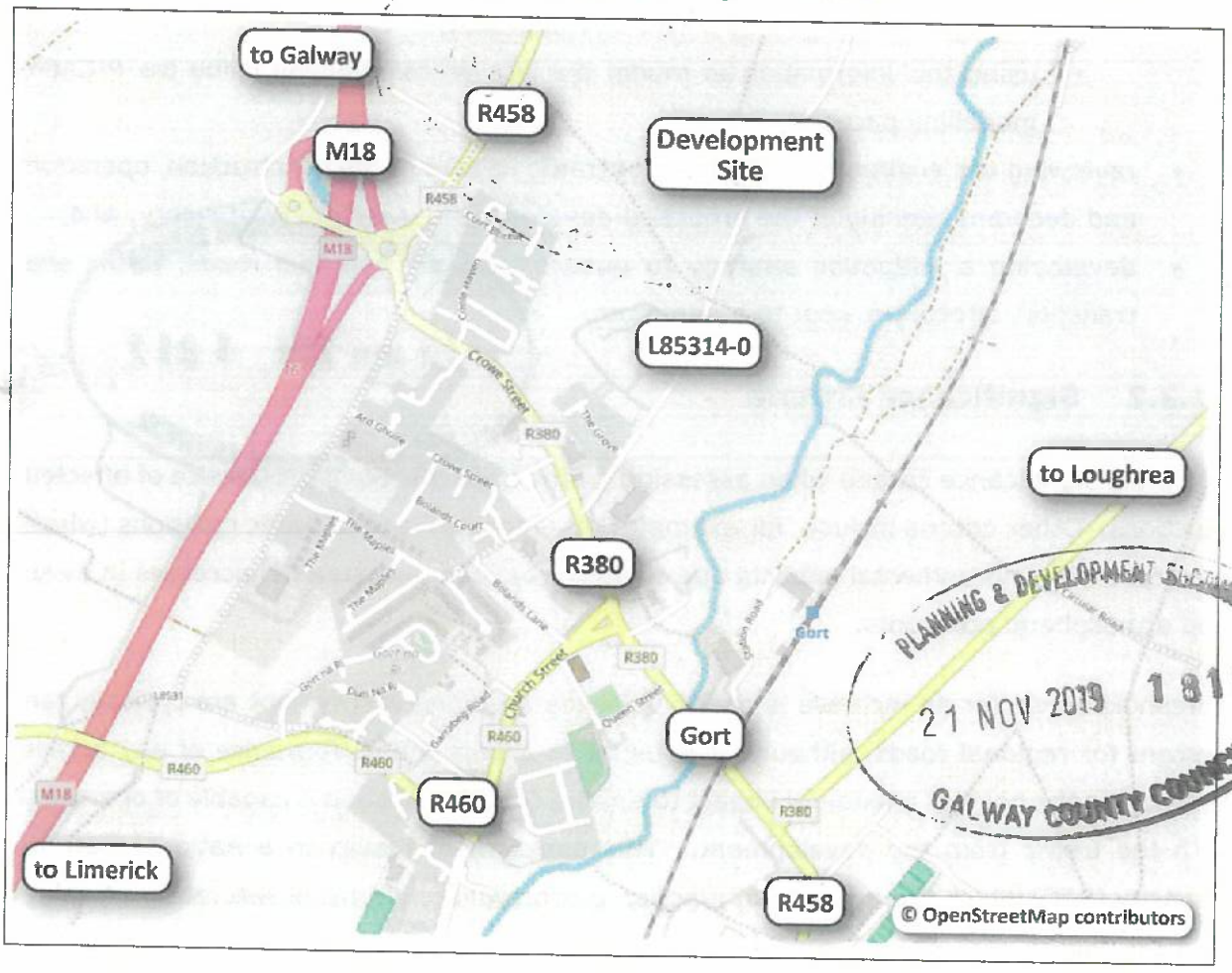
11 TRAFFIC AND TRANSPORT

11.1 Introduction

Traffic Transport and Road Safety Associates Limited (TTRSA) was commissioned by Halston Environmental & Planning Ltd. to prepare an assessment of the traffic and transport related impacts related to the construction of a proposed development in Gort, Co. Galway (Figure 11.1), comprising: construction of a commercial biogas plant which will transform naturally occurring organic wastes into clean gas (biomethane) and organic fertiliser/soil improver; including: the creation of a new site access junction off the R458 regional road; provision of approximately 200m of new internal road within the proposed development site; and, widening of an existing internal road within the development site. No access to the development site is proposed from the L85314-0 Kinincha Road. TTRSA have been informed that the biogas plant will operate 24 hours per day, seven days per week. A full description of the proposed development is included in Chapter 2 of this EIAR.

Figure 11.1 Location of the proposed development site



11.2 Assessment Methodology and Significance Criteria

11.2.1 Assessment Methodology

The roads, traffic and transport impacts of the proposed development have been assessed by utilising the following approach based on the prevailing Transport Infrastructure Ireland (TII) guidelines on Traffic and Transport Assessment (TTA) (May 2014).

The assessment combines:

- desktop study, for example of traffic collisions;
- site based field work, for example traffic counts and on-site geometric measurement;
- traffic modelling, including:
  - the factoring of traffic count data, for example to future assessment years, in this case a construction year of 2018, an opening year of 2020 and future assessment years of 2027 and 2037;
  - predicting the number of daily and peak hour trips during the construction, and operational phases of the development;
  - using this information to model the site access junction using the PICADY modelling package;
- reviewing the environmental impact of traffic related to the construction, operation and decommissioning of the proposed development, including road safety; and,
- developing a mitigation strategy to ensure that any potential roads, traffic and transport effects are kept to a minimum.

11.2.2 Significance Criteria

The main significance criteria when assessing traffic impact is the performance of affected junctions. Other criteria include, for example: any increase in road traffic collisions (which may result in environmental impacts due to spillage); and, measurable increases in noise and atmospheric pollutants.

Threshold levels for an increase in traffic volumes requiring assessment are typically ten percent for regional roads, although it is usual to assess the performance of any access junction as the point of maximum impact to ensure that the junction is capable of operating with the traffic from the development. This assessment results in a Ratio of Flow to Capacity (RFC) which is a measure of junction performance in terms of saturation. A value of 1.00, which can also be considered as 100% saturation, represents an arm of the junction operating at maximum capacity, in that any increase in the rate of vehicles

arriving on the link will result in significant additional queue lengths. Traditionally a figure of 0.85 or 85% is the maximum acceptable degree of saturation, with anything above this level considered to be congested. The assessment also takes account of queue lengths (measured in PCUs) which are primarily used to check for blocking back through, and therefore impact on, adjacent junctions.

11.2.3 Legislation and Guidance

Relevant guidance on assessing the impact of a development on roads, traffic and transport is contained within: the TTA guidelines produced by TII; and, the Environmental Protection Agency (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports. The latter states that traffic impact should be assessed for the construction phase, operational phase, and for unplanned events such as traffic collisions.

11.2.4 Consultations

A pre-planning meeting, involving the planning and roads departments of Galway County Council was held on 9th April 2019. The pre-planning meeting was followed by a site meeting with Mr Daithí Flood of Galway County Council, and Mr Des Glynn (representing the design team) on Thursday 9th May 2019. The principal of providing a new access off the R458 regional road, and the scope of the assessment contained within this chapter, were agreed at these meetings.

11.2.5 Desktop Study

ROAD SAFETY – REPORTED INJURY COLLISIONS

The Road Safety Authority online Collstats database[93] has been consulted for the period currently available (2005 to 2016 inclusive). This database indicates that one head-on collision resulting in serious injury to one person and minor injury to two further people occurred in the immediate vicinity of the proposed site access junction off the R458 regional road between 23:00 and 03:00 on a Tuesday in 2016.

The Road Safety Authority online Collstats database includes three further collisions between junction 16 of the M18 motorway and the proposed new site access junction, all rear-end collisions. In 2005 a collision resulting in two fatalities; in 2014 a collision resulting in one person receiving minor injuries; and, in 2016 a collision resulted in two

[93] *https://www.rsa.ie/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Ireland-Road-Collisions*

people receiving serious injuries. The fatalities from 2005 are detailed on a roadside memorial on the eastern side of the R458 regional road.

All of these recorded collisions occurred before the opening of the M18 motorway to the north of Gort on Wednesday 27th September 2017, during a period whilst the R458 regional road was still the N18 national road with considerably higher traffic flows[94] and a speed limit of 100km/h. No collision data is currently publicly available for this section of the R458 regional road following the opening of the M18 motorway.

11.2.6 Field Work

TRAFFIC COUNTS

TTRSA undertook an Automatic Traffic Count (ATC) on the R458 regional road in the vicinity of the new site access junction using a Metrocount 5600 vehicle classifier unit, over a 15-day period from 9th to 23rd May 2019 inclusive.

Based on this traffic count, the local traffic peak hours identified for assessment of the site access junction were 08:30-08:29 and 17:30-18:29. The assessment of local traffic peak hours tests the impact of the proposed development in a worst-case scenario, such that if the impact of the development does not cause congestion and queuing during the local traffic peak hours, it is very unlikely to cause congestion and queuing at other times.

For the purpose of analysis, the traffic count data has been converted into Passenger Car Units (PCUs) using factors of: 0.2 for pedal cycles; 0.4 for motorcycles; 1.0 for cars and light goods vehicles (LGV) including those towing trailers; and 2.3 for buses and all types of rigid and articulated Medium and Heavy Goods Vehicle (HGVs). Factoring the traffic count data in this way allows the relative impact of different types of vehicles to be modelled in a standard way, generally acknowledging the greater impact on road space and capacity of a HGV compared to a car or LGV.

Weekday AM peak hour and PM peak hour traffic flows recorded on the R458 regional road are summarised in Table 11.2, and traffic count data for the entire survey period is included in Appendix 11-1.

[94] *TII traffic counter output indicates an Annual Average Daily Traffic (AADT) flow of approximately 19000 prior to the opening of the M18 to the north of Gort.*

Table 11.1 Weekday peak-hour traffic flow recorded on the R458 regional road

Mode	Northbound		Southbound	
	AM	PM	AM	PM
Bicycle	6	7	6	7
Motorcycle	2	0	0	1
Car/LGV	150	208	209	230
HGV	9	4	6	6
Equating to PCUs	173	219	224	246

ROAD SAFETY AUDIT

A Stage 1 Road Safety Audit has been prepared under separate cover for the design of the new site access junction off the R458 regional road[95]. The Road Safety Audit is included as Appendix 11-2.

11.3 Description of the Receiving Environment

11.3.1 Introduction

The design characteristics of the R458 regional road in the vicinity of the proposed development (Plate 11.1) are consistent with its former status as a national primary route. The R458 carriageway is formed from two 3.5m wide running lanes, bounded by 2.4m wide shoulders. The carriageway is demarcated by a dashed centreline, dashed edge-lining and road studs. The surfaced carriageway is bounded by grass verges, backed by stone walls. A number of residential and agricultural accesses are present. Galway County Council have confirmed that the relevant posted speed limit is 80km/h.

11.3.2 Description of Local Road Network

The characteristics of the L85314-0 Kinincha Road are as follows: Between the proposed site access and the industrial estate site access, there is an undemarcated single carriageway with a typical width of between 2.7m and 3.2m. This is bounded by narrow verges, stone walls, hedges, and chain link fencing. Further to the south between the industrial site access and Lidl site access junction the width increases to 5.1m and then 7.6m at the northern radius of the Lidl site access junction. Two residential properties are present on the L85314-0 Kinincha Road, as are the Galway County Council Wastewater

[95] *A Stage 2 Road Safety Audit (prior to construction of the new site access junction) and Stage 3 Road Safety Audit (at completion of the works for the new site access junction), will be required if permission is granted for the proposed development.*

Treatment Plant for Gort, and a Galway County Council salt barn. TTRSA were informed by the Road Section of Galway County Council that the relevant posted speed limit is 50km/h. HGVs currently use the L85314-0 Kinincha Road to access both of the Galway County Council facilities.

Plate 11.1 R458 regional road in the vicinity of the proposed new site access junction

11.3.3 Existing Traffic Patterns

Existing traffic patterns are summarised in Appendix 11.3.

11.3.4 Background Traffic Growth

Subject to planning being granted, it is assumed for the purpose of this assessment that the construction of the proposed development will begin in 2020, with the proposed development being opened in 2022. Local traffic has been growthed to the opening year and future assessment years of 2027 and 2037 using factors based on the TII Project Appraisal Guidelines link based central growth factors for County Galway taking into account the 2.9% HGVs on the R458 regional road during the assessed peak hours. The growth factors applied being:

- From 2019 to 2020 a factor of 1.023
- From 2019 to 2025 a factor of 1.083; and,
- From 2019 to 2030 a factor of 1.153.

11.3.5 Access to Proposed Site

As part of the proposed development, a new site access junction is proposed off the R458 regional road. This junction is depicted in Grealish Glynn & Associates drawing number GBIO-19-002 Rev A, dated 18/08/19, and includes a ghost island right-turn facility. The

geometry of the proposed access has been incorporated into the Traffic Impact Assessment detailed in Section 11.4 of this EIAR.

