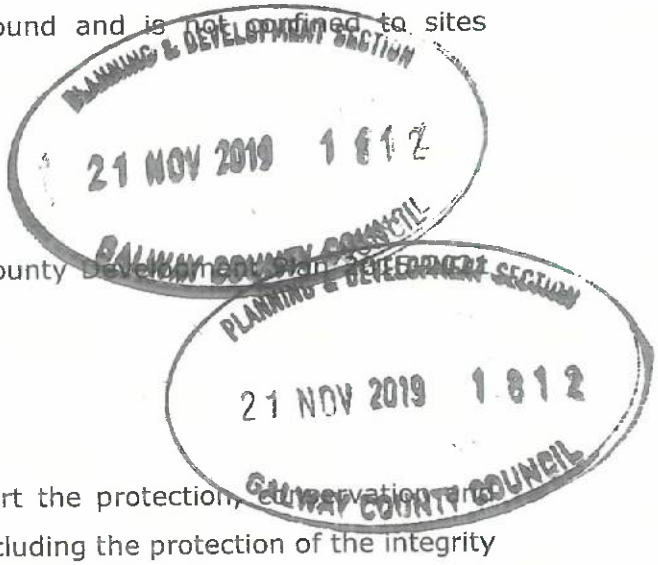
Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries.

The Wildlife Act (1976) as amended (2000)

The Wildlife Act 1976 gives protection a wide variety of birds, animals and plants in the Republic of Ireland. It is unlawful to disturb, injure or damage to their breeding or resting place wherever these occur without an appropriate licence from National Parks and Wildlife Service ("NPWS"). All birds, their nests and eggs are protected under law in Ireland through the Wildlife Act 1976 (as amended in 2000). Wilful destruction of an active nest from the building stage until the chicks have fledged is an offence. The act also provides a mechanism to give statutory protection to Natural Heritage Areas ("NHAs"). The amendment in 2000 broadens the scope of the Wildlife Acts to include most species, including the majority of fish and aquatic invertebrate species which were excluded from the 1976 Act.

Flora (Protection) Order, 1999

The Flora (Protection) Order affords protection to 56 vascular plants, fourteen mosses, four liverworts and two stoneworts. It is illegal to cut, uproot or damage the listed species in any way, or to offer them for sale. This prohibition extends to the taking or sale of seed. In addition, it is illegal to alter, damage or interfere in any way with their habitats. This protection applies wherever the plants are found and is not confined to sites designated for nature conservation.



POLICY

Galway County Development Plan 2015-2021

Relevant policies and objectives from the Galway County Development Plan ("the CDP")[60] are given below.

Natural Heritage Policies:

Policy NHB 1 – Natural Heritage and Biodiversity

It is the policy of Galway County Council to support the protection, conservation and enhancement of natural heritage and biodiversity, including the protection of the integrity of European sites, that form part of the Natura 2000 network, the protection of Natural Heritage Areas, proposed Natural Heritage Areas, Ramsar Sites, Nature Reserves, Wild Fowl Sanctuaries and Connemara National Park (and other designated sites including any future designations) and the promotion of the development of a green/ecological network

[60] *Galway County Council (2015). Galway County Development Plan 2015-2021. Written Statement. February 2015. Available at: http://www.galway.ie/en/services/planning/developmentplansandpolicy/galwaycountydevelopmentplan2015-2021/*

within the plan area, in order to support ecological functioning and connectivity, create opportunities in suitable locations for active and passive recreation and to structure and provide visual relief from the built environment.

Policy NHB 2 – Non-Designated Sites

Recognise that nature conservation is not just confined to designated sites and acknowledge the need to protect non-designated habitats and landscapes and to conserve the biological diversity in the County.

Natural Heritage Objectives:

Objective NHB 1 – Protected Habitats and Species

Support the protection of habitats and species listed in the Annexes to and/or covered by the EU Habitats Directive (92/43/EEC) (as amended) and the Birds Directive (2009/147/EC), and regularly occurring-migratory birds and their habitats and species protected under the Wildlife Acts 1976-2000 and the Flora Protection Order.

Objective NHB 2 – Biodiversity and Ecological Networks

Support the protection and enhancement of biodiversity and ecological connectivity within the plan area, including woodlands, trees, hedgerows, semi-natural grasslands, rivers, streams, natural springs, wetlands, stonewalls, geological and geo-morphological systems, other landscape features and associated wildlife where these form part of the ecological network and/or may be considered as ecological corridors or stepping stones in the context of Article 10 of the Habitats Directive.

Objective NHB 5 – Control of Invasive and Alien Invasive Species

Where the potential for spread of invasive species is identified as part of a development proposal the developer will be required to submit an invasive species management plan. A landscaping plan will be required for developments near water bodies and ensure that such plans do not include alien invasive species.

Objective NHB 6 – Protection of Bats and Bats Habitats

Seek to protect bats and their roosts, their feeding areas, flight paths and commuting routes. Ensure that development proposals in areas which are potentially important for bats, including areas of woodland, linear features such as hedgerows, stonewalls, watercourses and associated riparian vegetation which may provide migratory/foraging uses shall be subject to suitable assessment for potential impacts on bats. This will include an assessment of the cumulative loss of habitat or the impact on bat populations and activity in the area and may include a specific bat survey. Any assessment shall be carried out by a suitably qualified professional and where development is likely to result in

significant adverse effects on bat populations or activity in the area, development will be prohibited or require mitigation and/or compensatory measures, as appropriate.

Objective NHB 9 – Inland Waterways

Protect the amenity and recreational value of navigable and non-navigable waterways.

Objective NHB 11 – Trees, Parkland/Woodland, Stonewalls and Hedgerows

a) Protect important trees, tree clusters and hedgerows within the County and ensure that development proposals take cognisance of significant trees/tree stands. Ensure that all planting schemes use suitable native variety of trees of Irish provenance;

b) Seek to retain natural boundaries, including stonewalls, hedgerows and tree boundaries, wherever possible and replace with a boundary type similar to the existing boundary where removal is unavoidable. Discourage the felling of mature trees to facilitate development and encourage tree surgery rather than felling where possible. All works to be carried out in accordance with the provisions of the Forestry Act, 1946.

Objective NHB 12 – Soil/Ground Water Protection

Developments shall ensure that adequate soil protection measures are undertaken, where appropriate, including investigations into the nature and extent of any soil/groundwater contamination.

Objective NHB 14 – Protection of Riparian Zones

Protect the riparian zones of watercourse systems throughout the County, recognising the benefits they provide in relation to flood risk management and their protection of the ecological integrity of watercourse systems and ensure they are considered in the land use zoning in Local Area Plans.

<u>Bio-Energy policies:</u>

Policy ER 3 – Security of Supply

Facilitate the strategic goal of effective balanced regional development through the implementation of policies that will deliver reliable and effective energy networks and electricity grid for the West Region including County Galway, minimising environmental impact by:

a) Promoting and supporting the provision of secure and efficient energy supply and storage including electricity, gas, and renewable energy including wind, wave/tidal, solar, bio-energy and heat energy distribution;

Objective ER 4 – Renewable Energy

a) Support and facilitate the sustainable development and use of appropriate renewable energy resources and associated infrastructure within the County, including;

- Wind Energy;
- Wave/Tidal Energy;
- Hydro-Power;
- Solar Energy;
- Bio-Energy;
- Geo-Thermal;
- Combined Heat Power (CHP);
- Heat Energy Distribution (such as District Heating/Cooling Systems); and
- Other renewable energy sources, as appropriate and in line with national guidelines for sustainable development.

b) The Council shall commence a County Renewable Energy Strategy within the lifetime of the plan as resources permit. This document will also take micro generation options into account and will recognise that renewable energy projects are not just limited to large scale infrastructural projects.

GUIDANCE

Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities (2010)

The 'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities' (2010) ("the Appropriate Assessment Guidance")[61] provides methodological and legislative guidance on Appropriate Assessment for any proposals that may impact on Natura 2000 sites in Ireland. These guidelines are highly relevant in assessing the potential impact on neighbouring Natura 2000 sites.

CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal:

The 'CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal' (2016)[62] (the CIEEM Guidelines"), published by the Chartered Institute of Ecology and Environmental Management ("CIEEM"), are the acknowledged reference on ecological impact assessment and reflect the current thinking on good practice in ecological impact assessment across the UK and Ireland. They are consistent

[61] *Department of Environment, Heritage and Local Government, 2009. Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf*

[62] *CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.*

with the British Standard on Biodiversity, which provides recommendations on topics such as professional practice, proportionality, pre-application discussions, ecological surveys, adequacy of ecological information, reporting and monitoring.

These CIEEM Guidelines have the endorsement of the Institute of Environmental Management and Assessment ("IEMA"), the Chartered Institute of Water and Environmental Management, Northern Ireland Department of the Environment, Scottish Natural Heritage, The Wildlife Trusts and other leading environmental organisations.

Guidelines on the information to be contained in Environmental Impact Statements[63]

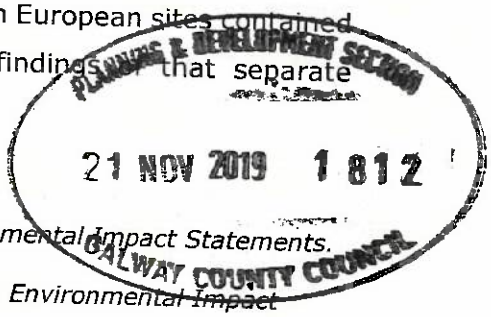
The Environmental Protection Agency's 2002 'Guidelines on the information to be contained in Environmental Impact Statements' were prepared in response to the 1992 Environmental Protection Agency Act (Section 72), which states that those preparing and evaluating Environmental Impact Statements shall have regard to such guidelines. The aim of these Guidelines is to improve the quality of Environmental Impact Statements in Ireland, and as such they address a wide range of project types and potential environmental issues.

EPA Draft revised guidelines on the information to be contained in Environmental Impact Statements[64]

The EPA Draft revised guidelines on the information to be contained in Environmental Impact Statements ("the revised EPA Draft Guidelines") have been produced by the Environmental Protection Agency in response to the adoption of revised Environmental Impact Assessment Directive 2014/52/EU. The new guidelines also incorporate experience arising from EU and Irish court cases, appeals and various pieces of new legislation adopted since the publication of the previous (2002) guidelines.

The revised EPA Draft Guidelines provide guidance on the principles and associated practice of preparing Environmental Impact Statements, with the aim of ensuring that the information that they contain is available in a format that is clear, concise and accessible to the greatest number of people.

The revised EPA Draft Guidelines state "A biodiversity section of an EIAR, for example, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement, but it should refer to the findings of that separate assessment". This approach has been adopted in this report.



[63] *EPA (2002). Guidelines on the information to be contained in Environmental Impact Statements. EPA, 2002*
[64] *EPA (2015). Revised Guidelines on the information to be contained in Environmental Impact Statements. Draft report.*

5.1.3 Overview of the Proposal

A full description of the EIA Development is provided in Chapter 2: Project Description of the EIAR. The EIA Development consists of:

- A biogas plant including digesters, odour control unit, gas purification and bottling plant, carbon dioxide compression building, gas flare and gas booster station, combined heat and power unit, control building, boiler house, foul effluent drain, lighting and security system and surface water drainage, and associated infrastructure including an access road and other hardstands areas

The Proposed EIA Development within the Application Site is illustrated in Figure 5.2: Proposed EIA Development Layout.

5.2 Assessment Methodology and Significant Criteria

5.2.1 Baseline Survey

Field surveys of the terrestrial ecology of the Application Site were undertaken following appropriate approaches for the relevant target habitats and species. These are outlined in **Table 5.1**. The importance of the habitats and species present is evaluated using the CIEEM Guidelines.