11.3.6 Transportation /Haulage Routes

Where possible, construction materials will be sourced locally and will be delivered to the site using the most direct route.

In relation to the operational phase of the proposed development, TTRSA have been informed that hauliers making deliveries related to the proposed development will be contracted to enter the site from the south via the M18 motorway junction 16 to the north of Gort, and via the R458 regional road from the motorway junction to the site access. TTRSA have also been informed that no feedstock deliveries will be made using tractor hauled slurry type tankers and that no feedstock deliveries will be routed through Gort town centre.

11.4 Impact Assessment

The Traffic Impact Assessment contained within this chapter takes account of a range of factors including: background traffic growth (Section 11.3.4); the site access junction and specified haulage routes (Sections 11.3.5 and 11.3.6); and, the trip generation associated with the various phases of the proposed development (Sections 11.4.1 and 11.4.2).

11.4.1 Construction Phase

TRIP GENERATION

During the construction phase of the proposed development, trip generation comprises two distinct elements: firstly, the delivery of construction related machinery and materials to the site usually by HGV; and, secondly, the workforce constructing the site usually by car or LGV. In relation to this proposed development, the main construction inputs are concrete, stone and reinforcing steel. Table 11.2 provides predicted construction phase traffic movements by type and month of construction, also summarising the total monthly and average daily two-way movements. Table 11.2 also details the distribution of the construction phase trips within the AM and PM peak hours.

The predicted distribution of these construction phase trips at the new site access junction off the R348 is detailed in Appendix 11-3. For the purpose of the assessment contained within this report construction traffic has been distributed evenly to the north and south at the R348 junction.

Table 11.2 Predicted construction phase two-way traffic movements by month

Bio-gas Plant in Gort – Construction Phase Trips

Estimate of Two-Way HGV Trips During Construction Phase (By Month of Construction)

Activity/Phase	Month of Construction																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Site Evaluation	5	5																						
Site Preparation/Clearance			5	5																				
Mobilisation (Cabins/Equipment etc.)		25	20																					
Civil and Structural Works					400	350	350	350	300	250	250	200												
Mechanical and Electrical Installation													15	10	5	5	5	0						
Commissioning and Testing																			0	0	0	0	0	0
Site Restoration/Clearance/Landscaping																						15	15	15
Ancillaries																								
Total (HGV two-way movements)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	5
Average Weekday (rounded HGV two-way movements)	15	40	35	15	410	360	360	360	310	260	260	210	25	20	15	15	15	10	10	10	10	25	21	20
Average Weekday PCUs (two-way movements)	0.7	1.9	1.6	0.7	19.1	16.7	16.7	16.7	14.4	12.1	12.1	9.8	1.2	0.9	0.7	0.7	0.7	0.5	0.5	0.5	0.5	1.2	1.0	0.9
Average Peak Hour PCUs (two-way movements)	1.6	4.3	3.7	1.6	43.9	38.5	38.5	38.5	33.2	27.8	27.8	22.5	2.7	2.1	1.6	1.6	1.6	1.1	1.1	1.1	1.1	2.7	2.2	2.1
Average Peak Hour Arrivals (PCUs)	0.2	0.4	0.4	0.2	4.4	3.9	3.9	3.9	3.3	2.8	2.8	2.2	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.3	0.2	0.2
Average Peak Hour Departures (PCUs)	0.2	0.4	0.4	0.2	4.4	3.9	3.9	3.9	3.3	2.8	2.8	2.2	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.3	0.2	0.2

Estimate of Workforce Two-Way Car/LGV Trips During Construction Phase

Activity/Phase	Month of Construction																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Average AM Peak Hour Arrivals PCUs	5	10	10	10	40	40	40	40	40	40	40	30	30	30	30	20	20	20	10	10	10	10	10	10
Average PM Peak Hour Departures PCUs	5	10	10	10	40	40	40	40	40	40	40	30	30	30	30	20	20	20	10	10	10	10	10	10

Estimate of Total Construction Phase Peak Hour Trips (Rounded to the nearest PCU)

Activity/Phase	Month of Construction																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Average AM Peak Hour Arrivals PCUs	5	10	10	10	44	44	44	44	43	43	43	32	30	30	30	20	20	20	10	10	10	10	10	10
Average AM Peak Hour Departures PCUs	0	0	0	0	4	4	4	4	3	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Average PM Peak Hour Arrivals PCUs	0	0	0	0	4	4	4	4	3	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Average PM Peak Hour Departures PCUs	5	10	10	10	44	44	44	44	43	43	43	32	30	30	30	20	20	20	10	10	10	10	10	10

HIGHWAY CAPACITY MODELLING

Based on the construction phase peak hour movements contained within Appendix 11-3, the operation of the R458/New site access junction has been assessed using the industry standard PICADY modelling software package for 2020 as a construction year. The results of the PICADY analysis are summarised in Table 11.3, and detailed in Appendix 11-4. The traffic modelling shows that new site access junction will operate with over 90% spare capacity during the construction phase of the proposed development, with negligible queuing. Minor changes to the construction phase trip generation and/or distribution will not affect the validity of this assessment.

Table 11.3 Summary of PICADY modelling output for construction phase

Year – Arm	AM Peak Hour		PM Peak Hour	
	Maximum RFC	Maximum Queue (Vehicles)	Maximum RFC	Maximum Queue (Vehicles)
2020 – R458	0.031	0.03	0.003	0.00
2020 – Development access	0.008	0.01	0.093	0.10

ROAD STRUCTURE IMPACT

As part of the construction phase of the proposed development, works are intended in the vicinity of the R458/New site access junction. Maintaining the structure of the R458 regional road in the vicinity of the junction will need to be incorporated into the detailed design of these works and therefore any impact will be fully mitigated. The relatively low levels of construction related vehicle movements are unlikely to impact elsewhere on the existing road structure.

TRAFFIC NOISE IMPACT

The environmental impact of traffic noise is assessed in terms of L^{den} and L^{night}. L^{den} is the equivalent continuous noise level over a whole 24-hour period, but with noise in the evening (19:00 to 23:00) increased by 5 dB(A) and noise at night (23:00 to 07:00) increased by 10 dB(A) to reflect the greater noise-sensitivity of people at those times. L^{night} is the equivalent continuous noise level over the night-time period (23:00 to 07:00).

L^{night} does not contain any night-time noise weighting[96]. Further assessment of traffic noise is presented in Chapter 9.

Traffic noise is generated by a combination of noise sources including vehicle engines and the interactions between vehicles and the road surface. Traffic noise is therefore a factor of the number and type of vehicles using a particular route. Whilst a noise source such as a HGV passing a noise receptor such as house is likely to generate a momentary noise at a level approximating 85dBA, when averaged over an extended period, such as a day, the impact of an individual vehicle in terms of a change in the averaged noise levels is negligible.

It is anticipated that whilst traffic related to the proposed development of the Biogas site is unlikely to generate a measurable traffic noise impact in terms of L^{den} or L^{night}, traffic and activity related to road construction activities will create significant noise for a short period of the construction phase of the proposed development, specifically associated with the construction of the new site access junction. Mitigation measures are included in Section 11.5.1.

AIR POLLUTION IMPACT (TRAFFIC)

Due to the existing traffic volume recorded on the R458 regional road (Appendix 11-1) and the relatively low number of additional vehicle movements associated with the proposed development, no measurable local air pollution impact is predicted as a result of the additional traffic generated by the proposed development.

11.4.2 Operational Phase

As part of this assessment an estimate has been made of operational phase trip generation based on the size of the workforce and material inputs and outputs from the processes on site. The predicted type and number of cumulative daily two-way movements during the operational phase of the proposed development is shown in Table 11.4. The majority of operatives (employees) will work based on a three-shift system which will not coincide with traffic peak hours. HGV trips will be distributed across the operational working day of the proposed development, but will typically occur during daylight hours.

The predicted distribution of these operational phase trips at the R458/New site access junction is detailed in Appendix 11-3. For the purpose of the assessment contained within

[96] *EPA Strategic Noise Mapping (Noise Round 3 Road) [https://gis.epa.ie/EPAMaps/] indicates L^{den} values of between 65dB and 69dB, and L^{night} values of between 55dB and 59dB for properties located adjacent to this section of the R458 regional road. These values may have altered since the opening of the M18 motorway.*

this report, traffic has been distributed based on existing movements on the R458 regional road. Operational phase trips equate to 4.2% of the AM peak hour traffic movements and 3.6% of the PM peak hour traffic movements at the R458/new site access junction, both below the normal threshold levels for assessment and intervention, which is 5%.

Table 11.4 Predicted maximum daily operational phase movements (PCUs)

Trip Type	Average Daily two-way movements		Maximum Daily two-way movements	
	Vehicles	*PCUs* [97]	Vehicles	*PCUs*
Operatives (employees) accessing the site (Cars and LGVs)	22	*22*	22	*22*
Vehicles (HGVs) delivering non-hazardous organic feedstocks	10	*25*	11	*25*
Vehicles (Tankers) collecting whole digestate	7	*16*	10	*24*
Vehicles (HGVs) collecting fibre digestate	4	*9*	4	*9*
Tankers collecting biomethane	4	*9*	4	*9*
Tankers collecting CO_2	4	*9*	4	*9*
Total daily movements (Cars/LGVs/HGVs)	51	*90*	55	*98*
Total Daily HGV movements	29	*68*	33	*76*

HIGHWAY CAPACITY MODELLING

Based on the operational phase peak hour movements contained within Appendix 11-3, the operation of the R458/New site access junction has been assessed using the industry standard PICADY modelling software package for the operational years of 2022, 2027 and 2037. The results of the PICADY analysis are summarised in Table 11.5, and detailed in Appendix 11-4. The traffic modelling shows that the junctions tested will operate with over 98% spare capacity, with negligible queuing, during the operational phase of the proposed development. Minor changes to the operational phase trip generation and/or distribution will not affect the validity of this assessment.

[97] *For definition of PCUs refer to Section 11.2.6*

Table 11.5 Summary of PICADY modelling output for operational phase

Year – Arm	AM Peak Hour		PM Peak Hour	
	Maximum RFC	Maximum Queue (Vehicles)	Maximum RFC	Maximum Queue (Vehicles)
2022 – R458	0.005	0.00	0.005	0.00
2022 – Development access	0.014	0.01	0.015	0.01
2027 – R458	0.005	0.01	0.005	0.01
2027 – Development access	0.015	0.01	0.015	0.02
2037 – R458	0.005	0.01	0.005	0.01
2037 – Development access	0.015	0.02	0.016	0.02

ROAD STRUCTURE IMPACT

Due to the low flows of HGV traffic during the operational phase of the proposed development, no road structure impact is predicted.

TRAFFIC NOISE IMPACT (TRAFFIC)

The environmental impact of traffic noise is assessed as detailed in Section 11.4.1. Due to the low traffic flow generated by the proposed development in the operational phase, particularly during the night-time period, no measurable noise impact is predicted, attributable to traffic related to the proposed development.

AIR POLLUTION IMPACT (TRAFFIC)

Due to the low traffic flow generated by the proposed development in the operational phase, no measurable impact in terms of local air pollution related to additional traffic is anticipated. TTRSA have also been informed that all HGVs serving the biogas plant will be sealed to reduce the potential for air pollution impacts.

11.5 Mitigation Measures and Monitoring

11.5.1 Construction Phase

The design of the new site access junction off the R458 regional road shall incorporate the recommendations contained within the Road Safety Audit (Appendix 11.2).

Construction of the new site access junction off the R458 regional road, construction of the new internal road within the proposed development site, and widening of an existing internal road within the proposed development site, should be programmed to be completed in advance of construction commencing of the Biogas plant.

A Temporary Traffic Management Plan (TTMP) in accordance with prevailing guidance, such as the Traffic Signs Manual 2019, should be designed for the construction of the new site access junction off the R458 regional road. The associated Temporary Traffic Management on the R458 regional road should maintain safe routes for through traffic and access for residents of neighbouring properties. Those requiring access should be consulted in advance of the implementation of the TTM and for example, prior to any surfacing works which may temporarily limit access.

Drivers delivering to the construction site should be informed of appropriate delivery routes. These routes should be reinforced with temporary traffic signing.

Road construction activity should be limited to the period 07:00-19:00 to minimise the noise impact of such activities in terms of L^{den} and L^{night}.

The spread of dust and materials into the local environment should be minimised through the use of facilities such as a wheel-wash for vehicles existing the construction site and during periods of dry weather loads of, for example, stone, may need to be covered.

11.5.2 Operational Phase

Drivers delivering to the Biogas site should be made aware of appropriate delivery routes, and local direction signing should be provided at the R458/R380 junction to reduce the likelihood of erroneous trips into, and u-turn manoeuvres within, Gort town centre, and also at the Biogas site access off the R458 regional road.