The sections below describe the methods used to survey and identify valued ecological receptors within, or surrounding, the Application Site and assess potential effects which may occur as a result of the Proposed EIA Development.

5.2.2 Desktop Study

A desktop survey was undertaken to gather information on the likely occurrence of species in the general area prior to the survey visits so that a targeted approach to surveying could be undertaken. Information was gathered online from a variety of sources including the National Biodiversity Data Centre ("NBDC") and National Parks and Wildlife Service ("NPWS") online database. The databases used to inform the desk study were:

- OSI Map Viewer;
- NBDC online map viewer;
- EPA online map viewer;
- NPWS Map Viewer;
- NPWS site synopses;

- Bat Conservation Ireland[65]; and,
- EPA Appropriate Assessment online tool[66].

Potential for the occurrence of breeding and wintering birds at the Application Site was further informed by consultation with distributional references including Balmer et al. (2013) and Crowe (2005).

5.2.3 Protected Areas / Designated Sites

Shapefiles of designated areas in Ireland, including NHAs, SPAs and SACs were downloaded from the NPWS website and imported into ArcGIS. Proximity of the proposal to designated areas and potential for connectivity with the proposal was assessed using ArcGIS, orthophotographs and Ordnance Survey maps as well as shapefile datasets of watercourses as potential connecting features. The potential for connectivity (such as resulting from joining watercourses or proximity) with the proposal was assessed using available datasets and professional judgement.

5.2.4 Field Work

Field surveys of the terrestrial ecology of the Proposed Development Site were undertaken following appropriate approaches for the relevant target species. These are outlined in Table 5.1. The importance of the habitats and species present is evaluated using the CIEEM Guidelines. The sections below describe the methods used to survey and identify valued ecological receptors and assess potential effects which may occur as a result of the proposal. Table 5.1 details the surveys and investigation and ongoing monitoring undertaken at the Proposed Development Site. Field surveys have been ongoing since December 2017. The results from these surveys, in combination with the desk study have informed the findings of this assessment. Due to the seasonal constraints associated with the commencement of the project and the required planning submission timelines, additional surveys are ongoing and the results will be used to provide further information as required and / or other environmental requirements to be conditioned by the planning authority.

[65] *Bat Conservation Ireland website: http://www.batconservationireland.org (Accessed September 2019)*
[66] *EAP Appropriate Assessment Tool: https://gis.epa.ie/EPAMaps/AAGeoTool (Accessed September 2019)*

Table 5.1 Overview of Field Investigations Undertaken

Description	Coverage	Dates and Personnel
Site scoping	Initial walkover of Proposed Development Site. Description and identification of issues.	15 December 2017 Róisín NigFhloinn Kate Bismilla
Habitat surveys	Habitat descriptions and classification to Fossitt code, concentrating on highlighting areas of conservation importance	15 December 2017 Róisín NigFhloinn 27 March 2018 Mike Trewby 06 August 2019 Hazel Doyle
	Detailed Habitat descriptions and attribution to Habitats Directive Annex 1 as appropriate	30 July 2018 Róisín NigFhloinn Hazel Doye
	Updated habitat survey and habitat survey of access track.	06 August 2019 Hazel Doyle
Bat Surveys	Habitat suitability assessment and potential roost availability / suitability surveys	15 December 2017 Róisín NigFhloinn Kate Bismilla
	Deployment of static detectors and transect survey during active bat season	28 June 2018 Hazel Doyle 29 June 2018 Hazel Doyle 30 July 2018 Róisín NigFhloinn Hazel Doyle 31 July 2018 Róisín NigFhloinn Hazel Doyle 06 August 2019 Hazel Doyle 07 August 2019 Hazel Doyle 20 August 2019 Hazel Doyle
Protected terrestrial mammals survey and general	Habitat suitability and field signs surveys for otter, Irish hare, badger and other mammals	15 December 2017 Róisín NigFhloinn
	Badger survey – field signs survey and deployment of trail cameras	30 January 2018 Hazel Doyle

Description	Coverage	Dates and Personnel
walkover surveys		06 August 2019 Hazel Doyle
	Badger survey – field signs survey and collection of trail cameras	15 February 2018 Will Woodrow 20 August 2019 Hazel Doyle
Bird surveys	Winter walkover bird survey (site)	30 January 2018 Hazel Doyle 15 February 2018 Will Woodrow
	Winter bird survey (waders and wildfowl) of wetland areas adjacent to the site	15 December 2017 Kate Bismilla 30 January 2018 Hazel Doyle 15 February 2018 Will Woodrow
	Breeding bird surveys (first visit)	27 March 2018 Mike Trewby
	Breeding bird surveys (second visit)	12 June 2018 Mike Trewby 29 June 2018 Hazel Doyle

All surveys undertaken followed industry-standard methodologies within timing limitations, as detailed in the following sections. Field survey data was recorded on maps and each record was accompanied by a photo and six figure grid references using 'Locus Map' software operating on a mobile phone. As a result, the data collected could then be used in Geographical Information System ("GIS").

HABITAT SURVEYS

Habitat surveys of the Application Site were undertaken on 15 December 2017 in the form of an initial site assessment following the standard methodology described in the Heritage Council publication A Guide to Habitats in Ireland, though noting the limitations of the survey timing. A further detailed vegetation survey was conducted on 30 July 2018 using quadrats on the grassland habitat in the site. The entire Application Site was walked, ecological features of interest noted and the habitats present classified into recognised vegetation communities. An update habitat survey was conducted on the 6th August 2019 there was no change on the previous habitat data collected in 2018.

During these visits, ecological features of interest were noted and habitats classified into recognised communities outlined by Fossitt, 2000. Potential correspondence to the Annex I Habitat Classification system of the Habitats Directive was also noted and cross referenced using appropriate NPWS interpretation guidelines. Relevés (or Quadrats), see Plate 5.1, were used during vegetation surveys on 30 July 2018 to survey the vegetation of the site in more detail. Engine for Relevés to Irish Communities Assignment (ERICA) was applied to the relevé data collected in order to assign the vegetation community types (that is Irish Vegetation Classification [IVC]). Irish Vegetation Classification (IVC) During the vegetation surveys, consideration was also given to identifying habitats that could be used by protected species. Full details of the habitat assessment are provided in Section 5.3.

Plate 5.1 Example of a quadrat on grassland vegetation

BIRD SURVEYS

Bird surveys undertaken at the Application Site as part of the assessment process included both wintering and breeding bird surveys. All species seen and heard were recorded using Ecolog, the number of birds and their behaviour was also recorded. British Trust for Ornithology (BTO) codes were applied to bird data presented in the figures in this document[67].

[67] *BTO codes: https://www.bto.org/sites/default/files/u16/downloads/forms_instructions/bto_bird_species_codes.pdf (Accessed October 2019)*

WINTER BIRD SURVEYS

As shown in Table 5.1, winter bird surveys were undertaken in 2018, focusing on the wetland area adjacent to Kinincha Road on 15th December 2017, 30th January 2018 and 15th February 2018. These surveys included the recording of all bird species occurring within and adjacent to the Application Site as well as counts of all waterfowl species, their location and behaviour.

BREEDING BIRD SURVEYS

As shown in Table 5.1, a total of three breeding bird surveys were conducted within the Application Site in 2018. An early season breeding bird walkover survey was undertaken on 27th March 2018, with two additional surveys conducted on 12th June 2018 and 29th June 2018. All bird species were recorded within the Application Site along with their location and behaviour.

PROTECTED SPECIES SURVEYS

Surveys were undertaken for protected species likely to occur in the Proposed Development Site and within the immediate vicinity. Mammal surveys were also incorporated into general surveys of the Kinincha Road where new works are req

Protected species surveys undertaken included:

Terrestrial mammals

Badger (*Meles meles*) surveys were undertaken to NPWS and Transport Infrastructure Ireland ("TII") specifications. Survey methodology described in the TII (previously National Roads Authority) publication *'Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes'*[68], was followed for assessing badger activity at the Proposed Development Site. The survey recorded all signs of badger activity, and any possible setts, within and around the Proposed Development Site, with particular emphasis on the EIA Development infrastructure layout. Within the search areas, boundary and fence lines and habitats were systematically surveyed for all evidence of badgers, such as feeding areas, hair traces, latrines and paths. Field surveys included the deployment of trail cameras at appropriate locations.

Field signs and habitat suitability surveys for other species (otter, fox and Irish hare) were undertaken as part of the walkover surveys and also incorporated into other surveys and

[68] *National Roads Authority (2006). Guidelines for the Treatment of Badgers prior to the Construction of a National Road Scheme. Environmental Series on Construction Impacts. Available at: http://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Badgers-prior-to-the-Construction-of-a-National-Road-Scheme.pdf*

site visits. These surveys included the identification of suitable habitat, detection of field signs such as tracks, markings, feeding signs, droppings and scent-points, and direct observation. Trail cameras were deployed on 30th January 2018, targeting potential badger setts, and collected on 15th February 2018, see Plate 5.2 for an example of a trail camera deployed at mammal burrow. Locations along Kinincha Road where construction works are required were assessed for potential to support badgers.

Plate 5.2 Example of a trail camera deployment at Gort, August 2019

Bats

A habitat suitability assessment for bats was carried out across the Application Site in December 2017 and January 2018 for its' potential to hold habitat for foraging / roosting bats. An update habitat suitability assessment was undertaken on 6th August 2019 to confirm these results.

Bat activity surveys were carried out in summer 2018 and summer 2019 in accordance with Bat Conservation Ireland (BCI) Bats and Appropriate Assessment Guidelines on how to address adequately potential effects on lesser horseshoe bats (BCI, 2012)[69] and Bat Mitigation Guidelines for Ireland in particular the specifications for surveys in relation to planning applications affecting possible lesser horseshoe bat feeding habitat. (Keller and Marnell, 2006)[70].

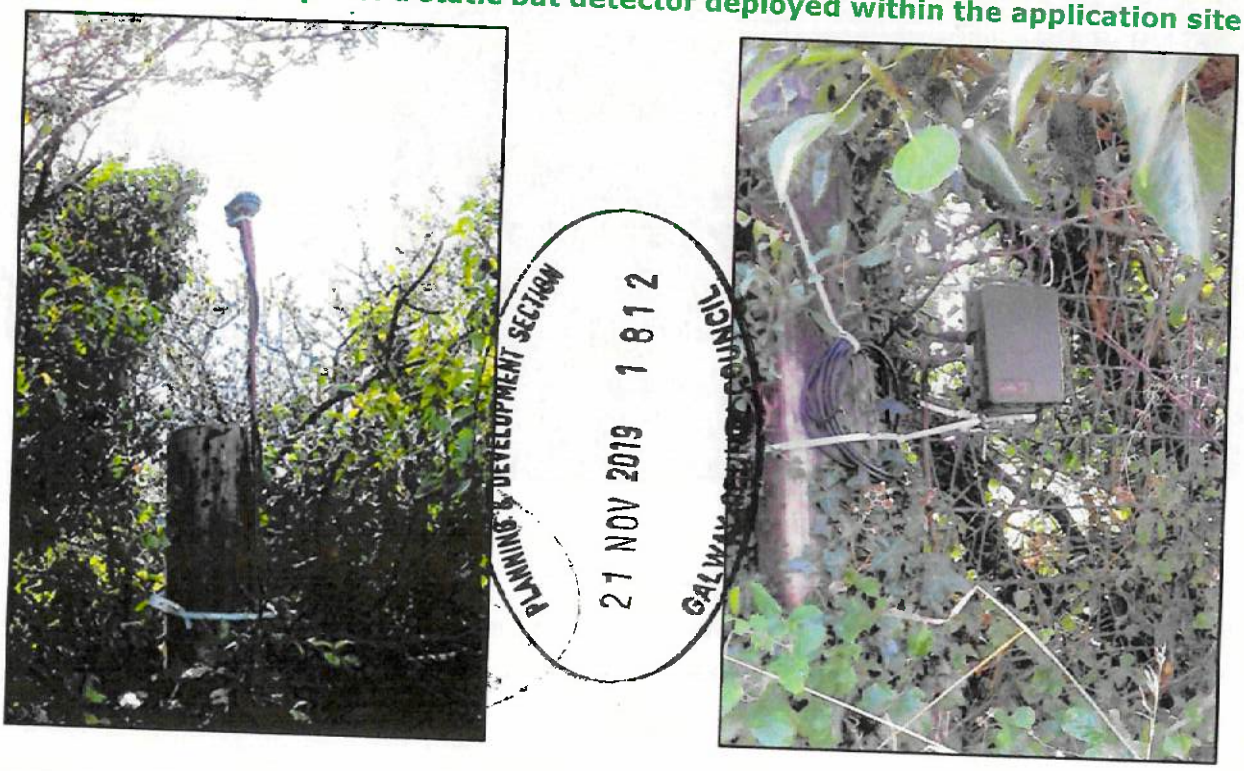
Monitoring the usage of the Application Site by bats, using SM2 static bat detector units was undertaken during the 2018 bat survey season. A total of four SM2 static bat detectors were deployed in June and July 2018, see Plate 5.3 for an example of a static bat detector. Dusk and dawn transect surveys were conducted during the 2018 and 2019