11.5.3 Decommissioning Phase

Mitigation measures for decommissioning should be a TTMP and appropriate haulage routes, as per the construction phase.

11.5.4 Cumulative Impacts

This assessment has taken account of the cumulative traffic and transport impact of the proposed development and existing uses it's immediate vicinity. The RFC and queuing values resulting from the traffic modelling detailed in Section 11.4.1 and 11.4.2 of this EIAR mean that the proposed development is unlikely to result in capacity related issues on the local road network.

11.6 Residual Impacts

If the proposed development proceeds without the recommended mitigation measures, particularly during the construction phase, there is an increased risk of collisions likely to result in injury to road users, and consequential environmental impacts including the uncontrolled release of pollutants into the local environment from vehicles involved in the collisions.

11.7 Summary of Significant Impacts

Mitigation measures have been proposed to reduce the level of risk of a road collision occurring, and the severity injury should a collision occur.

11.8 Statement of Significance

With the recommended 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.

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-12-27
-13-1

12 ARCHAEOLOGY AND CULTURAL HERITAGE

12.1 Introduction

John Cronin & Associates, commissioned by Halston Environmental & Planning Ltd., have prepared this assessment of the archaeological and cultural heritage resource within the environs of the site of a proposed Biogas Plant at Ballynamantin, Glenbrack & Kinincha, Gort, Co. Galway.

This Section presents a cultural heritage assessment of the proposed development site (PDS) a study area extending for 1km from its boundary. It provides the location of all recorded archaeological and architectural heritage sites within the study area extending and also provides the published inventory descriptions of these sites as appendices (Appendices 12.1 and 12.2). A wider study area extending 10km from the subject site was also examined to ascertain if any there are any potential visual impacts on National Monuments or monuments with astronomical alignments, e.g. megalithic tombs, stone rows, etc. The term 'cultural heritage' is used to encompass the overall archaeological, architectural, historical and folklore heritage resources.

12.2 Assessment Methodology and Significance Criteria

12.2.1 Assessment Methodology

The assessment methodology used for this assessment is based on EPA guidelines on assessment of Cultural Heritage, including folklore/tradition, architecture/settlements and monuments/features as well as per the Institute of Archaeologists (IAI) Good Practice Guidelines.

This assessment commenced with a desktop survey which identified all recorded archaeological, architectural and other cultural heritage sites within the study area. This was followed by a field inspection of the areas to be impacted by the proposed development. The desk top and field survey also endeavoured to identify any hereto now unrecorded features or areas of archaeological, architectural and cultural heritage significance.

12.2.2 Legislation and Guidance

The management and protection of cultural heritage in Ireland is achieved through a framework of international conventions and national laws and policies established in accordance with the provisions of the 'European Convention on the Protection of the

Archaeological Heritage' (the Valletta Convention) and 'European Convention on the Protection of Architectural Heritage' (Grenada Convention). Cultural heritage can be divided loosely into the archaeological resource covering sites and monuments from the prehistoric period until the post-medieval period and the architectural heritage resource, encompassing standing structures and sites of cultural importance dating from the post-medieval and modern period. In addition, local placenames, folklore and traditions are considered part of our cultural heritage. In summary, the national policy statements, guidelines and advice notes relevant to this assessment include:

- National Monuments Act 1930 (and amendments in 1954, 1987, 1994 and 2004);
- Heritage Act (1995);
- National Cultural Institutions Act (1997);
- Policy for the Protection of the Archaeological Heritage (Department of Arts, Heritage, Gaeltacht and the Islands 1999);
- Architectural Heritage (National Inventory) and National Monuments Act (1999);
- Planning and Development Act (2000); and
- Department of Environment, Heritage, and Local Government's Architectural Heritage Protection: Guidelines for Planning Authorities (2004).

RELEVANT ARCHAEOLOGICAL LEGISLATION

The National Monuments Acts 1930 to 2004, the Heritage Act 1995 and relevant provisions of the National Cultural Institutions Act 1997 are the primary means of ensuring the satisfactory protection of archaeological remains, which are deemed to include all man-made structures, of whatever form or date, except buildings habitually used for ecclesiastical purposes. A National Monument is described as 'a monument or the remains of a monument, the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (Section 2, National Monument Act, 1930). There are no recorded National Monuments within the study area. The Record of Monuments and Places (RMP) was established under Section 12 (1) of the National Monuments (Amendment) Act, 1994 and, as with the earlier Sites and Monuments Record (SMR), it comprises of lists and maps of archaeological monuments and relevant places in respect of each county in the State. All sites recorded on the RMP receive statutory protection under the National Monuments Act 1994 and any work undertaken at these sites must be licenced by the National Monuments Service (NMS). The location and descriptions of the RMP sites within the study area are provided (Section 12.3.2) while their available inventory descriptions are presented in Appendix 12.1.

RELEVANT ARCHITECTURAL HERITAGE LEGISLATION

Protection of the architectural/built heritage resource is provided through a range of legal and policy instruments. The Heritage Act, (1995) protects all heritage buildings owned by a local authority from damage and destruction. The Architectural Heritage Act, 1999, requires the Minister to establish a survey to identify; record and evaluate the architectural heritage of the country. The function of the National Inventory of Architectural Heritage (NIAH) is to record built heritage structures within the Republic of Ireland and to advise local authorities in relation to structures of interest within their areas. There are 41 NIAH structures located within the 1km wide study area surrounding the PDS; however, 38 of these structures are located within the town centre and only three structures are located in the rural hinterland surrounding the subject site. The relevant NIAH inventory descriptions are provided in Appendix 12.2.

The Planning and Development Act, 2000, requires all Planning Authorities to keep a 'Record of Protected Structures' (RPS) of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. As of the 1st January 2000, all structures listed for protection in current Development Plans, have become 'protected structures'. Since the introduction of this legislation, planning permission is required for any works to a protected structure that would affect its character. There are 28 Protected Structures within the study area and all of these are located within the town of Gort to the south of the PDS. The centre of Gort town is also listed as an Architectural Conservation Area (ACA) in the Galway County Development Plan 2015-2021 and the PDS is located outside this area.

12.2.3 Desktop Study

The principal sources reviewed for the assessment of the known archaeological resource were the *Sites and Monuments Record* (SMR) and the *Record of Monuments and Places* (RMP) for County Galway. These provide comprehensive lists of the known archaeological resource and their legislative basis is outlined above (Section 12.2.2). The Record of Protected Structures (RPS) and the National Inventory of Architectural Heritage (NIAH) were the main sources consulted for assessing the recorded architectural heritage resource. The following sources were also consulted:

DATABASE OF IRISH EXCAVATIONS

The Database of Irish Excavations contains summary accounts of all archaeological excavations carried out in Ireland (North and South) from 1970 to 2017. The excavations database contains summaries of a large number of excavations which were undertaken

within the study area and these are summarised within Section 12.3.10 while the full database entries are provided in Appendix 12.3.

DEVELOPMENT PLAN

The local authority development plan relevant to the study area was consulted as part of this assessment. These plans outline the local authorities' policies for the conservation of the archaeological and architectural heritage resource and include the Record of Protected Structures (RPS) and designate Architectural Conservation Areas (ACA). The relevant development plan for the study area comprises the Galway County Development Plan 2015-2021.

NATIONAL INVENTORY OF ARCHITECTURAL HERITAGE

The function of the National Inventory of Architectural Heritage (NIAH) is to record built heritage structures within the Republic of Ireland and to advise local authorities in relation to structures of interest within their areas. The NIAH commissions surveys of structures of architectural significance to assist in evaluating structures to be included in the RPS. Listing on the NIAH does not necessarily carry any statutory protection but does highlight the culturally significant aspects of the structure which ought to be conserved.

CARTOGRAPHIC SOURCES

The detail on cartographic sources can indicate past settlement and land use patterns in recent centuries and can also highlight the impact of modern developments and agricultural practices. This information can aid in the identification of the location and extent of unrecorded, or partially levelled, features of archaeological or architectural heritage interest. The cartographic sources examined for the study areas include the 1st edition of the 6-inch OS maps (surveyed and published in the 1830s) and the 25-inch OS maps (surveyed and published 1887-1913). Recent aerial imagery of the subject site was also reviewed.

LITERARY SOURCES

Literary sources are a valuable means of completing the written archaeological, historical and architectural record of study area and gaining insight into the history of the environs of the proposed scheme. A list of all literary sources consulted is provided below.

PLACENAMES DATABASE OF IRELAND

The Placenames Database seeks to establish the correct Irish language forms of the placenames of Ireland and to publish them on a public website (www.logainm.ie).

NATIONAL MUSEUM OF IRELAND TOPOGRAPHICAL FILES

These files are held in NMI, Kildare Street, Dublin and record the locations where artefacts in the museum collections were discovered.

12.2.4 Field Work

A field survey of the PDS was undertaken on Wednesday 20th December 2017 in order to determine if any surface traces of unrecorded cultural heritage sites were evident. A photographic record of the survey was compiled and extracts are provided in Section 12.3.12.

12.2.5 Consultation

There are no recorded archaeological or architectural heritage sites located within the PDS or its close environs and, therefore, no consultations with statutory agencies were undertaken.

12.3 Description of the Receiving Environment

12.3.1 Introduction

The PDS comprises approximately 10.1 hectares and is located in lands to the south-west of Gort town, within the townlands of Ballynamantin, Kinincha and Glenbrack. The site largely consists of improved grassland, which is used for agricultural (grazing) and equine related purposes, as well localised areas of woodland scrub to the south and east. Ground conditions, ground levels and field boundaries within the site were significantly altered in c. 2000 when the site was extensively landscaped to facilitate the development of a horse gallop with access to associated stables and a lunging ring located off-site to the northwest of the PDS (Galway County Council planning references 95/73, 97/2835 and 98/4738). The enabling works within the subject site at this time involved excavation of soils, profiling of ground, removal of field boundaries, importation of screened fine soils, grass reseeding, construction of a perimeter track and fencing. The topography of lands surrounding the site is generally flat with nearby rural housing primarily located to the west, which front onto the N18 (now designated as a regional road since the opening of the motorway in 2017).

12.3.2 Records of Monuments and Places

The following section is based on a desktop survey on the recorded archaeological resource within the study area in order to inform assessment of the potential impacts of the

proposed scheme. It provides a summary of the main phases of the Irish archaeological record and the date ranges used are based on those published by the National Monuments Service (2006). There are no recorded archaeological sites within the PDS or within 200m of its boundary and the nearest example is a ringfort (GA122-016----) located approximately 250m to the northwest. Figure 12.1 shows the location of the recorded archaeological sites in closest proximity to the PDS. Table 12.1 provides a list of all of the recorded archaeological sites within the 1km study area and provides grid coordinates for their locations as recorded by the Archaeological Survey of Ireland (www.archaeology.ie). The available published inventory descriptions of these archaeological monuments are provided in Appendix 12.1.

Figure 12.1 Map depicting recorded archaeological sites in closest proximity to the PDS with approximate perimeter of site outlined in red

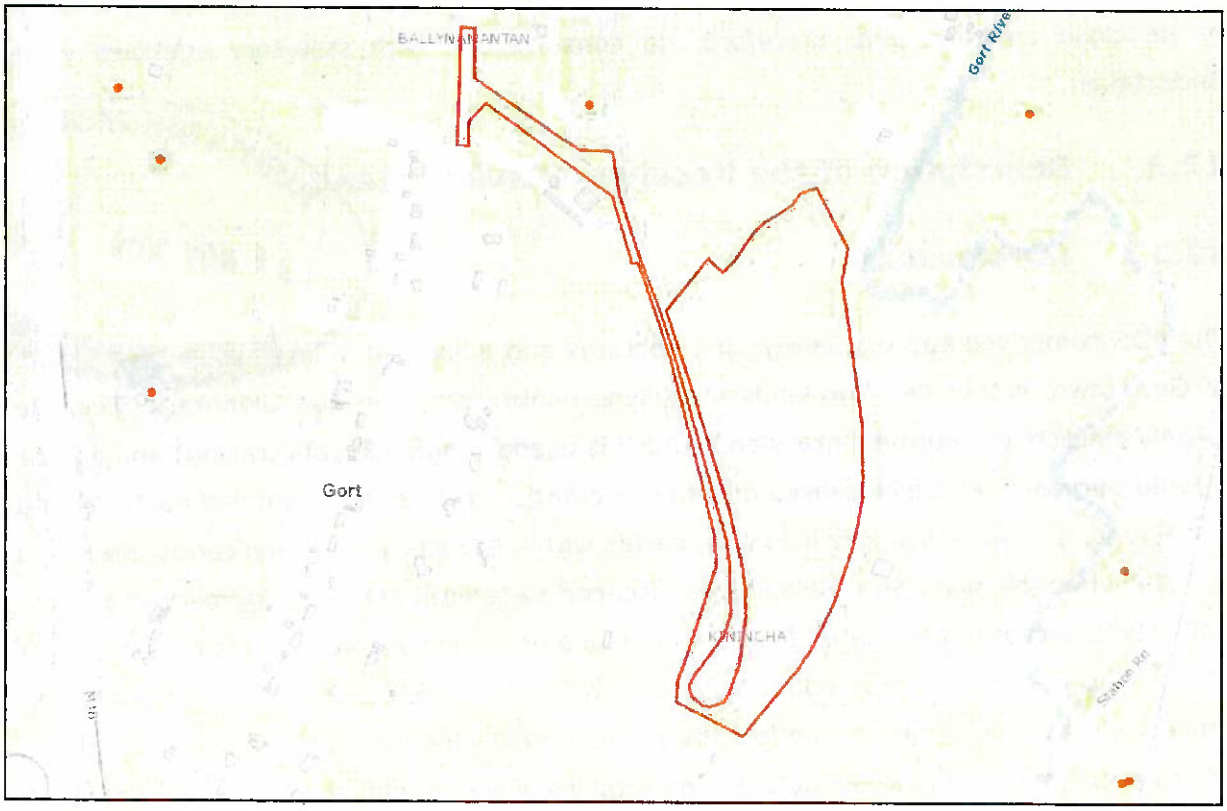


Table 12.1 List of recorded archaeological sites recorded within 1km of the subject site

Recorded Monument No.	Class	Townland	ITM Ref (E, N)
GA122-008----	Church	Ballyhugh	545030, 702052
GA122-016----	Ringfort - rath	Ballynamantan	545221, 703764
GA122-017----	House – 18th/19th century	Ballynamantan	545197, 704372
GA122-087----	Ringfort - unclassified	Glenbrack	544672, 703782
GA122-087001	Souterrain	Glenbrack	545672, 703782
GA122-088----	Ringfort - unclassified	Glenbrack	544719, 703697
GA122-089----	Ritual site - pond	Glenbrack	544713, 703424
GA122-090----	Redundant record	Glenbrack	544504, 702752
GA122-093----	Town	Gort	545076, 702145
GA122-094----	Redundant record	Gort	545337, 702439
GA122-096----	Redundant record	Gort	545115, 702509
GA122-097----	Castle - unclassified	Gort	545199, 702202
GA122-097001-	Earthwork	Gort	545229, 702164
GA122-097002-	Barracks	Gort	545229, 702164
GA122-098----	Milestone	Gort	545013, 702404
GA122-099----	Church	Gort	545062, 702490
GA122-109----	Mill - corn	Lavally	545294, 702177
GA123-062----	Ringfort - unclassified	Lavally	546339, 703022
GA123-063----	Ringfort - cashel	Lavally	545839, 702977
GA123-063001-	Souterrrain	Lavally	545839, 702977
GA123-063002-	Children's burial ground	Lavally	545839, 702977
GA123-064----	Enclosure	Lavally	546159, 702748
GA123-065----	Graveyard	Lavally	545957, 702250
GA123-066----	Souterrain	Lavally	545834, 703222
GA123-089	Redundant record	Rinneen	545839, 703950
GA123-090----	Redundant record	Rinneen	545724, 703752
GA123-091----	Ringfort - unclassified	Rinneen	546190, 703612
GA123-108----	Field boundary	Ballynamantan	545576, 704193

EARLY PREHISTORIC PERIODS

Traditionally, the earliest recorded evidence for human settlement in Ireland dates to the Mesolithic period (7000–4000 BC) when groups of hunter-gatherers arrived on the island, however recent evidence in the form of a butchered bear bone found in Alice and Gwendoline Cave near Ennis in Co. Clare now suggests that humans were present in Ireland c.12,500 years ago during the Paleolithic period (O'Dowd and Carden, 2016). While the Mesolithic settlers did not construct any settlements or monuments that leave any above ground traces, their presence in an area can often be identified by scatters of worked flints in ploughed fields, as well as shell middens on the coastline. There are no recorded Mesolithic sites within the study area, however, Mesolithic activity was recorded in Ballynaclogh townland near Cappataggle, Co. Galway during excavations associated with the M6 Galway to Ballinasloe project. The Neolithic period (4000-2400 BC) began with the arrival and establishment of agriculture as the principal form of economic subsistence, which resulted in more permanent settlement patterns. As a consequence of the more settled nature of agrarian life, new site-types, such as more substantial rectangular timber houses and various types of megalithic tombs, such as the portal tomb at Poulnabrone, Co. Clare, begin to appear in the archaeological record during this period. There are no recorded Neolihic sites within the study area, however, excavations associated with the N59 Moycullen Bypass uncovered Neolithic activity and artefacts at Ballyquirke East demonstrating the presence of settlements dated within the wider Co. Galway area.

LATE PREHISTORIC PERIODS

Metal-working arrived in Ireland with the advent of the Bronze Age period (c. 2400–500 BC). This period was also associated with the construction of monument types such as standing stones, stone rows, stone circles and *fulachta fiadh*. The development of new burial practices saw the construction of funerary monuments such as cairns, barrows, boulder burials and cists. The later first millennium BC and the early centuries AD comprise the Irish Iron Age, which is the most obscure period in the Irish archaeological record. While there is general agreement that the introduction of an iron technology was a significant factor in the eventual demise of bronze working on a large scale, but how, why and when this came about in Ireland is far from clear. The study area contains four *fulachta fiadh,* which translates as cooking places of the wild (or of deer). They are often interpreted as the remains of cooking sites and are the most numerous archaeological site type in Ireland and radiocarbon dating of excavated examples has generally produced Bronze Age dates. These sites are typically found close to a water source and often survive as horseshoe-shaped mounds surrounding a trough, which may be stone or timber-lined. They functioned by filling the trough with water, which was then heated by the introduction

of heated stones. Modern experiments have shown that this technique can bring the trough water to boiling point and it has been successfully demonstrated that it could cooked wrapped meats within a short period of time. The heated stones shattered on entering the cold water, and after use the trough was cleaned out and the burnt stones were thrown behind and to the sides of the trough, which eventually resulted in a horseshoe-shaped mound. Over time many of the mounds were ploughed out and now survive as sub-surface spreads of blackened soils with frequent inclusions of burnt stones. A number of alternative interpretations have been forwarded as to the function of these archaeological sites, such as their potential uses as bathing, saunas, garment washing and dyeing, and leather processing sites. The study area contains another recorded archaeological site of possible the Bronze Age origin; a ritual site (GA122-089----) located at a pond in Glenbrack townland, c.600m west of the PDS. Within the wider environs of the subject site, but outside the study area, a significant number of Bronze Age archaeological sites, predominantly comprising burnt spreads or *fulachta fiadh*, were revealed during archaeological investigations associated with the construction of the motorway to the lands to the west of the study area.

EARLY MEDIEVAL

This period began with the introduction of Christianity in Ireland and continued until the arrival of the Anglo-Normans during the 12th-century (*c.* 400–1169 AD). The establishment of the Irish church was to have profound implications for political, social and economic life and is attested to in the archaeological record by the presence of church sites, associated places for burial and holy wells. This period also saw the emergence of the first phases of urbanisation around the large monasteries and the Hiberno-Norse ports. However, the dominant settlement pattern of the period continued to be rural-based and centred on settlement sites known as ringforts, which comprise roughly circular enclosures delimited by roughly circular earthen banks formed of material thrown up from a concentric external ditch. Ringforts are one of the most numerous monuments in the Irish landscape and the early medieval terms for these sites – rath/lios/dun - still form some of the most common place-name elements in the country. Archaeological excavations indicate that the majority of ringforts were early medieval farmsteads with internal timber buildings and were surrounded by associated field systems. The study area contains six recorded ringforts (see Table 12.1 and Appendix 12.1) and the closest of these is located c.250m to the northwest of the subject site in Ballynamantan townland (GA122-016----). Three of the ringforts within the study area contain souterrains which are underground chambers constructed within ringforts that had a defensive and/or storage function. An enclosure site (GA123-064----) in Lavally townland may also date to the early medieval period.

LATE AND POST MEDIEVAL

The arrival and conquest of large parts of Ireland by the Anglo-Normans in the late 12th-century broadly marks the advent of the Irish late medieval period, which continued up until the beginning of the post-medieval period in c.1550. Most Irish market towns and villages were established during this period while the larger Hiberno-Norse port settlements were expanded. By the 15th-century the native Irish chieftains and lords began to establish tower houses and smaller castles in the lands as centres of territorial control. There are eleven recorded archaeological sites dating to the late and post medieval period within the study area (see Table 12.1 and Appendix 12.1) and the majority of these are located within Gort town. This market town is recorded in the RMP as a historic settlement (GA122-093----) and is reputed to take its name (in Irish 'Gort Inse Guaire' meaning Guaire's Island garden) from Guaire, the seventh century King of Connacht, who resided there (Ryan 1990, 146). The area was settled around the twelfth century by the O'Shaughnessy's who built a stronghold there during the late medieval period, before being deposed after the Battle of the Boyne. The O'Shaughnessy lands around Gort were subsequently granted to Thomas Prendergast in payment for his service to William of Orange (*ibid.*, 148). The development of much of the existing buildings in Gort began in the early 19th century when it was still under the control of the Prendergasts (later titled Lord Gort), although the street pattern in the historic core may preserve of its earlier layout. The town grew rapidly during the 19th century with many domestic, retail and civic buildings being constructed and the population had risen to 3,627 inhabitants, within 563 houses, by the 1830's (Lewis 1837, 666). A flour mill in the town, which produced 7,000 barrels of flour per year, was built by J. Mangan in 1806 and was further augmented in 1836 (Lewis 1837, 666). The growth of the town meant that it developed as an important stage on the road between Galway and Limerick/Ennis. Gort railway station opened on 15 September 1869 thereby connecting the town to Athenry, Tuam and Galway to the north and Limerick and Ennis to the south.

12.3.3 List of Monuments in State Ownership or Guardianship

There are no monuments in state ownership or guardianship recorded within the study area.

12.3.4 Register of Historic Monuments

Archaeological sites listed in the Register of Historic Monuments have been added to the RMP and SMR (see Section 12.3.2).

12.3.5 List of Preservation Orders

There are no Preservation Orders on any of the recorded archaeological sites within the study area.

12.3.6 Cartographic Evidence

The detail on historic cartographic sources demonstrates the nature of past settlements and land use patterns in recent centuries and also highlights the impact of modern developments and agricultural practices. This information can aid in the identification of the location and extent of unrecorded, or partially levelled, features of archaeological or architectural heritage interest. The cartographic sources examined for the study areas include the 1st edition of the 6-inch OS maps (surveyed 1839/1840) (Figure 12.2) and the 25-inch OS maps (surveyed 1893) (Figure 12.3). These maps indicate that the study area has been occupied by enclosed, primarily pastoral farmland since at least the 19th-century and significant sub-division of fields was undertaken in the decades between the production of these maps. The townland boundary separating the townlands of Kinincha and Glenbrack extends in a NE-SW direction through the north end of the PDS on the historic OS maps.

Figure 12.2 Extract from the 1st edition O.S map (surveyed 1839/1840) depicting approximate area of subject site and surrounding area (OSI Licence 0003318)