[69] *BCI Bats and Appropriate Assessment Guidelines https://www.batconservationireland.org/wp-content/uploads/2013/09/BCIreland-AA-Guidelines_Version1.pdf (Accessed September 2019)*
[70] *Bat Mitigation Guidelines for Ireland https://www.npws.ie/sites/default/files/publications/pdf/IWM25.pdf (Accessed September 2019)*

bat survey seasons. Bat activity surveys and roost presence/ absence surveys were undertaken in compliance with BCT Good Practice Guidelines (Collins, 2016) and BCI Bats and Appropriate Assessment Guidelines (BCI, 2012).

Consultation was also undertaken with BCI in March 2018 and again in September 2019, to ascertain any records or known roosts within 10 km of the Proposed EIA Development. In addition, the NBDC bat landscapes database was consulted.

Plate 5.3 Example of a static bat detector deployed within the application site



5.2.5 Impact Assessment Methodology

The impact assessment methodology applied is from the CIEEM Guidance, as well as building on other methodologies for faunal groups. The general approach is to identify and characterise potential impacts, assess the magnitude / extent and probability of occurrence of each impact, and relate these factors to the value and sensitivity of the receptor. These terms are quantified in the following subsections.

IDENTIFYING ECOLOGICAL FEATURES WITHIN THE ZONE OF INFLUENCE

Information acquired during the desk-study and field surveys determines those ecological features which have the potential to be affected by the proposed EIA Development and as such occur within the *'zone of influence'* of the proposed EIA Development. The zone of influence depends on the type of development taking place, its likely impacts and the presence of ecological connections which provide a pathway for such impacts to an

ecological feature of interest which is sensitive to such impacts. As such, the zone of influence may extend beyond the boundaries of the Proposed Development Site due to the presence of ecological connections with an ecological feature of interest. Similarly, ecological features which have no ecological connection with the proposed EIA Development, and as such no pathway for impacts, are not within the zone of influence regardless of their proximity to the proposed EIA Development. Any such ecological / hydrological connections which provide pathways for impacts are identified and described below.

EVALUATING ECOLOGICAL FEATURES WITHIN THE ZONE OF INFLUENCE

Those ecological features which occur within the zone of influence such as nature conservation sites, habitat or species are then evaluated in geographic hierarchy of importance. Depending on the receptor's status and its context in the wider area, its nature conservation value may be assigned one of the categories detailed in Table 5.2.

Approaches to attributing nature conservation value to species have been developed for some specific groups such as bats and birds. The approach outlined in 'Valuing Bats in Ecological Impact Assessment'[71] is summarized in Table 5.3 and Table 5.4 (Note – guidance on attributing rarity and ascertaining what constitutes a 'small' or 'large' number exists but is not reproduced here). Table 5.5 lists the conservation status of individual Irish bat species.

Table 5.2 Geographic frame of reference used to determine value of ecological resources (NRA 2009).

Importance	Criteria
International Importance	• 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. • Proposed Special Protection Area (pSPA). • Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). • Features essential to maintaining the coherence of the Natura 2000 Network • Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. • Resident or regularly occurring populations (assessed to be important at the national level) of the following: ▪ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; ▪ and/or ▪ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.

[71] *Wray S, Wells D, Long E, Mitchell-Jones T (December 2010). Valuing Bats in Ecological Impact Assessment, IEEM In-Practice p 23-25*

Importance	Criteria
	• Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). • World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). • Biosphere Reserve (UNESCO Man & The Biosphere Programme) • Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). • Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). • Biogenetic Reserve under the Council of Europe. • European Diploma Site under the Council of Europe. • Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance	• Site designated or proposed as a Natural Heritage Area (NHA). • Statutory Nature Reserve. • Refuge for Fauna and Flora protected under the Wildlife Acts. • National Park. • Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. • Resident or regularly occurring populations (assessed to be important at the national level) of the following: ▪ Species protected under the Wildlife Acts; and/or ▪ Species listed on the relevant Red Data list. ▪ Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance	• Area of Special Amenity. • Area subject to a Tree Preservation Order. • Area of High Amenity, or equivalent, designated under the County Development Plan. • Resident or regularly occurring populations (assessed to be important at the County level) of the following: ▪ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; ▪ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; ▪ Species protected under the Wildlife Acts; and/or ▪ Species listed on the relevant Red Data list. ▪ Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. • County important populations of species; or viable areas of semi-natural habitats; or natural heritage features identified in the National or Local BAP; if this has been prepared. • Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. • Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance	• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;

Importance	Criteria
(Higher Value)	• Resident or regularly occurring populations (assessed to be important at the Local level) of the following: ▪ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; ▪ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; ▪ Species protected under the Wildlife Acts; and/or ▪ Species listed on the relevant Red Data list. ▪ Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; • Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower Value)	• Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; • Sites or features containing non-native species that is of some importance in maintaining habitat links.

Table 5.3 Scoring system for valuing the presence of recorded commuting and foraging bats

Geographic Frame Reference	Score
Regional	31-40
County	21-30
District / Local / Parish	11-20
Not Important	1-10

Table 5.4 Methodology for valuing foraging areas (scoring in brackets)

Species	Number of Bats	Roosts / Potential Roosts Nearby	Foraging Habitat Characteristics
Common (2)	Individual bats (5)	None (1)	Industrial or other site without established vegetation (1)
		Small number (3)	Suburban areas or intensive arable land (2)
Rarer (5)	Small number of bats (10)	Moderate number / Not known (4)	Isolated woodland patches, less intensive arable and / or small towns and villages (3)
		Large number of roosts or close to NHA for species (5)	Larger or connected woodland blocks, mixed agriculture, and small villages (4)
Rarest (20)	Large number of bats (20)	Close to or within SAC for species (20)	Mosaic of pasture, woodlands and wetland areas (5)

Table 5.5 Conservation status of bat species in Ireland (taken from an aggregate of Roche at al, 2014[72] and Marnell *et al.* 2009)[73] (those considered to have reasonable potential to occur at the site are in bold)

Species	Common Name	Population trend	Irish Red List status
Myotis daubentonii	Daubenton's bat	Favourable	Least Concern
Myotis mystacinus	Whiskered bat	Unknown	Least Concern
Myotis nattereri	Natterer's bat	Unknown	Least Concern
Nyctalus leisleri	Leisler's bat	Increasing	Near Threatened
Pipistrellus nathusii	Nathusius' pipistrelle	Limited data, probably stable	Least Concern
Pipistrellus	Common pipistrelle	Stable / Increasing	Least Concern
Pipistrellus pygmaeus	Soprano pipistrelle	Stable / Increasing	Least Concern
Plecotus auritus	Brown long-eared bat	Stable	Least Concern
Rhinolophus hipposideros	Lesser horseshoe bat	Stable	Least Concern
Myotis brandtii	Brandt's bat	Unknown	Data deficient
Rhinolophus ferrumequinum	Greater horseshoe bat	Unknown	Not listed – rare and endangered in UK

Key Ecological Features are those features which are within the zone of influence and are evaluated as being of Local Importance (Higher Value) or greater.

IDENTIFICATION AND CHARACTERISATION OF IMPACTS

When describing ecological impacts reference should be made to the following characteristics;

- positive or negative;
- extent;
- magnitude;
- duration;
- timing;
- frequency; and,
- reversibility.

The magnitude of an impact refers to its size, amount, intensity and volume. Impact magnitude depends upon the nature and sensitivity of a receptor and the range of potential

[72] *Roche, N., Aughney, T., Marnell, F., and Lundy, M (2014) Irish bats in the 21st Century. Bat Conservation Ireland.*
[73] *Marnell, F., Kingston, N. & Looney, D. (2009). Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.*

effects arising from the construction and operation of a proposed development. For the purposes of this assessment, the impact magnitude is influenced by the intensity, duration, frequency and reversibility of a potential impact. When quantifying impact magnitude, its potential to impact upon long-term populations and the integrity of the ecological system should be taken into account.

However, the assessment only needs to describe those characteristics relevant to understanding the ecological effect and determining the significance and as such does not need to incorporate all stated characteristics (CIEEM, 2016).

IMPACT PROBABILITY

The likelihood that an impact will occur is categorized to be:

- Certain/ near certain – probability of occurrence estimated at 95% chance or higher;
- Probable – probability of occurrence estimated above 50% but below 95%;
- Unlikely – probability of occurrence estimated above 5% but less than 50%; and
- Extremely unlikely – probability of occurrence estimated at less than 5%.

SIGNIFICANT EFFECTS ON KEY ECOLOGICAL FEATURES

For the purpose of EcIA, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for those ecological features which have been identified as important (Key Ecological Features). Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy). As such effects can be considered significant in a wide range of geographic scales from international to local. Consequently, 'significant' effects should be qualified with reference to the appropriate geographic scale (CIEEM, 2016).

IMPACT SIGNIFICANCE (DEGREE OF IMPACT)

The significance of impacts relates to the value and sensitivity of the receptor, combined with the overall level of the impact. The more ecologically valuable a receptor and the greater the potential impact, the higher the significance of that impact is likely to be.

The value of the receptor takes into account its importance at international, national, regional and local levels. The overall level of impact of a given action is dependent on a combination of factors including impact magnitude, timing, duration, reversibility and probability, as well as the sensitivity of the receptor. Each of these factors is taken into consideration in order to determine the overall significance of each individual impact.

ASSESSMENT OF RESIDUAL IMPACTS AND EFFECTS

After characterising the potential impacts of the Development and assessing the potential effects of these impact on the *'Key Ecological Features'* mitigation measures are proposed to avoid and / or mitigate the identified ecological effects. Once measures to avoid and mitigate ecological effects have been finalised, assessment of the residual impacts and effects should be undertaken to determine the significance of their effects on the *'Key Ecological Features'*.

ASSESSMENT OF CUMULATIVE IMPACTS AND EFFECTS

Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location (CIEEM, 2016). Different types of actions can cause cumulative impacts and effects. As such, these types of impacts may be characterised as;

- Additive/incremental – in which multiple activities/projects (each with potentially insignificant effects) add together to contribute to a significant effect due to their proximity in time and space (CIEEM, 2016).
- Associated/connected – a development activity 'enables' another development activity e.g. phased development as part of separate planning applications. Associated developments may include different aspects of the project which may be authorised under different consent processes. It is important to assess impacts of the 'project' as a whole and not ignore impacts that fall under a separate consent process (CIEEM, 2016).