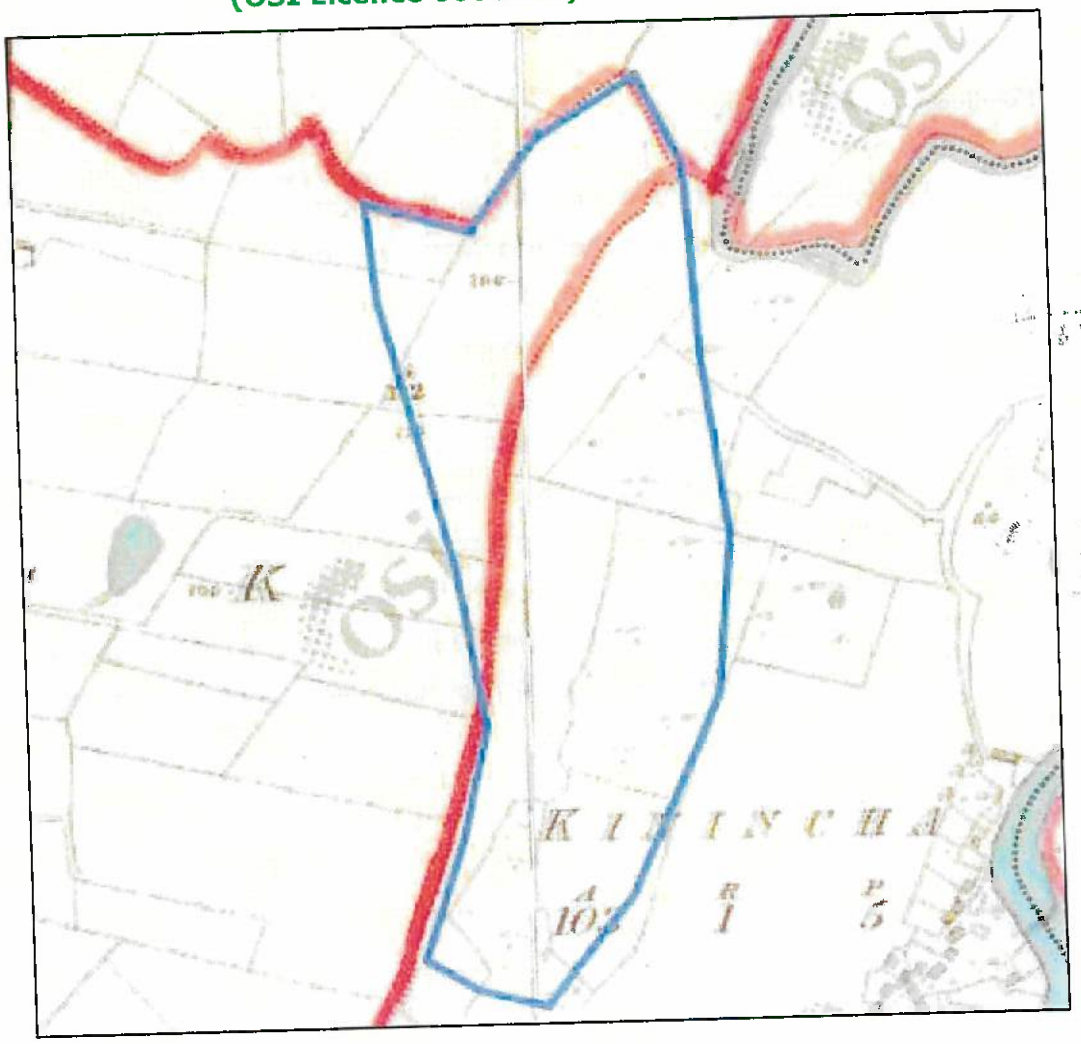
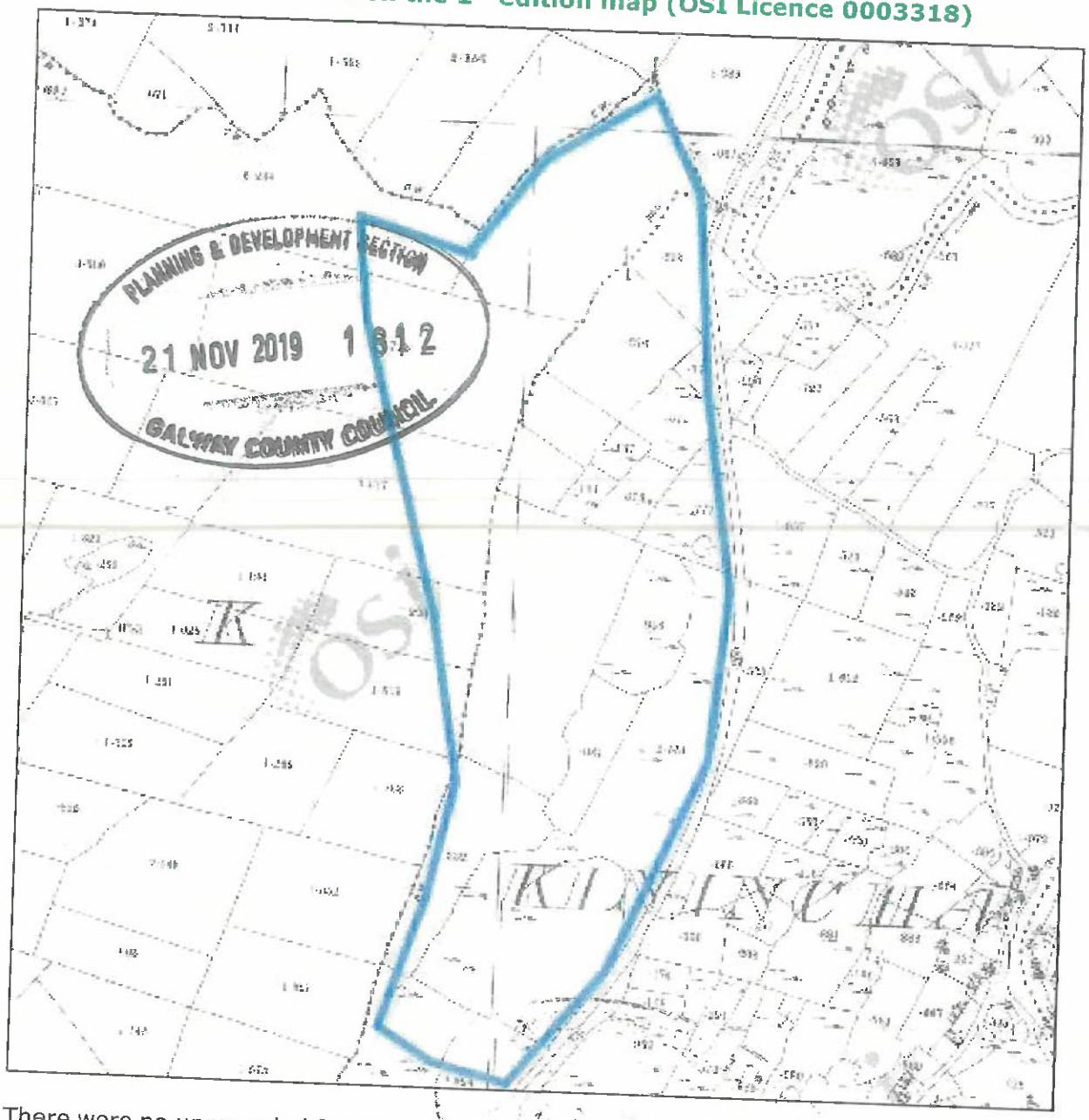


Figure 12.3 **Extract from the 25-inch edition O.S. map (surveyed 1893) depicting approximate area of the subject site and surrounding area, a greater sub-division of fields is evident in comparison to the detail on the 1st edition map (OSI Licence 0003318)**



There were no unrecorded features of archaeological or architectural significance noted on the footprint of the proposed scheme during the inspection of the 1st edition map, however, the later 25-inch edition map depicts a small circular enclosure near the east-central margin of the site and this possibly represents a small animal pen (Figure 12.4). The feature is not depicted on the First Edition 6-inch map and this indicate a late 19th century date or that it was too small to be included - small field features and structures were often omitted from the first edition 6-inch maps. The circular feature is approximately 10m in diameter which is too small to be a ringfort, but possibly an animal pen or another form

of enclosed feature. The feature is not present on the Cassini edition OS map surveyed in the 1940s which may indicate that it was levelled in the early 20th century.

The extent of the ground reduction works undertaken within the site during the development of the horse gallop is clearly demonstrated on an OS aerial image taken during the course of the ground works in 2000 (Figure 12.5). There are no visible traces of soil marks that may suggest the presence of an archaeological site evident in the exposed subsoils on this image. An OS aerial image taken in 2005 shows the completed horse gallop and indicates that the townland boundary between Kinincha and Glenbrack was levelled during the site preparation works (Figure 12.6).

Figure 12.4 Small circular feature depicted in the eastern margin of the subject site on the 25-inch OS map; *(OSI Licence 0003318)*

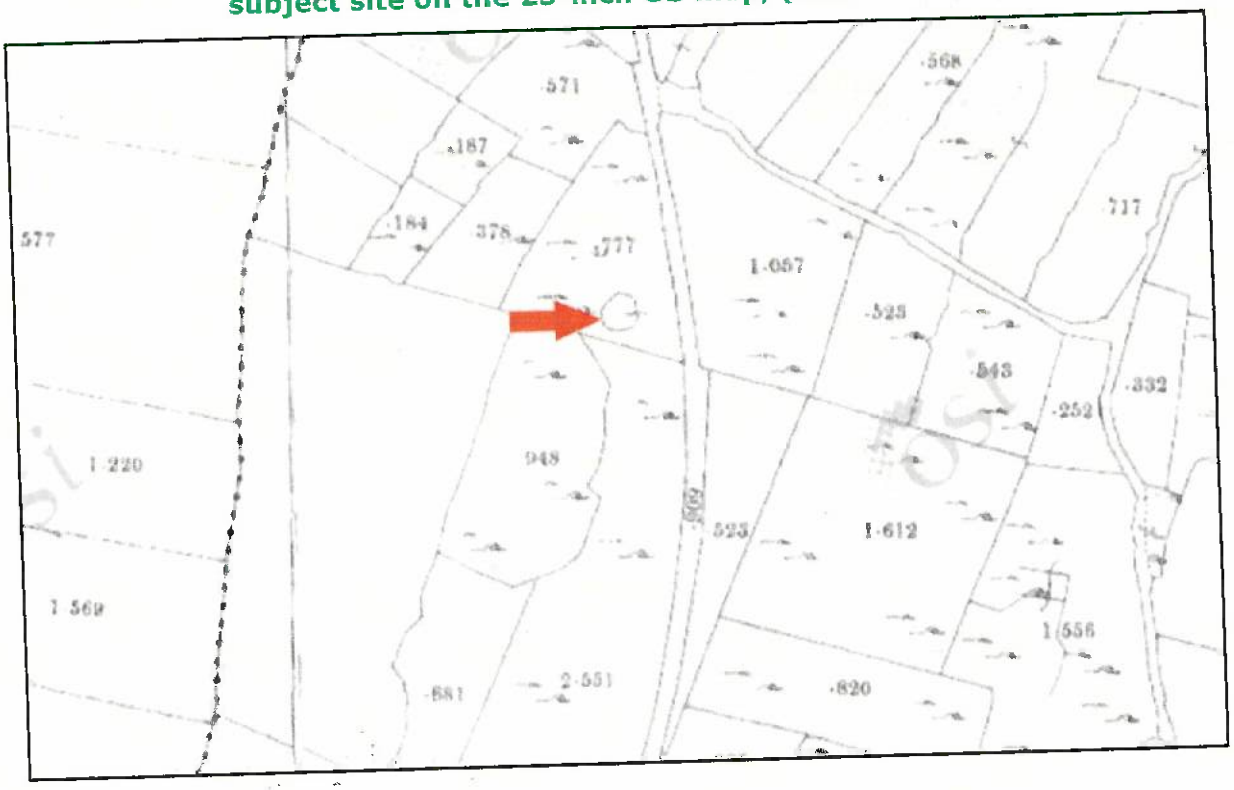


Figure 12.5 **Extract from OS aerial image of PDS in 2000 showing ground works in progress, including at location of the small circular feature noted on the 25-inch map (arrow); (OSI Licence 0003318)**

Figure 12.6 Extract from recent OS aerial image of PDS showing completed horse gallop development; *(OSI Licence 0003318)*

12.3.7 Placename Evidence

The study area is located within the parish and barony of Kiltartan and encompasses nine townlands (Table 12.2). The PDS extends into sections of the townlands of Ballynamantan, Kinincha and Glenbrack. Townlands are the smallest unit of land division in the Irish landscape and many may preserve early Gaelic territorial boundaries that pre-date the Anglo-Norman conquest. The boundaries and nomenclature of the Irish townlands were recorded and standardised by the Ordnance Survey in the 19th-century. The Irish roots of townland names often refer to natural topographical features but some name elements may also give an indication of the presence of past human activity within a townland, e.g. *dun, lios or rath* indicate the presence of a ringfort while *temple, saggart, termon or kill*

record an association with a church site. One of the townland names within the study area records the presence of a castle site (Castletown), three may refer to previous landowners (Gort, Ballyhugh and Ballymurphy) while the remainder (including Kinincha and Glenbrack) refer to topographical features.

Table 12.2 Translation of Townland Names within study area (Source: www.logainm.ie)

Townland	Irish Root	Translation
Ballyhugh	Baile Uí Aodha	Town/townland of Hugh
Ballymurphy	Baile Uí Mhurchú	Town/townland of Murphy
Ballynamantan	Béal Átha na Miontán	Mouth of the ford of the tit (bird)
Castletown	Baile an Chaisleáin	Town of the Castle
Glenbrack	An Gleann Breac	The speckled glen
Gort	An Gort 'Gort Inse Guaire'	Guaire's Island Garden
Kinincha	Cionn Inse	Headland of the river meadow
Lavally	An Leathbhaile	The half town/townland
Rinneen	An Rinnín	The small point

12.3.8 Recorded Archaeological Finds

The National Museum of Ireland topographical files are archived in the premises on Kildare Street, Dublin. The files were inspected on the 26th January 2018 and contained no entries for townlands in the study area.

12.3.9 Previous Excavations

The Excavations Database lists no archaeological investigations within the PDS while entries for 20 archaeological investigations undertaken within townlands in the surrounding study area and these are provided in Appendix 12.3. While the majority of these investigations revealed nothing of archaeological significance a number did uncover previously unrecorded archaeological features. These included two development sites adjacent to the Kinincha Road in Gort where human burials of unknown date were identified (Appendix 12.3: Crumlish Licence 05E1052 and Wilkinson Licence 06E0925). Disarticulated human remains were also discovered in a section of the former Glenbrack townland boundary ditch located in Gort town (Appendix 12.3: Delaney 09E0508). Archaeological test trenching in advance of the N18 Gort to Crusheen road scheme identified a probable charcoal clamp pit in Glenbrack townland (Appendix 12.3: Baley Licence 07E0456).

12.3.10 Architectural and Built Heritage

The subject site is located outside the Gort Architectural Conservation Area. There are 28 protected structures located within the study area; however, all of these are located within Gort town and the closest example is over 800m to the south of the subject site. There are 41 NIAH structures located within the 1km wide study area and 38 of these are within Gort town. Only three NIAH structures are listed in the rural hinterland surrounding the subject site and the closest example is Roseville Cottage (NIAH ref. 30412308) located 565m to the northeast. The NIAH descriptions for the listed structures within the study area are provided in Appendix 12.2.

12.3.11 Field Inspection

The PDS was inspected on 20th of December 2017 in overcast conditions that nonetheless did not form a constraint to the visual inspection of the ground terrain. The landholding is bounded at east by a hedgerow planted on an earthen road bank and by an earthen field boundary to the north while the western boundary is formed by a modern timber fence. A horse trackway along the inside of these boundaries extends around the whole perimeter of the property. Almost the entire area within the boundary has been affected by modern ground reduction works and the creation of the horse gallop. Overall, the ground levels slope gradually down from north to south with two artificial shallow depressions occupying the majority of the site. The northern depression is ovoid in plan, while the southern depression is roughly triangular and both depressions are defined by machine-excavated slopes. The whole site is currently used as horse pasture.

The topsoil cover appears thin and poor in organic content which has resulted in the development of moss and sedge vegetation within the sod layer. A number of dispersed hawthorn, hazel and ash trees are present, and their presence may indicate areas of relatively undisturbed ground terrain. Potential surface traces of the levelled townland boundary between Kinincha and Glenbrack in the north end of the site are barely perceptible as three short remnants of the base of the earthen bank, overgrown hawthorn bushes. Badgers and foxes appear to be using low remains for their setts and burrows. There is no clear trace of the boundary bank visible in the recent aerial image of the site (Figure 12.6).

The approximate area of the small enclosed feature (ITM 545943, 703371) visible on the 25-inch map (Figure 12.4) is located adjacent to an area occupied by a cluster of bushes and ivy which obscure a dump of large stones that cover a 5m by 7m area. It is possible that the stones are either the destroyed remnants of the circular feature or field clearance

material dumped by machine in any area of remnant vegetation. No surface traces of the associated enclosure feature were evident.

While topsoil stripping and some reduction of natural subsoil levels appear to have been carried out across the entire site it is possible that areas of undisturbed natural subsoil retaining some archaeological potential survive beneath introduced soils in areas where previous ground works were limited to topsoil stripping. It is only in the extreme north and north-west ends of the site that significant ground reduction works into subsoil levels appear to have completely removed the potential for the survival of archaeological remains.

Plate 12.1 View of PDS from trackway inside eastern boundary looking north-west to northern boundary. Note former height of ground levels within lands outside the PDS in background

Plate 12.2 View south across site from inside northern boundary

Plate 12.3 View southwards from start of excavated slope down into northern depression

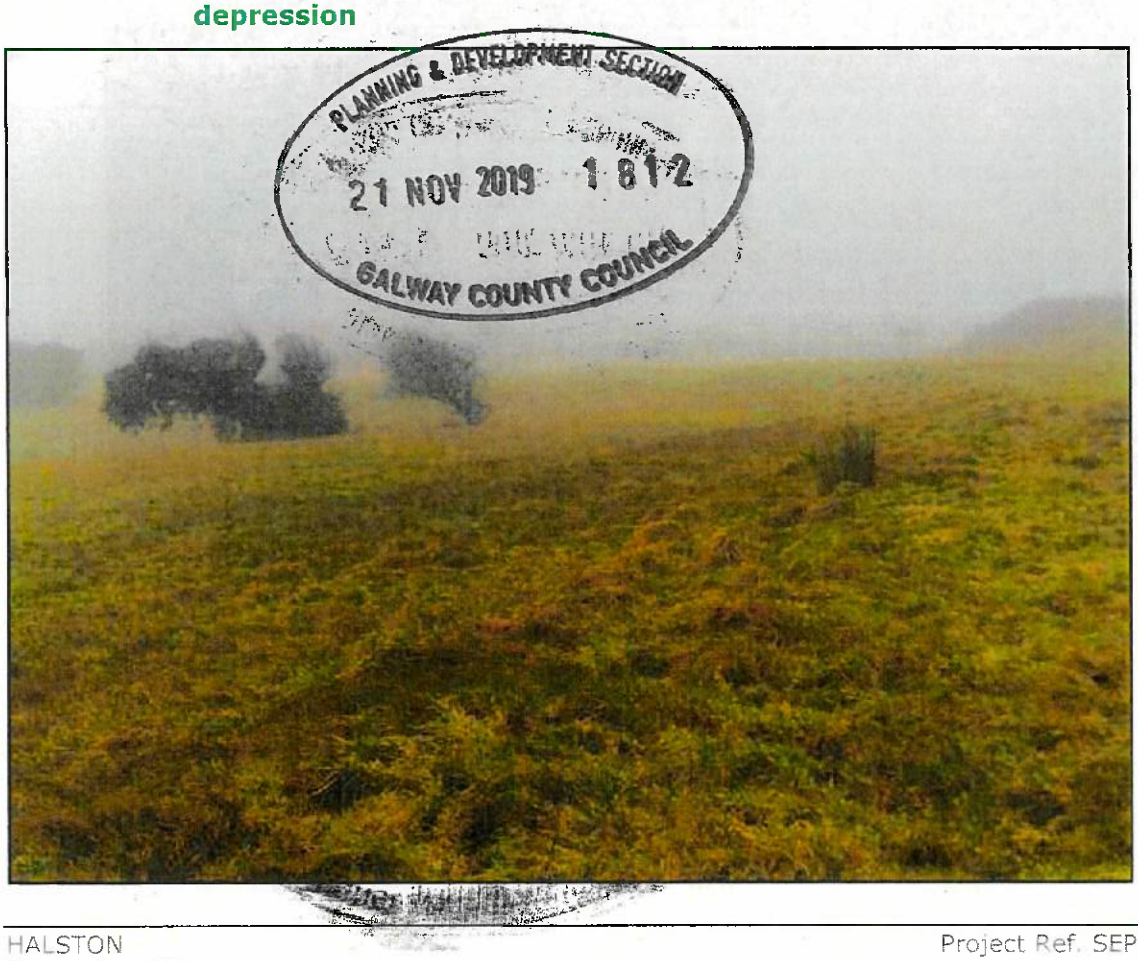


Plate 12.4 Remnants of townland boundary, largely obscured by hawthorns, looking south-west

Plate 12.5 View of south end of site, looking south-east

Plate 12.6 View of south end of site, looking north west

Plate 12.7 View of bushes which obscure pile of stones adjacent to location of small circular feature indicated on 25" inch edition O.S. map, looking south east

12.3.12 Summary

The inspection of the published datasets that detail the protected cultural heritage resource in the vicinity of the proposed Biogas Plant at Ballynamantin, Glenbrack & Kinincha, Gort, Co. Galway indicate that there are no recorded archaeological, architectural or other cultural heritage features on the footprint of the PDS or within 250m of its boundary. There are no National Monuments in State ownership or guardianship within the surrounding study area.

As outlined above, the PDS was previously impacted by extensive ground reduction works undertaken during the development of a horse gallop during the late 1990's/early 2000's (Galway Co. Co. Ref. No. 98/4738). During these works much of the upper soil layers were removed to allow for the deposition of a more suitable soils across the site. As a result, any unrecorded archaeological remains which may have existed across the excavated areas were likely severely truncated or destroyed. There is no record of any archaeological mitigation having taken place during these works. An overgrown dump of stones, noted during the field inspection, may represent the remnants of a small circular feature depicted on the 25-inch edition Ordnance Survey map (Figure 12.4). This feature is not depicted on the earlier 6-inch edition O.S. map and may represent a late 19th-century field pen. The overgrown concentration of stones may form the destroyed remains of this potential agricultural feature although it is noted that the feature is not present on the Cassini edition OS map surveyed in the 1940's and may have been removed in the early 20th century.

12.4 Impact Assessment

Given the absence of any recorded cultural heritage sites on the footprint of the proposed development or in its close environs combined with the extensive ground reduction works undertaken across the entire site in recent decades, the impacts of the proposed scheme on the known archaeological and cultural heritage resource are assessed as being **imperceptible** in nature. There is, nonetheless, is the potential to reveal hitherto unknown sub-surface archaeological remains within (a) the vicinity of the former line of the levelled townland boundary between Kinincha and Glenbrack in the north end of the PDS and (b) the overgrown dump of stones near the east-central margin of the site (ITM 545513, 703371).

12.4.1 Construction Phase

Ground works undertaken during the construction phase of the proposed project may potentially directly, negatively and permanently impact on any unrecorded sub-surface

archaeological remains that may survive within the previously disturbed lands within the PDS.

12.4.2 Operational Phase

Following construction and the successful implementation of a programme of archaeological mitigation measures outlined below (Section 12.5), it is predicted that no direct operational phase impacts on the cultural heritage resource will arise.

12.5 Mitigation Measures and Monitoring

12.5.1 Construction Phase

As outlined above, the PDS was previously impacted by extensive ground reduction works undertaken during the development of a horse gallop during the late 1990's/early 2000's (Galway Co. Co. Ref. No. 98/4738). During these works much of the upper soil layers were removed to allow for the deposition of a more suitable soils across the site. As a result, any unrecorded archaeological remains which may have existed across the excavated areas were likely severely truncated or destroyed. However, there is the potential to reveal hitherto unknown sub-surface archaeological remains within (a) the vicinity of the former line of the levelled townland boundary between Kinincha and Glenbrack in the north end of the PDS and (b) the overgrown dump of stones near the east-central margin of the site (ITM 545513, 703371). All ground works that may impact on any sub-surface traces of the townland boundary will be subject to a programme of archaeological monitoring and a detailed written, drawn and photographic record will be compiled. The stone dump may represent the remnants of a late 19th century agricultural feature or may be associated with the modern site clearance activity. The supervised removal of the vegetation from the stones will be carried out manually as will the removal of the large stones where possible. A detailed photographic record of these works will be compiled and, in the event that any potential archaeological features are identified, all works at this location will be halted, the area will be cordoned off and the NMS will be consulted to determine the appropriate mitigation strategy. This process will also be enacted in the event that any other archaeological features are noted during the monitoring of ground works in the remainder of the PDS.

A report on the archaeological supervision of localised ground works will be submitted to the NMS and Galway County Council as part of the monitoring process for the proposed development mitigation measures.

The following mitigation strategies will be enacted, after consultation with the NMS, for any unrecorded sub-surface archaeological features identified during the course of archaeological supervision of ground works.

MITIGATION BY AVOIDANCE

Should extensive archaeological remains be uncovered during ground excavation operations with the PDS, a process of liaison between the appointed archaeologist and the NMS will be undertaken to determine if the identified remains will be preserved in situ and thereby avoided. This would necessitate a redesign of elements of the proposed site layout determined by the location of the significant archaeological remains.

MITIGATION BY REDUCTION

Should extensive archaeological remains be wholly or partly located within the PDS, a process of liaison between the appointed archaeologist and the NMS will be undertaken to determine whether the remains shall be partially excavated and a buffer zone created around the remaining sub-surface remains (typically if located outside the site boundary) thereby reducing the overall magnitude of impact.

MITIGATION BY REMEDIATION

Should archaeological remains be uncovered during topsoil stripping and ground excavation operations the appointed archaeologist shall be afforded suitable time to evaluate, characterise and determine the extent of the remains. Liaison with the National Monuments Service shall determine an appropriate Method Statement and Programme of Works in order to fully excavate and record the archaeological remains.

12.5.2 Operational Phase

MITIGATION BY AVOIDANCE

Adoption of the construction phase mitigation measures shall ensure that no further potential impacts will occur on the archaeological and cultural heritage resource and no impacts are predicted during the operation phase. As such, no mitigation by avoidance measures are required.

MITIGATION BY REDUCTION

Adoption of the construction phase mitigation measures shall ensure that no further potential impacts will occur on the archaeological and cultural heritage resource and no impacts are predicted during the operation phase. As such, no mitigation by reduction measures are required.

MITIGATION BY REMEDIATION

Adoption of the construction phase mitigation measures shall ensure that no further potential impacts will occur on the archaeological resource and no impacts are predicted during the operation phase. As such, no mitigation by remediation measures are required.

12.5.3 Decommissioning Phase

Should the proposed mitigation measures be followed as recommended, this shall provide for either the avoidance of any archaeological or cultural heritage resource or the proper and adequate recording of this resource (including presently unknown potential archaeological features). As a result, there shall be no effects on the archaeological resource during the decommissioning phase of the proposed development.