5.3 Description of the Receiving Environment

5.3.1 Site Description

The Application Site abuts the western side of the Kinincha Road (a minor road leading north from Gort town). The site lies east of the M18 and the R458/N18 (which run parallel to the west of the Application Site). The majority of the Application Site lies approximately 900m north of Gort town at approximate Grid Reference: M 45490 03291. The proposed biogas plant, which occupies an area of c. 10.01 ha, is currently used for horse grazing and as an exercise track for horses.

The general area where the Application Site is situated is within an area of High groundwater vulnerability which is due to its karst landscape (the stratigraphy here is Burren Limestone). The environs support a concentration of limestone lakes and turloughs*. The Gort River/Castletown River runs to the east of the site (immediately

adjacent to the north-east site extents) and Ballynamantan Lake is situated c. 360 m north of the site boundary. The Coole-Garryland Complex Special Area of Conservation (SAC) lies c. 900 m to the west of the Proposed EIA Development. Turloughs* (a European priority habitat) are one of the reasons for the designation of this SAC, and the groundwater within this area is sensitive to changes in water levels and water quality impacts. The groundwater body in which the Application Site is situated is the Groundwater Dependent Terrestrial Ecosystem (GWDTE) Caherglassaun Turlough* (SAC000238). The central area of this particular turlough* (and its' SAC boundary) lies directly c. 4.6 km northwest of the Application Site, however, the SAC shares a groundwater body with the Application Site. The proposed location for the Biogas Plant is surrounded by improved agricultural land to the west, north and north-east. Calcareous grassland, scrub and wet grassland exists to the south and east of the site.

The Application Site (bar the area for the proposed access track) has undergone clearance works in the past. According to the online historic mapping[74], pre-1995 much of this area supported dense scrub and grassland along its central and eastern extents, while the north and west extents appeared to have been managed for agriculture. Large extents of the Application Site, if not the entire site, were cleared (according to the Aerial mapping from 2000), and re-vegetated by 2005. However, the Application Site continues to support a mosaic of rough grassland, wet and calcareous grassland.

5.3.2 Designated Areas

INTERNATIONALLY DESIGNATED SITES WITHIN THE POTENTIAL ZONE OF INFLUENCE OF THE EIA DEVELOPMENT

Internationally designated sites within the potential zone of influence of the Proposed EIA Development are listed in Table 5.6 below. This sets out potential connectivity for all sites within 15 km. Figure 5.1 shows the Natura 2000 Sites within 15 km of the Application Site.

NATIONALLY DESIGNATED SITES WITHIN THE POTENTIAL ZONE OF INFLUENCE OF THE EIA DEVELOPMENT

Nationally designated sites within the potential zone of influence of the Proposed EIA Development are listed in Table 5.7 below. This sets out potential connectivity for all sites within 15 km. Figure 5.2 shows the NHS within 15 km of the Application Site.

[74] *GeoHive – Ordnance Survey Ireland: http://map.geohive.ie/mapviewer.html (Accessed September 2019).*

Table 5.6 European Sites within 15 km of the Application Site at Gort, Co. Galway.

Light green rows delineate SAC Light Blue rows delineate SPA Purple rows delineate Ramsar

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
Coole-Garryland Complex SAC 000252	• Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation [3150] • Turloughs [3180] • Rivers with muddy banks with *Chenopodion rubri p.p.* and *Bidention p.p.* vegetation [3270] • *Juniperus communis* formations on heaths or calcareous grasslands [5130] • Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210] • Limestone pavements [8240] • *Taxus baccata* woods of the British Isles [91J0]	900m	✓ Surface water and ground water connections PLANNING & DEVELOPMENT SECTION 21 NOV 2019 1812 GALWAY COUNTY COUNCIL
Carrowbaun, Newhall and Ballylee Turloughs SAC 002293	• Turloughs* [3180]	1.35 km	✓ Potential for groundwater impacts. No surface water connection.
Coole-Garryland SPA 004107	• Whooper Swan (*Cygnus cygnus*) [A038]	1.35 km	✓ Surface water and ground water connections Potential for noise disturbance to wintering waterfowl due to close proximity to the EIA Development
Kiltartan Cave (Coole) SAC 000286	• Caves not open to the public [8310] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	1.9 km	None Hydrological connectivity will not have an impact upon the Qualifying interest of this site.

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
Coole Lough & Garryland Wood Ramsar Site 473	• This site lies within a low-lying karstic limestone area characterized by a subterranean drainage system, and is composed of turloughs surrounded by woodland, limestone heath and grassland. • The site, and adjacent nutrient-poor lakes, are the most important turlough complex in Ireland. Water levels fluctuate widely.	2.3 km	✓ Surface water and ground water connections
Eastern Burren SAC 001926	• Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140] • Turloughs [3180] • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] • Alpine and Boreal heaths [4060] • *Juniperus communis* formations on heaths or calcareous grasslands [5130] • Calaminarian grasslands of the Violetalia calaminariae [6130] • Semi-natural dry grasslands and scrubland facies on calcareous substrates *(Festuco-Brometalia)* (* important orchid sites) [6210] • Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510] • Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae [7210] • Petrifying springs with tufa formation (*Cratoneurion*) [7220] • Alkaline fens [7230] • Limestone pavements [8240] • Caves not open to the public [8310]	3.5 km	✓ There is a ground water connection between the proposed works and part of the Eastern Burren SAC. The north-eastern section of the SAC is located within the same groundwater body as the proposed works. There is no surface water connection.

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
	• Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0] • *Euphydryas aurinia* (Marsh Fritillary) [1065] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] • *Lutra* (Otter) [1355]		
Ballinduff Turlough SAC 002295	• Turloughs [3180]	3.7 km	None There is no surface water connection and the SAC is located in a different groundwater body to the EIA Development
Lough Coy SAC 002117	• Turloughs [3180]	3.75 km	✓ Lough Coy SAC is located within the same groundwater body as the EIA Development.
Lough Cutra SAC 000299	• Lesser Horseshoe Bat (*Rhinolophus hipposideros*) [1303]	3.8 km	None Lough Cutra SAC is located within the same groundwater body as the EIA. However, this will not have an impact upon the Qualifying interest of this site.
Lough Cutra SPA 004056	• Cormorant *(Phalacrocorax carbo)* [A017]	3.9 km	None Lough Cutra SPA is located within the same groundwater body as the EIA Development. However, does not have the potential to affect breeding cormorant at the site. Although cormorant will fly through and over the site *en route* to and from the Inner

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
			Galway Bay SPA, there is no suitable breeding or feeding habitat in the vicinity of the application site. The distance between the SPA and the EIA Development is too great for there to be potential for disturbance impacts affecting breeding cormorant at the SPA.
Slieve Aughty SPA 004168	• Hen Harrier *(Circus cyaneus) [A082]* • Merlin *(Falco columbarius) [A098]*	4 km	None Slieve Aughty SPA is located within the same groundwater body as the EIA Development, however this does not have the potential to affect either Qualifying Interest of the site. No other ecological connection exists. The EIA Development site does not contain suitable breeding or foraging habitat for either QI bird species of the SPA.
Caherglassaun Turlough SAC 000238	• Turloughs [3180] • Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	4.4 km	✓ There is a potential surface water connection to Caherglassaun Turlough SAC via the Cannahowna River, and potential underground flow between the proposed works and Galway Bay. Caherglassaun Turlough SAC is located within the same groundwater body as the EIA Development.

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
Termon Lough SAC 001321	• Turloughs [3180]	4.6 km	✓ No obvious surface water connectivity The northern part of the SAC lies within the same groundwater body as the EIA development
Cahermore Turlough SAC 002294	• Turloughs [3180]	5.3 km	None The SAC is located within a Karstic Turlough adjacent to the groundwater body where the EIA Development is located; however, there is no groundwater connection to the turloughs of the SAC. There is no surface water connectivity between the EIA Development and Cahermore Turlough SAC.
PeterswellTurlough SAC 000318	• Turloughs [3180] • Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270]	5.7 km	None The SAC drains into the same river system as the EIA development, but into a different tributary, and upstream of their confluence, so no potential for surface water connectivity The SAC and the EIA are located within different groundwater bodies
Drummin Wood SAC 002181	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]	6.35 km	None The qualifying habitat is not groundwater-dependent and

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
			there is no surface water connection between this SAC and the EIA Development.
Gortacarnaun Wood SAC 002180	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]	6.7 km	None The qualifying habitat is not groundwater-dependent and there is no surface water connection between this SAC and the EIA Development (the SAC is located upstream of the site).
Ardrahan Grassland SAC 002244	• Alpine and Boreal heaths [4060] • *Juniperus communis* formations on heaths or calcareous grasslands [5130] • Limestone pavements [8240]	8.5 km	None Qualifying Interests are not susceptible to hydrological connectivity – however there is no surface water connectivity and the SAC and EIA development occur in different groundwater bodies The SAC's location 8.5km north of the EIA development means that potential for airborne pollutants affecting the site is low
Cregg House Stables, Crusheen SAC 002317	• *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	9.8 km	None Hydrological connectivity will not have an impact upon the Qualifying interest of this site. Although there may be a network of bat foraging habitat

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European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
			linking the SAC to the EIA development, the distance between the two areas if too great for bats to move between the two areas.
Galway Bay Complex SAC 000268	• Mudflats and sandflats not covered by seawater at low tide [1140] • Coastal lagoons [1150] • Large shallow inlets and bays [1160] • Reefs [1170] • Perennial vegetation of stony banks [1220] • Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • *Salicornia* and other annuals colonising mud and sand [1310] • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] • Mediterranean salt meadows (Juncetalia maritimi) [1410] • Turloughs [3180] • *Juniperus communis* formations on heaths or calcareous grasslands [5130] • Semi-natural dry grasslands and scrubland facies on calcareous substrates *(Festuco-Brometalia)* (* important orchid sites) [6210] • *Calcareous fens with Cladium mariscus and species of the Caricion davallianae* [7210] • Alkaline fens [7230] • Limestone pavements [8240] • *Lutra lutra* (Otter) [1355] • *Phoca vitulina* (Harbour Seal) [1365]	10.2 km	✓ There is potential for surface and groundwater connectivity between the proposed works and the Galway Bay Complex SAC, via the Cannahowna River and potential underground flow during flood events from the turloughs of the Coole-Garryland Complex SAC.
Inner Galway Bay SPA 004031	• Great Northern Diver (Gavia immer) [A003] • Cormorant (*Phalacrocorax carbo*) [A017]	10.2 km	None

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
	• Grey Heron (*Ardea cinerea*) [A028] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Shoveler (*Anas clypeata*) [A056] • Red-breasted Merganser (*Mergus serrator*) [A069] • Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Lapwing (*Vanellus vanellus*) [A142] • Dunlin (*Calidris alpina*) [A149] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Turnstone (*Arenaria interpres*) [A169] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Common Gull (*Larus canus*) [A182] • Sandwich Tern (*Sterna sandvicensis*) [A191] • Common Tern (*Sterna hirundo*) [A193] • Wetland and Waterbirds [A999]		There is no groundwater or surface water connections between the Inner Galway Bay SPA and the EIA Development. There is potential for the foraging and wintering QI bird species of the SPA to use the suitable wetland habitat within the vicinity of the application site and curlew, lapwing, teal, grey heron and black-headed gull were recorded during the winter bird surveys. However, it is unlikely that significant numbers of birds from the SPA populations would utilise the wetland habitat around the EIA development due to the proximity of, and potential for disturbance from, residential and public shopping areas to the south west.
Moyree River System SAC 000057	• Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] • Alkaline fens [7230] • Limestone pavements [8240] • Caves not open to the public [8310] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] • *Lutra lutra* (Otter) [1355]	10.2 km	None There is no surface water connection between the proposed works and the Moyree River System SAC.
Lough Fingall Complex SAC	• Turloughs [3180] • Alpine and Boreal heaths [4060]	10.35 km	None