12.5.4 Cumulative Impacts

There are no recorded cultural heritage sites located within the site boundary or its close environs and no likely direct/indirect negative impacts on any known elements of this resource are predicted. The mitigation measures shall provide for either the avoidance or adequate recording of any unknown, sub-surface elements of the archaeological resource. As a result, no cumulative effects on the cultural heritage resource are predicted following the construction of the proposed development.

12.6 Residual Impacts

Should the proposed mitigation measures be followed as recommended, this shall provide for either the avoidance of any archaeological or cultural heritage resource or the proper and adequate recording of this resource (including presently unknown potential archaeological features). As a result, there shall be no residual effects on the archaeological or cultural heritage resource following construction of the proposed development.

12.7 Summary of Significant Impacts

There are no predicted significant adverse impacts arising from the proposed development on the cultural heritage resource of the PDS and its environs. The impacts of the proposed scheme on the known archaeological and cultural heritage resource is assessed as being imperceptible in nature.

12.8 Statement of Significance

The proposed development will result in no significant adverse effects on the cultural heritage resource.

12.9 References

12.9.1 Literary Sources

- Fahy, M. (2004) Kiltartan Many leaves One Root – A History of the Parish of Kiltartan. The Kiltartan Gregory Cultural Society, Gort
- Lewis, S. (1837) A Topographical Dictionary of Ireland, Vol. 1. London
- O'Dowd, M. and Carden, R. (2016). Journal of Quaternary Science Review
- Ryan, A. (1990) Gort Inse Guaire, A Royal Residence in South Galway. JGAHS, Vol. 42, 144-149

12.9.2 Internet Sources

- National Excavations Database: www.excavations.ie
- National Monuments Service: www.archaeology.ie/historicenvironmet
- Placename Index of Ireland: www.logainm.ie
- www.galway.ie/galwaycountydevelopmentplan2015-2021
- www.archaeology.ie/historicenvironment
- www. osi.ie/mapviewer

13 MATERIAL ASSETS

13.1 Introduction

This Section evaluates the impacts, if any, which the development will have on material assets. In the EPA draft advice notes on current practice in the preparation of Environmental Impact Assessments, 2015, material assets are defined as *"Resources that are valued and that are intrinsic to specific places are called material assets"* and *"they may be of either human or natural origin"*

Directive 2014/52/EU includes those heritage aspects as components of cultural heritage. Material assets are taken to mean built services and infrastructure.

Material assets of *natural origin* and the existing quality of natural resources such as air, water, soils, landscape etc., are discussed in depth in earlier Sections of the EIAR along with those of human origin such as traffic and transport infrastructure, archaeological /architectural heritage and flood protection.

Material assets of natural and human origin which are included in this assessment are the following:

- Ownership and access
- Agricultural land and practices
- Foul wastewater
- Potable water
- Agricultural practices
- Site utilities

The objective of the assessment is to ensure that these assets are used in a sustainable manner, so that they will be available for future generations, after the development of the project.

13.2 Assessment Methodology and Significance Criteria

13.2.1 Assessment Methodology

13.2.2 Legislation and Guidance

The assessment was undertaken in accordance with:

- Environmental Protection Agency (2002) Guidelines contained in Environmental Impact Statements;
- Environmental Protection Agency (2003) Advice notes on current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (2017) DRAFT Guidelines on the information to be contained in Environmental Impact Assessment Reports
- Environmental Protection Agency (2015) DRAFT Advice notes for preparing Environmental Impact Statements;

13.2.3 Desktop Study

A desk study of the proposed Development Site and the surrounding study area, dependent on the topic being assessed, was largely completed in advance of undertaking the walkover survey. This involved consultation with publicly available environmental and planning datasets:

- Environmental Protection Agency database (https://gis.epa.ie/EPAMaps/);
- Geological Survey of Ireland database (www.dcenr.maps.arcgis.com);
- http://map.geohive.ie/mapviewer.html;
- Catchments website (https://www.catchments.ie/maps/);and
- Galway County Council Planning database (http://www.galwaycoco.ie/en/)

13.2.4 Field Work

A walkover survey of the Proposed Development Site was undertaken by Halston on the 18th July 2017 and again on the 10th October 2017 to verify the findings of the desk study and to obtain an understanding of the local site and wider area.

13.3 Description of the Receiving Environment, Impacts and Mitigation

13.3.1 Introduction

A description of the receiving environment is presented in Section 2 of the EIAR.

13.4 Ownership and Access

As described in Section 2, the proposed development consists of the construction of a Biogas Plant on a 10.1-hectare (ha) site in the townlands of Ballynamantin, Glenbrack and Kinincha, Gort, County Galway. Sustainable Bio-Energy Limited is applying for full

planning permission for this development. There will be no severance of land as a result of the proposed development or loss of rights of ways or amenities. Relevant landowner consents letters associated with the proposal are provided in Appendix 1.2.

13.5 Agriculture

The opportunities and challenges facing agriculture are well recognised stakeholders such as the Department of Agriculture Food and the Marine (DAFM), Department of Housing Planning and Local Government (DHPLG), Bord Bia, Teagasc, Environmental Protection Agency have incorporated environmental protections and associated recommendations /actions in national plans (such as Foodwise 2025) to ensure that sustainable growth of the sector is not achieved at the expense of environmental impact; in particular concerns associated with water quality, greenhouse gas emissions and depletion of natural resources. A guiding principle that Food Wise 2025 will seek to embed at all levels of the agri-food industry is that environmental protection and economic competitiveness are equal and complementary. Food Wise 2025 also recognises that the three pillars of sustainability - social, economic and environmental - are equally important and carry commensurate weight. As the sector continues to develop and grow, the view that development must be undertaken within a framework of sustainability must become further embedded in the industry.

While the proposed Sustainable Bio-Energy Ltd. biogas plant is being developed on agricultural lands, the proposal conforms with national and international best practice in relation to the siting of such bioenergy infrastructure. Siting bioenergy proposals within populated urban environments is inappropriate and can lead to potential nuisance complaints from nearby receivers.

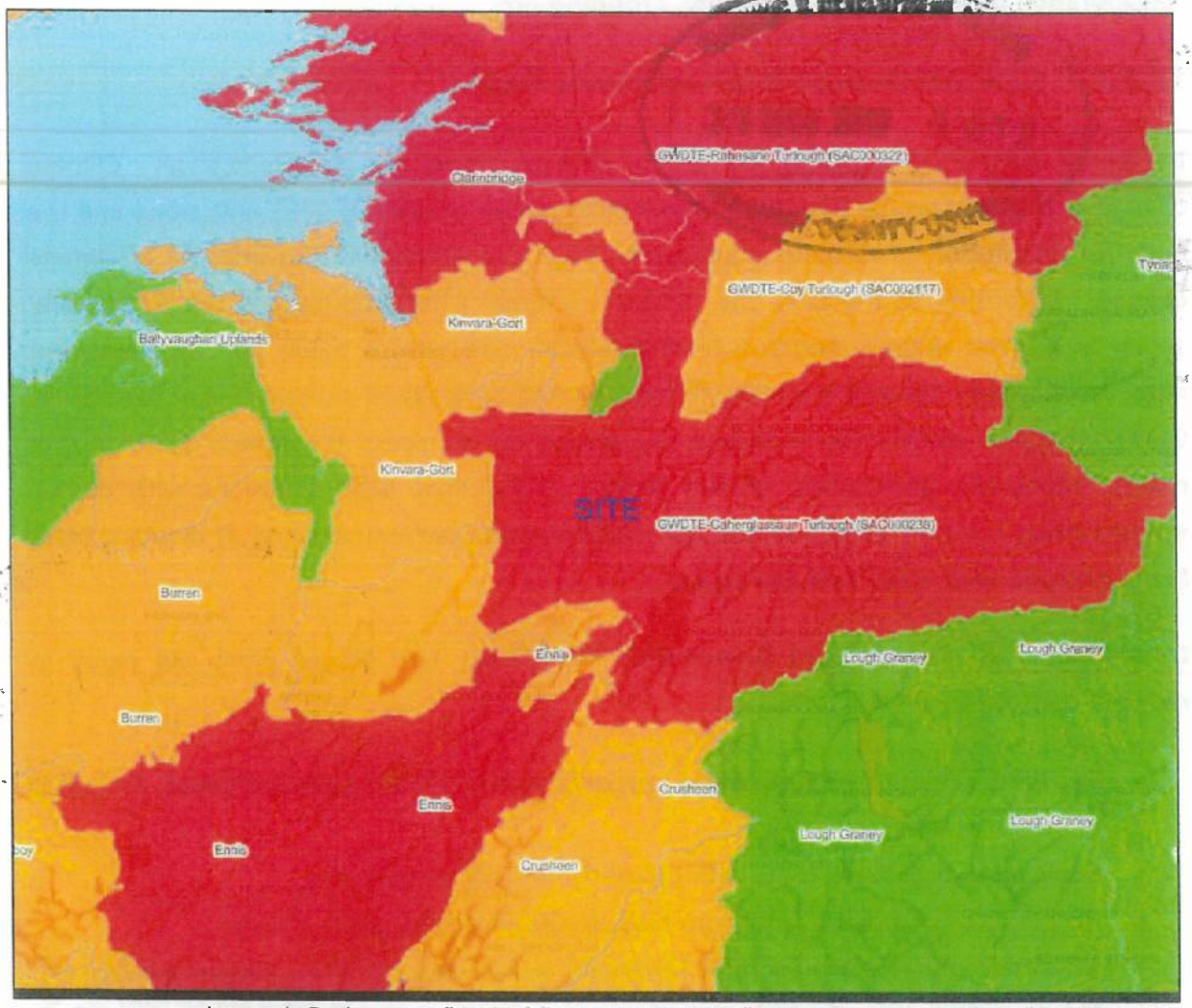
13.5.1 Water Quality

The recently published River Basin Management Plan for Ireland 2018-2021, sets out the actions that Ireland will take to improve water quality and achieve 'good' ecological status in water bodies (rivers, lakes, estuaries and coastal waters) by 2027. Water quality in Ireland has deteriorated over the past two decades. The Plan provides a more coordinated framework for improving the quality of our waters — to protect public health, the environment, water amenities and to sustain water-intensive industries, including agri-food and tourism, particularly in rural Ireland. The River Basin Management Plan includes an assessment of environmental pressures preventing the water bodies from achieving the required environmental objectives. These assessments are based on over 142 national datasets comprising information on pressures, impacts and physical settings. In addition, local authorities, Inland Fisheries Ireland (IFI) and Irish Water provided local knowledge

and information, which was incorporated into the assessment. In total, 17 pressure types were identified.

Agriculture has been identified as a significant pressure in 780 (53%) of the 1,460 water bodies identified as *At Risk* of not meeting their environmental objective. Of these water bodies, 629 are rivers, 80 are lakes, 8 are coastal waters, 32 are transitional waters, and 31 are groundwater. Impacts are evident in all catchments but are most prevalent in the areas where there are poorly drained soils and subsoils. The pressures relate to diffuse runoff of nutrients and sediment from land, and to point source pollution associated with farmyards. Along the southern catchments, where the soils and subsoils are free draining, the estuaries are impacted by excess nitrogen from the contributing catchment areas.

Figure 13.1 Map showing River and Groundwater Bodies at Risk



Legend: Red means *"At Risk"*, orange means *"Review"*, green means *"Not at Risk"*

The Nitrates Regulations and associated Nitrates Action Programme (NAP) are the basic measures that this RBMP sets out for the protection of waters from pollution from agricultural sources. The primary focus is on preventing and reducing water pollution from

nutrients (nitrogen and phosphorus) arising from agricultural sources. However, other complementary supporting measures are also necessary to further reduce pollution from agricultural sources. These complementary supporting measures include "targeted agricultural modernisation schemes" and the "Green, Low Carbon, Agri-Environment Scheme" (GLAS) under the rural development programme. Under grant support to participating farmers requires preparation of nutrient management plans.

Development of the proposed biogas plant on agricultural lands in the townlands of Glenbrack, Ballynamantan, and Kinincha, County Galway will support the agricultural sector by processing and converting raw organic wastes into certified organic fertiliser with known nutritional composition. Its application to lands will also require effective and robust nutrient management planning to ensure appropriate application rates in consideration of soil types, topography, cropping etc.

13.5.2 Climate Change & Greenhouse Gases

In Ireland, agriculture accounts for 32% of all greenhouse gas emissions to air. Climate change is challenging for Irish agriculture both in the context of GHG emissions and the need for adaptation of farming practices to be more resilient to the impacts of climate change. According to the EPA, the 32% of national GHG produced by the agricultural sector is derived mainly methane from livestock and nitrous oxide due to the use of nitrogen fertiliser. Teagasc's strategy[98] for reducing agricultural emissions is a) to stabilise GHG emissions, particularly methane, by enhanced efficiency measures, b) to further reduce emissions, particularly nitrous oxide, c) to offset GHG emissions with carbon sequestration from afforestation and agricultural land management and d) displace fossil fuel emissions with wood fuel and biogas.

Development of the proposed Sustainable Bio-Energy Ltd. Biogas plant will result in reduced GHG emission by:

- Recovering biogas (methane and carbon dioxide) from organic feedstock, including animal manures;
- Replacement of fossil fuels with biomethane (renewable gas);
- Recovery of carbon dioxide from biogas and replacing other sources;
- Utilisation of digestate (organic fertiliser) by farmers replacing inorganic fertiliser - the manufacturing of which manufacturing results in GHG emissions; and

[98] *https://www.teagasc.ie/publications/2017/reducing-greenhouse-gas-emissions-from-agriculture.php*

- reduction in N_2O emissions from land application of digestate in comparison to the use of inorganic fertilisers - Digestate having higher nitrogen availability and reduced losses.

13.5.3 Settlements

Impacts and mitigation measures associated with population are detailed in Section 4 (Population and Human Health) as outlined previously. No significant impacts on agriculture will result with respect to land take and land severance as agreements are in place to provide for Sustainable Bio-Energy Limited being the land owner, upon obtaining planning consent.

13.5.4 Services (Foul, Storm, Electricity)

The biogas plant includes a combined heat and power (CHP) plant which will be used to serve the house load of the plant (parasitic load). No process effluents will be discharges to ground or to the municipal sewer network. Foul effluents arising from office /canteen activities will be discharged to the municipal sewer located along Kinincha Road near the front of the site.

A stormwater drainage design has been prepared for the site which recovers and harvests rainwater for use in the process and employs the sustainable drainage system (SuDS) principles to manage surface water within the extent of the site.

The requirements to ensure prevention and control of fire will be addressed under a separate application to the Fire Authority (Fire Certificate). Measures have been incorporated into the development proposal to provide for compliance with building regulations and fire fighting water and fire retention water aspects have been considered within the design.

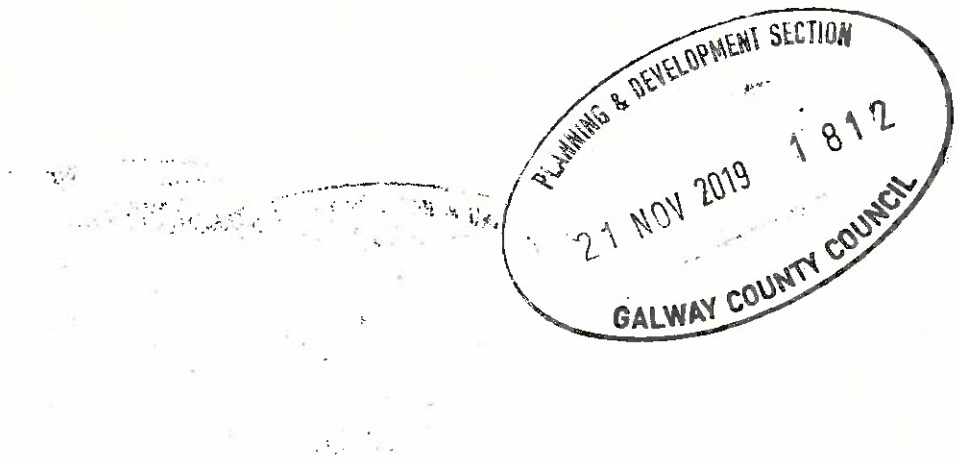
A flood risk assessment was undertaken to assess the potential impact of the development proposal on the receiving environment and existing flood defences. The development does not give rise to flood impacts.

13.6 Summary of Significant Impacts

No significant impacts are likely given the mitigation measures that have been and will be embedded in the design and implementation of the proposed biogas plant development at Ballynamantan, Glenbrack and Kinincha, Gort, Co. Galway.

13.7 Statement of Significance

There are no predicted significant adverse impacts arising from the proposed development on material assets. The impacts of the of the proposed Sustainable Bio-Energy Limited Biogas Plant are long-term slight /moderate positive; direct and indirect in nature.



14 INTERACTIONS

This Section of the EIAR describes interactions between the various impacts identified under Environmental Factors described in each of the previous Sections of the EIAR during both the construction and operational phases of the proposed development of the Sustainable Bio-Energy Limited Biogas Plant, Ballynamantin, Glenbrack & Kinincha, Gort. Co. Galway.

The project team, described, identified and assessed the potential impacts arising from the construction, operation and decommissioning of the proposed EIA Development. The interaction of environmental factors was identified and carefully considered from the outset of the project. Interactions during construction, operational and decommissioning stages of the project are considered. Potential impacts during decommissioning are generally similar in nature to those during construction.

Table 14.1 presents a matrix of interactions likely to occur from the proposed development (highlighted in green). The level of interaction between the various media will vary greatly but the table allows the interactions to be identified and detailed where necessary. If the development does not have the potential to impact or affect the interaction then that interaction is not highlighted in green.

The interaction matrix is based on the potential interrelationships of the environmental media both during the construction, operation and decommissioning phases of the proposed development.


PLANNING & DEVELOPMENT SECTION
21 NOV 2019 1812
GALWAY COUNTY COUNCIL

Table 14.1 Interactions between Environmental Factors

	Population & Human Health	Air, Odour & Climate	Noise & Vibration	Landscape	Biodiversity	Waters	Soils & Geology	Material Assets	Traffic & Transport	Archaeology & Cultural Heritage
Population & Human Health		C/D, O	C/D, O	C/D, O	C/D	C/D, O	C/D		C/D, O	
Air, Odour & Climate	C/D, O				C/D, O		C/D		C/D, O	
Noise & Vibration	C/D, O				C/D				C/D, O	
Landscape	C/D, O				O				C/D, O	
Biodiversity	C/D	C/D, O	C/D	O		C/D, O	C/D		C/D, O	
Waters	C/D				C/D, O		C/D, O	C/D		
Soils & Geology	C/D, O	C/D			C/D	C/D		C/D	C/D	
Material Assets						C/D	C/D			
Traffic & Transport	C/D, O	C/D, O	C/D, O	C/D, O	C/D, O					
Archaeology & Cultural Heritage										

C/D= Construction /Decommissioning
O = Operation

Table 14.2 Summary of Interactions

Interaction of Environmental Factors	Description
Population and Human Health	Interactions of environmental factors will occur during construction activities as a direct result of earth works associated with site clearance and civils works (construction of structure foundations, road improvement works, internal road constructions, berm construction, etc). These activities will result in the generation of noise and dust. The development would have the potential for negative impact if construction activities were to proceed without implementing adequate mitigation measures. Health and Safety on site is also recognised as being of paramount importance to human health during the construction, operational and decommissioning phases and this will not be compromised, if the specified mitigation measures outlined in the various chapters of the EIAR are adhered too.
Air Quality and Population & Human Health and Biodiversity	There is potential for impact to human beings living in the area of the proposed development during the construction, operation and decommissioning phases of the development. These have been outlined and assessed in Section 8 (Air Quality, Climate and Odour) of the EIS. The air quality impact at the nearest residential receivers is predicted to be below the relevant air quality standard limit values and is therefore determined to be low. The assessment of odour impact shows that worst-case odour impact will be well below the odour target value of $C_{98,\ 1\text{-Hour}}$ 1.5 ou_E/m^3 at the sensitive residential receptors in the area. The emissions from the Feedstock Reception Building Odour Control Stack results in effective dispersion of the odours from the Sustainable Bio-Energy Limited facility. The main interactions between air quality and flora and fauna are related to emissions of acidifying gases such as nitrogen oxides (NOx). The predicted nitrogen deposition rate at the Coole-Garryland Complex SAC (0.394 Kg/Ha/Yr) is 7.9% of the relevant Critical Load of 5 Kg/Ha/Yr. The predicted nitrogen deposition rate at the East Burren Complex SAC (0.02 Kg/Ha/Yr) is 0.2% of the relevant Critical Load of 5 Kg/Ha/Yr. As the maximum predicted nitrogen deposition rate at the Coole-Garryland Complex SAC and the East Burren Complex SAC is less than 10% of the relevant Critical Level (Cle) and 3.9% of the existing background nitrogen deposition level, the proposed Sustainable Bio-Energy Limited facility will not have a significant impact on nitrogen deposition rates at nearby designated sites or sensitive habitats. One of the most important contribution of biogas technology to environmental protection is that it avoids additional carbon dioxide (CO_2) emissions compared with fossil energy sources. Producing energy from biogas is largely CO_2 neutral, i.e. the CO_2 released by burning biogas was previously removed from the atmosphere during the generation of biomass through photosynthesis. The fermentation of manure also reduces emissions of methane, a gas that has an effect on the climate and would otherwise escape uncontrolled from raw liquid manure with far more damaging effects for the climate than CO_2. New research suggests that emissions of laughing gas (N_20) – which also has an effect on the climate – can also be reduced by fermentation. Furthermore, fermentation

Interaction of Environmental Factors	Description
	reduces the development of odours during liquid manure storage and spreading since the odours contained in it are broken down and neutralised during the fermentation process. In addition, fermentation improves the quality of manure as pathogens and weed seeds are killed and nutrients made more available for plants, enabling the manure to be applied in a more targeted fashion as a substitute for inorganic fertilisers. Therefore, the digestate is an ideal fertiliser in arable farming/crop production and a good soil conditioner
Noise, Human Beings and Biodiversity	The impact of noise on the human beings living in the area of the proposed development has been addressed during the construction, operational and decommissioning phases of the proposed development. Appropriate mitigation measures have been recommended to ensure the construction phase target noise limits are not exceeded. The contractor will also be required to adopt and implement suitable control measures as recommended in BS 5228. These will be further prescribed in a construction management plan subject to planning. The predicted noise levels at the nearest neighbouring residential properties due to the operation of the proposed Anaerobic Digestor and CHP Plant are in accordance with the WHO *Guidelines for Community Noise* during daytime and night-time and the relevant noise limits outlined in the EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4). In relation to the interaction of noise from the proposed development with biodiversity, the noise generated by the development will not have a significant adverse impact on the local birdlife and wildlife. Local birdlife and wildlife will quickly accustom to any change in the noise climate of the area as occurs throughout the country. Noise levels generated during the operation of the proposed development will not be audible at the nearest sensitive ecological receptors.
Landscape and Visual, Biodiversity, Population and Human Health	The landscape and visual impacts have potential interactions with impacts resulting from other environmental statement topics. The interactions of these impacts are usually highly complex in practice and this section serves to act as a brief overview to these issues. In addition, the proposed development will create varying impacts during the construction phase and the operation phase. No designated scenic views will be affected by the proposed development. The removal of some of the existing vegetation along boundaries and roadsides, will temporarily impact on the volume of vegetation providing potential wildlife habitat. However, the proposed mitigation planting (including a new berm; refer Appendix 10.2) will increase the variety of native tree and shrub species on site and this will have a positive impact of providing increasing screening and increased ecological benefit. The management of the site vegetation will also result in a positive impact to the appearance and condition of site vegetation. There will be noticeable impacts on landscape character as a result of the introduction of the propose biogas plant. These will be most apparent in the localised environs of the site, which are predominantly rural in character. However, when considered in the slightly broader context of the northern urban fringe of Gort the scheme, although considerable in scale, is

Interaction of Environmental Factors	Description
	consistent with the gradual progression of peri-urban development and is not incongruous in terms of form of function within this landscape setting. These effects are aided by the siting and design of the development which takes advantage of an existing enclosed setting, which can be readily modified to reduce the floor levels of structures and enclose the only open side of the site using excavated material from the site.
Soils, Geology, Hydrology and Hydrogeology	There is a strong interaction between soils & geology and Hydrology and Hydrogeology (surface waters and groundwater). The disturbance of soil during construction has the potential to impact on water quality. Construction activities which disturb or expose the soil have the potential to elevate suspended solids in runoff from the site which could impact on surface water bodies such as the Gort River. Mitigation measures during the construction process will prevent sediment run-off and construction discharges. The outline CEMP will be further developed and implemented for the construction phase of the development. This document will provide 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. There will be no direct discharges to soils or surface water bodies during the operational phase of the development. A tank farm bund has been designed in accordance with best practice to contain and spillages /escape of organic materials. A second outer concrete bund, which encompasses areas where processing relating activities will be carried out is also included within the design. This removes the pathway of potential sources of pollution to receptors. Stormwater generated on the site will be managed in accordance with proposals as presented in the drainage report which accompanies the EIAR.
Traffic & Transport, population and human health, landscape and visual, noise & vibration, and biodiversity	There will be potential interactions with increased traffic movements as a result of the construction and operation of the proposed biogas plant with population and human health, air quality, odour and climate, landscape & visual and noise and vibration and biodiversity. Recommended mitigation is proposed within each of the Sections of the EIAR.

The Sustainable Bio-Energy Limited Biogas Plant development has the potential to impact on various environmental aspects, and there are interactions and inter-relationships between these aspects, as presented in Table 14.1 and described in Table 14.2. This EIAR has considered these interactions and inter-relationships throughout the design process through appropriate siting of development components, functional design in accordance

with the relevant standards /codes and guidelines and incorporation of mitigation measures as recommended by the EIA team of specialists.