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
000606	• *Juniperus communis* formations on heaths or calcareous grasslands [5130] • Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] • Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae [7210] • Limestone pavements [8240] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]		No surface water connectivity The SAC and EIA development occur in different groundwater bodies
Castletaylor Complex SAC 000242	• Turloughs [3180] • Alpine and Boreal heaths [4060] • *Juniperus communis* formations on heaths or calcareous grasslands [5130] • Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] • Limestone pavements [8240]	10.6 km	None No surface water connectivity The SAC and EIA development occur in different groundwater bodies
Kiltiernan Turlough SAC 0001285	• Turloughs [3180]	10.6 km	None No surface water connectivity The SAC and EIA development occur in different groundwater bodies
Sonnagh Bog SAC 001913	• Blanket bogs (*if active bog) [7130]	10.85 km	✓ Blanket bogs are classed as groundwater-dependent terrestrial ecosystems by the EPA. Sonnagh Bog is located within the same groundwater body as the EIA development. There is also potential for airborne nitrogen deposits,

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
			ammonia and sulphur dioxide affecting the blanket bog habitat habitat, due to the direction of the prevailing wind.
Ballyogan Lough SAC 000019	• Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae [7210]	12 km	None There is no surface water or groundwater connectivity between Ballyogan Lough SAC and the EIA development.
Rahasane Turlough SAC 000322	• Turloughs [3180]	14.1 km	✓ Rahasane Turlough SAC is located within the same groundwater body as the EIA Development.
Rahasane Turlough SPA 004089	• Whooper Swan (*Cygnus cygnus*) [A038] • Wigeon (*Anas penelope*) [A050] • Golden Plover (*Pluvialis apricaria*) [A140] • Black-tailed Godwit (*Limosa limosa*) [A156] • Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] • Wetland and Waterbirds [A999]	14.3 km	✓ Rahasane Turlough SPA is located within the same groundwater body as the EIA Development. An ecological pathway also exists as there is a potential for the foraging, wintering Qualifying Interest bird species of the SPA to use the suitable wetland habitat within the vicinity, to the east of the EIA Development. However, none of the QI bird species of the SPA were recorded during the winter bird surveys at the development site and it is unlikely that significant numbers

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
			of birds from the SPA populations would utilise the wetland habitat around the EIA development due to the proximity of, and potential for disturbance from, residential and public shopping areas to the south west.
Glendree Bog SAC 001912	• Blanket bogs (* if active bog) [7130]	14.5 km	✓ Glendree Bog SAC is located within the same groundwater body as the EIA Development. There is also potential for airborne nitrogen deposits affecting the blanket bog habitat

Figure 5.1 **Natura 2000 sites within 15km of the proposed EIA Development**

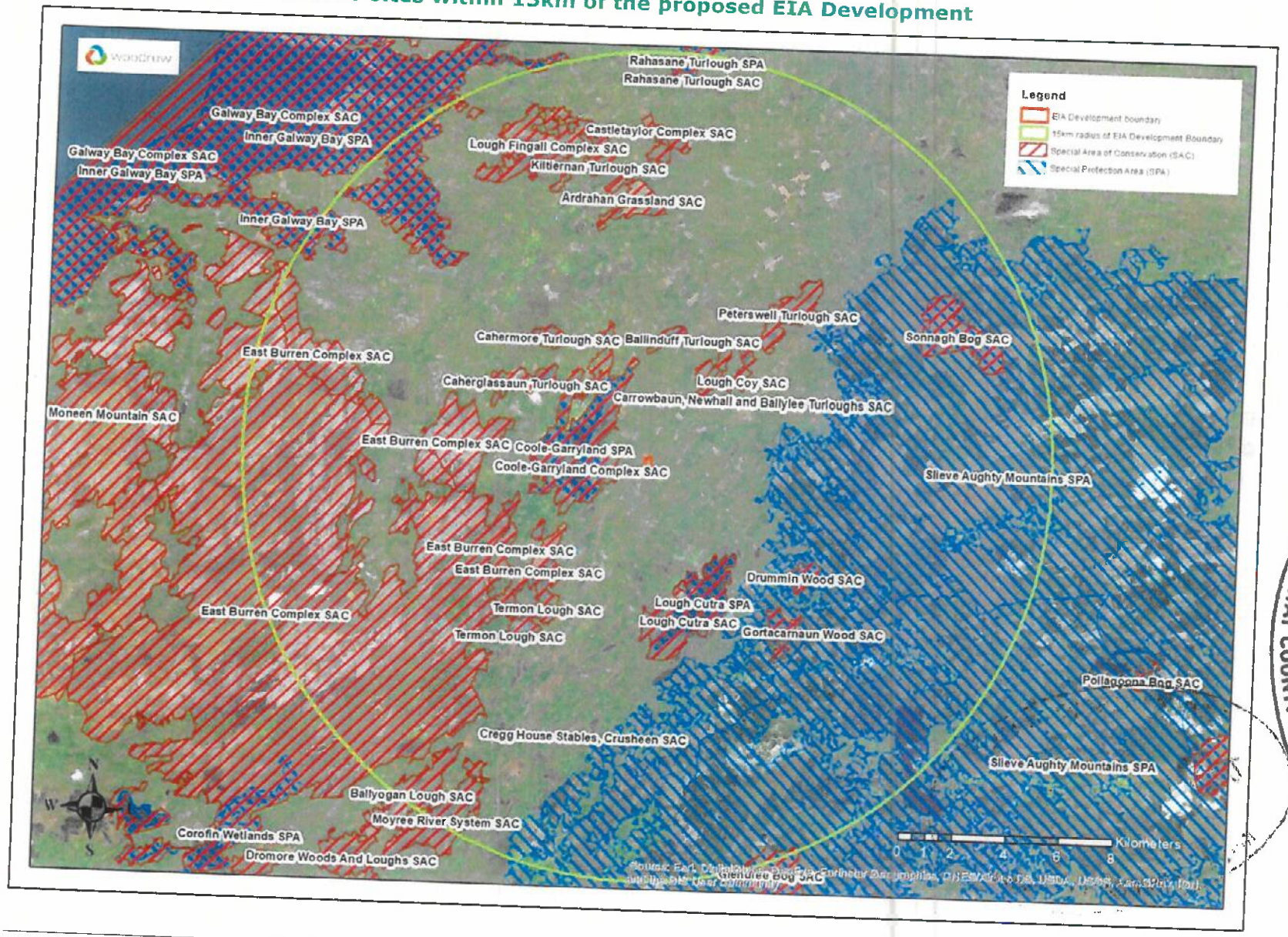

Table 5.7 Natural Heritage Areas (NHAs) & proposed pNHAs within 15 km of the EIA development at Gort, Co. Galway.

Assumed sites election features where site synopses are not available are highlighted in green cells.

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
Coole-Garryland Complex pNHA 000252	• Natural eutrophic lakes • Turloughs • Rivers • *Juniperus communis* formations on heaths or calcareous grasslands • Semi-natural dry grasslands and scrubland facies on calcareous substrates • Limestone pavements • *Taxus baccata* woods • Whooper Swan (*Cygnus cygnus*) [A038] (Assumed - site synopsis not available)	1 km	✓ There is potential for both surface water and ground water connections between the Coole-Garryland Complex pNHA and the EIA development
Kiltartan Cave (Coole) pNHA 000286	• Caves • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) (Assumed - site synopsis not available)	2 km	✓ Hydrological connectivity will not have an impact upon the Qualifying interest of this site.
Pollduagh Cave, Gort pNHA 000320	• A water-filled limestone cave at the rising of the Cannahowna River, supporting a nursery colony of Daubenton's bat (*Myotis daubentonii*) (Assumed - site synopsis not available)	2.85 km	✓ Pollduagh cave is located upstream of the EIA development, on the same river system. The features of interest of the pNHA do not have any potential to be affected by changes in groundwater quality.
East Burren Complex pNHA 001926	• Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. • Turloughs	3.5 km	✓ There is a potential ground water connection between the proposed works

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
	• Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation • Alpine and Boreal heaths • *Juniperus communis* formations on heaths or calcareous grasslands • Calaminarian grasslands • Semi-natural dry grasslands and scrubland facies on calcareous substrates] • Lowland hay meadows • Calcareous fens • Petrifying springs with tufa formation • Alkaline fens • Limestone pavements • Caves • Alluvial forests • *Euphydryas aurinia* (Marsh Fritillary) • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) • *Lutra lutra* (Otter) (Assumed - site synopsis not available)		and part of the Eastern Burren Complex pNHA. The north-eastern section of the pNHA is located within the same groundwater body as the proposed works. There is no potential for surface water connection.
Lough Cutra pNHA 000299	• Lesser Horseshoe Bat (*Rhinolophus hipposideros*) • Cormorant *(Phalacrocorax carbo)* (Assumed - site synopsis not available)	3.8 km	None Lough Cutra pNHA is located within the same groundwater body as the EIA. However, this will not have an impact upon the Qualifying interest of this site.
Caherglassaun Turlough pNHA 000238	• Turloughs • Rivers with muddy banks • *Rhinolophus hipposideros* (Lesser Horseshoe Bat)	4.4 km	✓ There is a potential surface water connection to Caherglassaun Turlough pNHA via the Cannahowna River, and potential underground flow between the proposed works and Galway Bay.

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European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
	(Assumed - site synopsis not available)		Caherglassaun Turlough pNHA is located within the same groundwater body as the EIA Development so there is potential for groundwater connectivity.
Termon Lough pNHA 001321	• Turloughs (Assumed - site synopsis not available)	6.6 km	✓ There is no obvious surface water connectivity. The northern part of the pNHA lies within the same groundwater body as the EIA development so there is potential for groundwater connectivity.
Peterswell Turlough pNHA 000318	• Turloughs • Rivers with muddy banks (Assumed - site synopsis not available)	5 km	None Peterswell Turlough pNHA drains into the same river system as the EIA development, but into a different tributary, and upstream of their confluence, so there is no potential for surface water connectivity The pNHA and the EIA are located within different groundwater bodies.
Galway Bay Complex pNHA 000268	• Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Large shallow inlets and bays • Reefs • Perennial vegetation of stony banks • Vegetated sea cliffs • *Salicornia* and other annuals colonising mud and sand • Atlantic salt meadows	10.2 km	✓ There is potential for surface and groundwater connectivity between the proposed works and the Galway Bay Complex pNHA, via the Cannahowna River and potential overland/ underground flow during flood events from the turloughs of the Coole-Garryland Complex pNHA.

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
	• Mediterranean salt meadows • Turloughs • *Juniperus communis* formations on heaths or calcareous grasslands • Semi-natural dry grasslands and scrubland facies on calcareous substrates • Calcareous fens • Alkaline fens • Limestone pavements • *Lutra lutra* (Otter) • *Phoca vitulina* (Harbour Seal) • Great Northern Diver (Gavia immer) [A003] • Cormorant (*Phalacrocorax carbo*) • Grey Heron (*Ardea cinerea*) • Light-bellied Brent Goose (*Branta bernicla hrota*) • Wigeon (*Anas penelope*) • Teal (*Anas crecca*) • Shoveler (*Anas clypeata*) • Red-breasted Merganser (*Mergus serrator*) • Ringed Plover (*Charadrius hiaticula*) • Golden Plover (*Pluvialis apricaria*) • Lapwing (*Vanellus vanellus*) (Assumed - site synopsis not available)		
Lough Fingall Complex pNHA 000606	• Turloughs • Alpine and Boreal heaths • *Juniperus communis* formations on heaths or calcareous grasslands • Semi-natural dry grasslands and scrubland facies on calcareous substrates • Calcareous fens	10.35 km	None There is no potential for surface water connectivity. The pNHA and EIA development occur in different groundwater bodies.

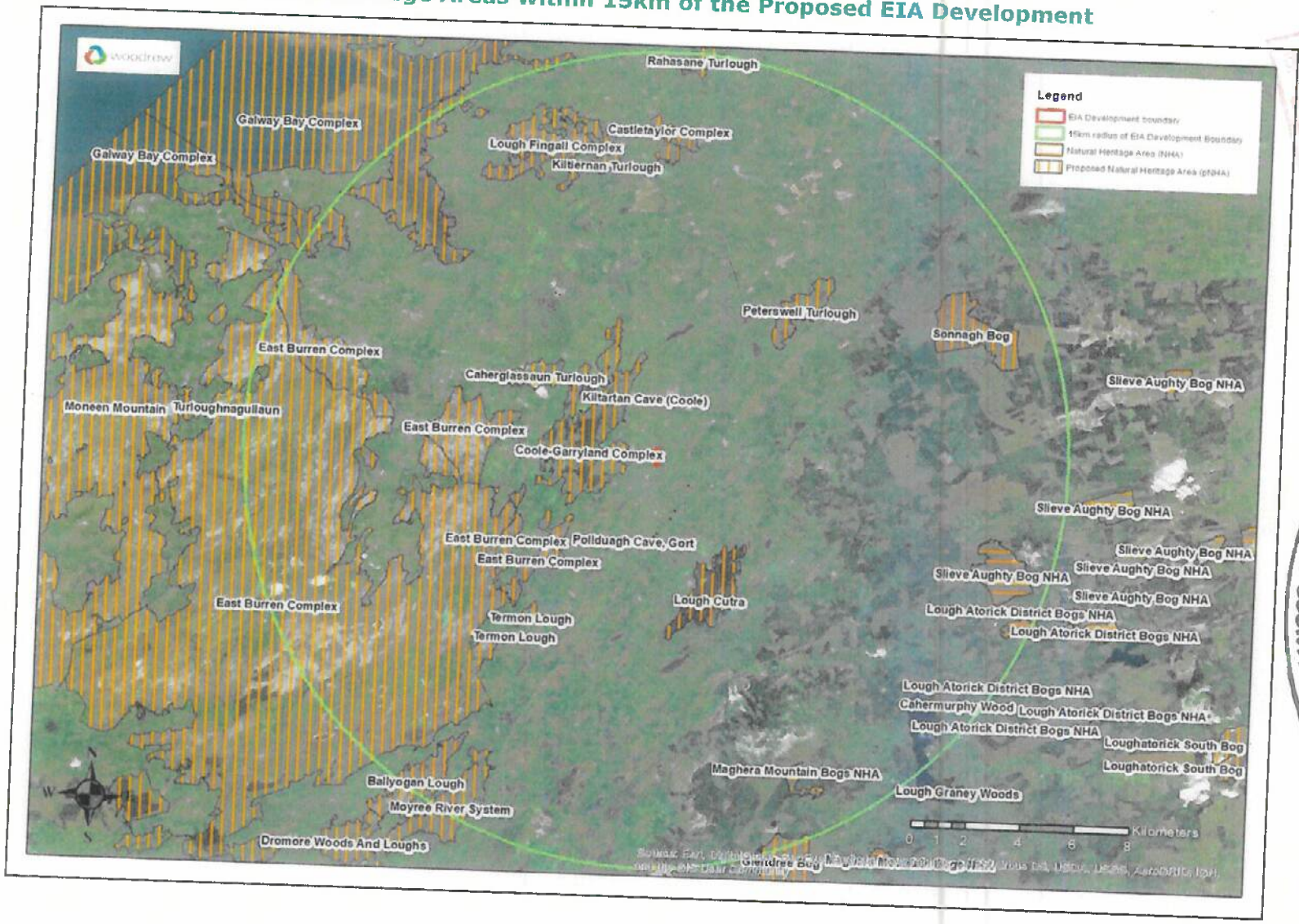
European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
	• Limestone pavements • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) (Assumed - site synopsis not available)		
Castletaylor Complex pNHA 000242	• Turloughs • Alpine and Boreal heaths • *Juniperus communis* formations on heaths or calcareous grasslands • Semi-natural dry grasslands and scrubland facies on calcareous substrates • Limestone pavements (Assumed - site synopsis not available)	10.6 km	None There is no potential for surface water connectivity. The pNHA and EIA development occur in different groundwater bodies
Kiltiernan Turlough pNHA 0001285	• Turloughs (Assumed - site synopsis not available)	10.6 km	None There is no potential for surface water connectivity between Kiltiernan Turlough pNHA and the EIA development. The pNHA and EIA development occur in different groundwater bodies.
Sonnagh Bog pNHA 001913	• Blanket bogs (Assumed - site synopsis not available)	85 km	✓ Blanket bogs are classed as groundwater-dependent terrestrial ecosystems by the EPA. Sonnagh Bog is located within the same groundwater body as the EIA development so there is potential for groundwater connectivity. There is also potential for airborne nitrogen deposits, ammonia and sulphur dioxide affecting the blanket bog

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
			habitat, due to the direction of the prevailing wind.
Ballyogan Lough pNHA 000019	• Calcareous fens (Assumed - site synopsis not available)	12 km	None There is no potential for surface water or groundwater connectivity between Ballyogan Lough pNHA and the EIA development.
Slieve Aughty Bog NHA 001229	• Upland blanket bog and heath with flushes and small lakes • Red grouse, hen harrier, whooper swan	12 km	✓ Slieve Aughty NHA is located within the same groundwater body as the EIA Development. Designated features of the Slieve Aughty NHA include blanket bog which has the potential to be affected by changes in groundwater. No other ecological connection exists. The EIA Development site does not contain suitable breeding or foraging habitat for either red grouse or hen harrier. While the site may provide some winter foraging habitat for whooper swan, it is unlikely that significant numbers of birds would utilise this area due to the proximity of, and potential for disturbance from, residential and public shopping areas to the south west.
Moyree River System pNHA 000057	• Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation • Alkaline fens • Limestone pavements	12 km	None There is no surface water connection between the EIA development and the Moyree River System pNHA , and they

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
	• Caves • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) • *Lutra lutra* (Otter) (Assumed - site synopsis not available)		are located within different groundwater bodies.
Maghera Mountain Bogs NHA 002442	• A cluster of three upland blanket bogs with red grouse, Irish hare and otter	12.3 km	None There is no potential for either surface water or groundwater connectivity between Maghera Mountain Bogs NHA and the EIA development.
Rahasane Turlough pNHA 000322	• Turloughs • Whooper Swan (*Cygnus cygnus*) • Wigeon (*Anas penelope*) • Golden Plover (*Pluvialis apricaria*) • Black-tailed Godwit (*Limosa limosa*) • Greenland White-fronted Goose (*Anser albifrons flavirostris*) • Wetland and Waterbirds (Assumed - site synopsis not available)	14.1 km	✓ Rahasane Turlough pNHA is located within the same groundwater body as the EIA Development so there is potential for groundwater connectivity.
Lough Atorick District Bogs NHA 002377	• A cluster of seven blanket bogs with characteristics transitional to raised bog, supporting red grouse and hen harrier	14 km	None There is no potential for either surface water or groundwater connectivity between Lough Atorick District Bogs NHA and the EIA development.
Cahermurphy Wood pNHA 000022	• Sessile oak woodland with birch, ash and beech and a rich groundflora, on heavy poorly drained clay soils.	14 km	None There is no potential for either surface water or groundwater connectivity

European designated area and site code	Qualifying Interests	Distance from EIA Development	Potential connectivity relevant to Qualifying interest features
			between Lough Atorick District Bogs NHA and the EIA development
Glendree Bog pNHA 001912	• Blanket bogs (Assumed - site synopsis not available)	14.5 km	✓ Glendree Bog pNHA is located within the same groundwater body as the EIA Development, so there is potential for groundwater connectivity. Blanket bog habitat has the potential to be affected by changes in groundwater. There is also potential for airborne nitrogen deposits, ammonia and sulphur dioxide affecting the blanket bog habitat

Figure 5.2 Natural Heritage Areas within 15km of the Proposed EIA Development



5.3.3 Designated Sites with Potential Connectivity to the Proposal

10 SACs, 2 SPAs, 1 Ramsar Site, 1 NHA and 12 pNHAs lie within the potential zone of influence of the Proposed Development Site.

Of these designated areas, 2 Natura 2000 sites have potential surface water connectivity with the Proposed Development Site. These are Coole-Garryland Complex SAC and Coole-Garryland Complex SPA. Coole-Garryland Complex is also designated in part as a Ramsar Site as Coole Lough and Garryland Wood Ramsar Site. In addition, the Coole-Garryland Complex NHA is connected in the same way.

The above sites are hydrologically connected to the Gort River which flows adjacent Proposed Development.

Coole-Garryland Complex SAC and Coole-Garryland Complex SPA are considered to be features of International importance due to their EU designated status. Coole-Garryland Complex NHA is a site of National importance but as it is largely encompassed by the SAC and SPA footprints and is proposed for designation for the same features, it is here considered alongside these Natura 2000 sites.

Other sites have potential connectivity via groundwater, falling within the same groundwater body of the site within a karst area, and holding groundwater dependent features.

The locations of these designated areas in relation to the Proposed Development Site, and means of connectivity, are illustrated in Figure 5.3: Designated Sites - Special Areas of Conservation and Special Protection Areas and Figure 5.4: Designated Sites – Natural Heritage Areas and Proposed Natural Heritage Areas.

5.3.4 Desktop study for recorded important and protected species

Records for important and protected species within proximity of the site were obtained from the NBDC online database. The NBDC database incorporates a number of databases for Ireland, including the mammal database, as well as atlas information for a variety of other taxa, including amphibians, invertebrates and Botanical Society of Britain & Ireland ("BSBI") data.

The Application Site falls within the 10 km grid square M40 and 2 km grid square M40L. **Table 5.8** shows records of species of conservation importance and protected species gathered from the NBDC database for the 2 km and 10 km grid squares within which the Application Site lies (i.e. M40 and M40L).

Table 5.8 Records of protected and important species recorded in the proximity of the proposed Development Site (Source: National Biodiversity Data Centre)

Species	Scientific name	Recorded within 2km	Recorded within 5km	EU Directive	Wildlife Act (1976) as	Other notable species category	Likelihood on site*	Likelihood within 2 km*
Common kingfisher	*Alcedo atthis*	✓	✓	EU Birds Directive Annex I	Y	BoCCI Amber list (breeding)	4	1
Cormorant	*Phalocrocorax carbo*	✓	✓		Y	BoCCI Amber list (Breeding and wintering)	3	1
Lesser black-backed gull	*Larus fuscus*	✓	✓		Y	BoCCI Amber list (Breeding)	3	1
Black-headed Gull	*Larus ridibundus*	✓	✓		Y	BoCCI Red list (Breeding)	3	1
Common Starling	*Sturnus vulgaris*	✓	✓		Y	BoCCI Amber list (Breeding)	2	1
Common Swift	*Apus*	✓	✓		Y	BoCCI Amber list (Breeding)	4	1
Common Wood Pigeon (Columba palumbus)	*Columba palumbus*	✓	✓	EU Birds Directive Annex II Section I, Annex III Section I	Y		2	1
European Greenfinch	*Carduelis chloris*	✓	✓		Y	BoCCI Amber list (Breeding)	2	1
European Robin	*Erithacus rubecula*	✓	✓		Y	BoCCI Amber list (Breeding)	2	1
Goldcrest	*Regulus regulus*	✓	✓		Y	BoCCI Amber list (Breeding)	3	1
House martin	*Delichon urbicum*	✓	✓		Y	BoCCI Amber list (Breeding)	2	1
House sparrow	*Passer domesticus*	✓	✓		Y	BoCCI Amber list (Breeding)	2	1
Meadow pipit	*Anthus pratensis*	✓	✓		Y	BoCCI Red list (Breeding)	2	1
Mistle thrush	*Turdus viscivorus*	✓	✓		Y	BoCCI Amber list (Breeding)	2	1

Species	Scientific name	Recorded within 2km	Recorded within 5km	EU Directive	Wildlife Act (1976) as	Other notable species category	Likelihood on site*	Likelihood within 2 km*
Spotted flycatcher	*Muscicapa striata*	✓	✓		Y	BoCCI Amber list (Breeding)	3	1
Lapwing	*Vanellus vanellus*	✓	✓	EU Birds Directive Annex II Section II	Y	BoCCI Red list (Breeding and wintering)	3	1
Curlew	*Numenius arquata*	✓	✓	EU Birds Directive Annex II Section II	Y	BoCCI Red list (Breeding and wintering)	3	1
Dunlin	*Calidris alpina*	✓	✓	EU Birds Directive Annex I	Y	BoCCI Red list (Breeding and wintering)	4	1
Golden Plover	*Pluviaria apricaria*	✓	✓	EU Birds Directive Annex I, Annex II Section II, Annex II Section III	Y	BoCCI Red list (breeding and wintering)	4	1
Whooper Swan	*Cygnus cygnus*	✓	✓	EU Birds Directive Annex I	Y	BoCCI Amber list (wintering)	4	1
Bewick's swan	*Cygnus coumbaris ssp. bewickii*	✓	✓	EU Birds Directive Annex I		BoCCI Red list (Wintering)	4	1
Mute swan	*Cygnus olor*	✓	✓		Y	BoCCI Amber list (breeding and wintering)	4	1
Mallard	*Anas platyrhynchos*	✓	✓	EU Birds Directive Annex II Section I, Annex III Section I	Y		3	1
Common goldeneye	*Bucephala clamgula*	✓	✓	EU Birds Directive Annex II Section II	Y	BoCCI Red list (wintering)	4	1
Wigeon	*Anas penelope*	✓	✓	EU Birds Directive Annex II Section I, Annex III Section II	Y	BoCCI Red list (wintering)	4	1

Species	Scientific name	Recorded within 2km	Recorded within 5km	EU Directive	Wildlife Act (1976) as	Other notable species category	Likelihood on site*	Likelihood within 2 km*
Pochard	*Aythya ferina*	✓	✓	EU Birds Directive Annex II Section I, Annex III Section II	Y	BoCCI Red list (wintering)	4	1
Tufted duck	*Aythya fuligula*	✓	✓	EU Birds Directive Annex II, Annex II Section I, Annex III Section II	Y	BoCCI Red list (wintering)	4	1
Lesser horseshoe bat	*Rhinolophus hipposideros*	✓	✓	EU Habitats Directive Annex II and IV	Y	IUCN Red list - Near threatened	3	1
lesser noctule	*Nyctalus leisleri*	✓	✓	EU Habitats Directive Annex IV	Y	Irish Red List No 3 – Mammals – Near Threatened	2	1
brown long-eared bat	*Plecotus auritus*	✓	✓	EU Habitats Directive Annex IV	Y		3	1
Daubenton's bat	*Myotos daubentonii*	✓	✓	EU Habitats Directive Annex IV	Y		3	1
Natterer's bat	*Myotis nattereri*	✓	✓	EU Habitats Directive Annex IV	Y		2	1
Pipistrelle / Soprano pipistrelle	*Pipostrellus* sp./ *Pipistrellus pygmaeus*	✓	✓	EU Habitats Directive Annex IV	Y		2	1
Badger	*Meles meles*	✓	✓		Y		1	1
Pine Marten	*Martes martes*	✓	✓	EU Habitats Directive Annex V	Y		2	1
Otter	*Lutra lutra*	✓	✓	EU Habitats Directive Annex II and IV	Y	Irish Red List No 3 – Mammals – Near Threatened	3	1
Red squirrel	*Sciurus vulgaris*	✓	✓		Y	Irish Red List No 3 – Mammals – Near Threatened	3	1
Hedgehog	*Erinaceus europaeus*	✓	✓		Y			

Species	Scientific name	Recorded within 2km	Recorded within 5km	EU Directive	Wildlife Act (1976) as	Other notable species category	Likelihood on site*	Likelihood within 2 km*
Marsh fritillary	*Euphydryas aurinius*		✓	EU Habitats Directive Annex II			3	2
Common Lizard	*Zootoca vivipara*	✓	✓		Y		3	1
Common frog	*Rana temporaria*	✓	✓	EU Habitats Directive Annex V	Y		3	1
Irish whitebeam	*Sorbus hibernica*	✓	✓			Irish Red List of Vascular Plants- Vulnerable	4	1

Key to likelihood of species presence: 1 = Confirmed; 2 = Likely; 3 = Possible; 4 = Unlikely
Key to Red List Status: CR = Critical; NT = Near threatened; LC = Least Concern

Table 5.9(a) Bat species recorded within a 10km radius of the Proposed Development Site (Source: Bat Conservation Ireland)

Roosts			
Name	**Grid reference**	**Address**	**Species observed**
Private	M4007	Gort; Co. Galway	*Rhinolophus hipposideros*
Bridge	M4804	Co. Galway	*Myotis daubentonii*
Private	M4509	Ballymaquiff; Co. Galway	*Myotis mystacinus/brandtii; Myotis natterreri; Pipistrellus pygmaeus; Pipistrellus spp. (45kHz/55kHz); Plecotus auritus; Rhinolophus hipposideros*
Private	M4504	Gort; Co. Galway	*Myotis spp.; Plecotus auritus; Rhinolophus hipposideros*
Private	M4500	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4405	Kiltartan; Co. Galway	*Rhinolophus hipposideros*
Private	M4400	Gort; Co. Galway	*Myotis daubentonii; Rhinolophus hipposideros*
Private	M4507	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4405	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	R3598	Kiltacky Beg; Boston; Co. Clare	*Rhinolophus hipposideros*
Private	R4493	Carheny; Crusheen; County Clare	*Pipistrellus pygmaeus; Plecotus auritus*

Roosts			
Name	**Grid reference**	**Address**	**Species observed**
Private	R4296	Curtaun; Tubber; Co. Galway	*Rhinolophus hipposideros*
Private	R3795	Kilkeedy; Tubber; Co. Clare	*Rhinolophus hipposideros*
Private	M4604	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M3901	Poulataggle; Co. Clare	*Rhinolophus hipposideros*
Private	M4112	Ardrahan; Co. Galway	*Myotis spp.*
Private	M4505	Gort; Co. Galway	*Pipistrellus pygmaeus; Pipistrellus spp. (45kHz/55kHz); Plecotus auritus; Rhinolophus hipposideros*
Private	M4505	Gort; Co. Galway	*Pipistrellus pygmaeus*
Private	M4712	Ardrahan; Co. Galway	*Rhinolophus hipposideros*
Private	M4103	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	R4595	Gort; Co. Galway	*Pipistrellus pygmaeus; Pipistrellus spp. (45kHz/55kHz); Plecotus auritus*
Private	M4307	Gort; Co. Galway	*Myotis daubentonii; Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Plecotus auritus; Rhinolophus hipposideros*
Private	M4304	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4503	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4503	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4006	Kinvarra; Co. Galway	*Rhinolophus hipposideros*
Private	M4709	Ardrahan; Co. Galway	*Nyctalus leisleri*
Private	R4798	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4806	Ardrahan; Co. Galway	*Myotis daubentonii*
Private	M4406	Gort; Co. Galway	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pygmaeus; Plecotus auritus*
Bridge	M4509	Ballymaquiff; Co. Galway	*Myotis natterreri; Pipistrellus pygmaeus; Unidentified bat*
Private	M4709	Ardrahan; Co. Galway	*Plecotus auritus*
Private	M3908	Kinvarra; Co. Galway	*Rhinolophus hipposideros*
Private	R3898	Kilcorkan; Co. Clare	*Rhinolophus hipposideros*
Private	M4709	Ardrahan; Co. Galway	*Plecotus auritus; Rhinolophus hipposideros*
Private	R4095	Tubber; Co. Galway	*Rhinolophus hipposideros*

Roosts			
Name	Grid reference	Address	Species observed
Private	M4113	Ballinderreen; Co. Galway	*Rhinolophus hipposideros*
Private	M4300	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4312	Ardrahan; Co. Galway	*Rhinolophus hipposideros*
Private	M4601	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4712	Ardrahan; Co. Galway	*Rhinolophus hipposideros*
Private	M4112	Killeenavarra; Co. Galway	*Rhinolophus hipposideros*
Private	M4112	Ardrahan; Co. Galway	*Rhinolophus hipposideros*
Private	M4502	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4201	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M3908	Kinvarra; Co. Galway	*Rhinolophus hipposideros*
Private	R4393	Crusheen; Co. Galway	*Rhinolophus hipposideros*
Private	R4798	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4806	Gort; Co. Galway	*Rhinolophus hipposideros*
Private	M4709	Ardrahan; Co. Galway	*Rhinolophus hipposideros*
Private	M4406	Gort; Co. Galway	*Nyctalus leisleri*
Private	M4205	Kinvarra; Co. Galway	*Rhinolophus hipposideros*
Private	M4704	Gort; Co. Galway	*Rhinolophus hipposideros*

Table 5.9(b) Bat species recorded within a 10km radius of the Proposed Development Site (Source: Bat Conservation Ireland)

Transects		
Name	Grid reference start	Species
Castletown Mill Transect	M4583303174	*Myotis daubentonii;Unidentified bat*
Interpretive Centre Transect	M4782105523	*Myotis daubentonii;Myotis spp.;Pipistrellus pygmaeus;Unidentified bat*
Interpretive Centre Transect; Spot 1	M4782105523	*Myotis daubentonii*
Interpretive Centre Transect; Spot 10	M4814606223	*Myotis daubentonii*
Interpretive Centre Transect; Spot 2	M4790705556	*Myotis daubentonii;Nyctalus leisleri*
Interpretive Centre Transect; Spot 3	M4800605619	*Myotis daubentonii*

Transects		
Name	**Grid reference start**	**Species**
Interpretive Centre Transect; Spot 4	M4808005691	*Myotis daubentonii*
Interpretive Centre Transect; Spot 5	M4808905785	*Myotis daubentonii*
Interpretive Centre Transect; Spot 6	M4808805860	*Myotis daubentonii*
Interpretive Centre Transect; Spot 7	M4812605913	*Myotis daubentonii*
Interpretive Centre Transect; Spot 8	M4817105998	*Myotis daubentonii*
Interpretive Centre Transect; Spot 9	M4814906106	*Myotis daubentonii*
R28 (10) 2004-	M467030	*Nyctalus leisleri;Pipistrellus pipistrellus (45kHz);Pipistrellus pygmaeus;Pipistrellus spp. (45kHz/55kHz);Unidentified bat*
R28 (11) 2004-	M448073	*Nyctalus leisleri;Pipistrellus pipistrellus (45kHz);Pipistrellus pygmaeus;Pipistrellus spp. (45kHz/55kHz);Unidentified bat*
R28 (12) 2004-	M407085	*Nyctalus leisleri;Pipistrellus nathusii;Pipistrellus pipistrellus (45kHz);Pipistrellus pygmaeus;Pipistrellus spp. (45kHz/55kHz);Plecotus auritus;Unidentified bat*
R28 (13) 2004-	M360096	*Myotis spp.;Nyctalus leisleri;Pipistrellus pipistrellus (45kHz);Pipistrellus pygmaeus;Pipistrellus spp. (45kHz/55kHz);Unidentified bat*
R28 (8) 2004-	R470963	*Myotis spp.;Nyctalus leisleri;Pipistrellus pipistrellus (45kHz);Pipistrellus pygmaeus;Pipistrellus spp. (45kHz/55kHz)*
R28 (9) 2004-	R490991	*Myotis spp.;Nyctalus leisleri;Pipistrellus pipistrellus (45kHz);Pipistrellus pygmaeus;Pipistrellus spp. (45kHz/55kHz)*

Table 5.9(c) Bat species recorded within a 10km radius of the Proposed Development Site (Source: Bat Conservation Ireland)

Ad-Hoc Observations			
Survey	**Grid reference**	**Date**	**Species**
BATLAS 2010	M445003	15/08/2005	*Myotis daubentonii; Rhinolophus hipposideros*
BATLAS 2010	M3971401250	09/09/2009	*Myotis spp.; Nyctalus leisleri; Pipistrellus pygmaeus*

Ad-Hoc Observations			
Survey	**Grid reference**	**Date**	**Species**
BATLAS 2010	M5138805619	15/09/2009	*Myotis spp.; Unidentified bat*
BATLAS 2010	R426961	15/08/2005	*Myotis mystacinus/brandtii; Myotis natterreri; Pipistrellus pygmaeus; Plecotus auritus; Rhinolophus hipposideros*
BATLAS 2010	M5070106910	15/09/2009	*Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*
BATLAS 2010	R431933	15/08/2005	*Rhinolophus hipposideros*
BATLAS 2010	M3825609882	09/09/2009	*Pipistrellus pipistrellus (45kHz)*
BATLAS 2010	M4604312193	09/09/2009	*Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Pipistrellus spp. (45kHz/55kHz)*
BATLAS 2010	R414943	15/08/2005	*Pipistrellus pygmaeus*
BATLAS 2010	M5141609979	15/09/2009	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*
BATLAS 2010	R4396	15/08/2005	*Pipistrellus pygmaeus; Plecotus auritus; Rhinolophus hipposideros*
Brown long-eared Roost Monitoring Scheme	M438079	03/10/2008	*Myotis daubentonii; Myotis natterreri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Plecotus auritus; Rhinolophus hipposideros*
Buildings At Risk Grant; The Heritage Council	R455958	02/09/2006	*Nyctalus leisleri; Pipistrellus pygmaeus*
EIS Surveys	M4300010000	03/08/2005	*Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*
EIS Surveys	M4400002000	06/08/2005	*Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Plecotus auritus*
EIS Surveys	M4300008000	03/08/2005	*Myotis daubentonii; Pipistrellus pygmaeus; Rhinolophus hipposideros*
EIS Surveys	M4500006000	03/08/2005	*Myotis natterreri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Rhinolophus hipposideros*
EIS Surveys	M4500005000	05/08/2005	*Myotis daubentonii; Myotis mystacinus/brandtii; Myotis natterreri; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Rhinolophus hipposideros*
EIS Surveys	M4300011000	03/08/2005	*Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*
EIS Surveys	M4400003000	06/08/2005	*Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*
EIS Surveys	M4400008000	03/08/2005	*Myotis natterreri; Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*

Ad-Hoc Observations			
Survey	**Grid reference**	**Date**	**Species**
EIS Surveys	M4500007000	03/08/2005	*Pipistrellus pygmaeus; Rhinolophus hipposideros*
EIS Surveys	M4400006000	05/08/2005	*Myotis daubentonii; Myotis natterreri; Myotis spp.; Nyctalus leisleri; Pipistrellus pygmaeus; Plecotus auritus; Rhinolophus hipposideros*
EIS Surveys	M4300012000	03/08/2005	*Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus*
EIS Surveys	M4400004000	05/08/2005	*Myotis daubentonii; Myotis mystacinus/brandtii; Myotis natterreri; Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Plecotus auritus*
EIS Surveys	M4820004700	26/04/2005	*Pipistrellus pipistrellus (45kHz)*

5.4 Existing Ecological Baseline

5.4.1 General Site description

The Application Site is situated in an area which was historically used for agricultural grazing, but which has more recently been developed as an equine exercise track, as well as being grazed by low numbers of horses. The topographical levels of the site have been altered following soil excavation, with the northern boundary being more elevated on a steep slope, and the field gently sloping in a southerly direction. A man-made embankment runs along the south west of the Application Site on which the horse track runs. The track along the field boundary is recolonising within grassland.

According to the OSI mapping online (GeoHive[75]), the well-developed mixed hedgerow (south-western corner behind the mound, just outside the site boundary) and the tall hawthorn treeline (northern boundary upon the slope) are both historic townland boundaries, which is confirmed by their size, connectivity and maturity. The remaining boundaries include wooden post fencing and a mature hawthorn hedgerow.

The site is accessed from the R458 along a proposed access track into the north west corner of the site. This track is surrounded by improved agricultural grassland (Fossitt code: GA1), a steep grassy bank to the east in the south western corner of the site and lined by hawthorn dominated hedgerows and stone walls in some sections.

The majority of grassland in this area is calcareous given the karst landscape, but the site is dominated by rough grassland which shows signs of being altered/improved and is

[75] *GeoHive – Ordnance Survey Ireland: http://map.geohive.ie/mapviewer.html (Accessed September 2019)*

grazed. The central area on the site continues to support a calcareous grassland sward, and where depressions arise in the north-eastern extents of the site a wet grassland/ calcareous assemblage has formed here in smaller patches.

The only mature trees recorded within the Application Site boundary were hawthorn trees along the eastern and northern boundary of the site. Dense patches of scrub and a small number (<5) immature broadleaved trees are also present around the Application Site.

In areas of intensive agriculture and management, hedgerows provide valuable habitat for wildlife and greatly enrich biodiversity. They may support a large variety of shrubs, trees and herbaceous plants, which in turn provide a food source for invertebrates, birds and small mammals. During the course of the site visits, each boundary was walked and its general character and main species noted.

There were no significant water features within the main area of the Application Site for the biogas plant, however shallow drainage ditches existed within the hedgerow boundaries. In addition, the Kinincha Road immediately to the east of the Application Site, runs parallel to a complex network of wet ditches which feed directly into the Gort River which flows in a northerly direction on the eastern side of the road.

According to the draft CFRAM flood mapping[76] the Application Site does not flood, other than some minor pluvial flooding (this assessment ties in with the findings of the habitat survey conducted in December 2017) and the vegetation recorded on this site. Ballynamantan Lake[77] is situated to the north of the Application Site, as is the Coole-Garryland Complex SAC to the west of the Application Site demonstrating the complex hydrological regime occurring in the environs of this site.

Plate 5.4 A panoramic view of the Application Site taken from on top of the man-made embankment/track

[76] Catchment Flood Risk Assessment and Management (CFRAM) http://www.cfram.ie/pdfs/PFRA%20Integrated%20Map_194.pdf (Accessed September 2019).
[77] Likely to be a Turlough as it appears that this water feature is largely fed by groundwater (draft PFRA maps, CFRAMS), and water flows out of the lake and into the Gort River (EPA Maps).

5.4.2 Habitats within the Proposed Development Site

An Extended Phase 1 Habitat Assessment was undertaken on the 15 December 2017 of the Proposed EIA Development for the Gort biogas plant. This survey was carried out during a sub-optimal time of year for botanical assessments (winter 2017). However, further habitat surveys were carried out on 27 March 2018, 30 July 2018 with an update survey carried out on 06 August 2019 to confirm the results from the 2018 habitat surveys. The habitat survey techniques followed best practice methodology of The Heritage Council's publications *Best Practice Guidance for Habitat Survey and Mapping*[78] and *A Guide to Habitats in Ireland*[79]. A total of four relevés were surveyed in order to assign vegetation communities (see **Table 5.11**). ERICA was used following this data collection to determine the vegetation community types. The resulting community types are discussed further below within the grassland habitat descriptions.

Table 5.10 below lists the habitat types (according to Fossitt, 2000) which occur within the Application Site (including along the Kinincha Road). Figure 5.3 illustrates the Fossitt Habitat types within the Application Site. A description of each habitat, and an associated photograph, is also provided below. Habitats which have no ecological value are not considered further within this assessment. Those of ecological value are illustrated in **bold**. A map of the distribution of habitats is provided as **Figure 5.3.**

Table 5.10 Habitat types occurring within the Proposed Development Site (Fossitt, 2000)

Code	Habitat Name	Of Ecological Value?
WD5	Scattered trees and Parkland - Immature planted trees	Yes – potential for nesting birds. Value limited to single tree.
BL3	Buildings and artificial surfaces - Road - Fence-line - Track There were also areas of fly-tipping (ED5) along the Kinincha road.	No
BL3	- Buildings and artificial surfaces - Derelict house (off site; south of site boundary)	Yes – potential for roosting bats.
ED2	Spoil and bare ground	Yes – potential for reptile hibernacula & some potential for use by invertebrates.

[78] *Smith, G., O'Donoghue, P., O'Hora, K. And Delaney, E. (2011) Best Practice Guidance for Habitat Survey and Mapping. The Heritage Council.*
[79] *Fossitt J.A. (2000). A Guide to Habitats in Ireland. The Heritage Council. ISBN 1 901137 27 9*

Code	Habitat Name	Of Ecological Value?
ED3	Recolonising bare ground	Yes – some potential for use by invertebrates.
FW2	Depositing/lowland rivers	Yes – Flora and fauna (otter, fish birds etc.). Sensitive to water quality impacts.
FW4	Drainage ditch	Yes – Flora and fauna (otter, fish birds etc.). Sensitive to water quality impacts.
WL1	Hedgerows - includes Hedgerows with BL1 Stone walls and FW4 Drainage ditches	Yes – Flora and fauna (reptiles, birds, mammals (including bats) etc.)
WL2	Treelines	Yes– Flora and fauna (reptiles, birds, mammals (including bats) etc.)
GA1 / GS1	Improved agricultural grassland / Dry calcareous and neutral grassland	Yes – some floral diversity and potential foraging area for fauna.
GS1 (and habitat mosaics) In this survey area, this habitat occurs in mosaics with: ER2 GS4 WS1	Dry calcareous and neutral grassland In this survey area, this habitat occurs in mosaics with: Exposed calcareous rock Wet grassland Scrub	Yes – flora diversity and potential for use as a foraging and nesting area by local fauna. Also potential to support invertebrates.
GSi1	Dry calcareous and neutral grassland (showing signs of improvement but still of ecological value)	Yes – some floral diversity and potential foraging area for fauna.
GS2 In this survey area, this habitat occurs in mosaics with: ED2	Dry meadows and grassy verges In this survey area, this habitat occurs in mosaics with: Spoil and bare ground There were also areas of fly-tipping (ED5) along the Kinincha road.	Yes – flora diversity and potential for use as a foraging and nesting area by local fauna. Also potential to support invertebrates.
GS4	Wet grassland	Yes – some floral diversity and potential foraging area for fauna.
WS1 In this survey area, this habitat occurs in mosaics with: ED1 ER2	Scrub In this survey area, this habitat occurs in mosaics with: Exposed sand Exposed calcareous rock	Yes – some floral diversity and potential for fauna (breeding birds, mammal resting sites and foraging areas).