PURSER

EIAR Addendum

Nua Bioenergy, Lisheen

Volume 3: Appendices

Prepared for: Nua Bioenergy Limited

March 2025

Document Control

Document	EIAR Addendum - Volume 3
Project	Nua Bioenergy, Lisheen
Client	Nua Bioenergy Limited
Project Reference:	P-2024-35-59

Document Issue and Check				
Issue	Date	Status	Issued to:	Checked by:
P_01_R1	05.03.2025	Final	DM	SD

Contents

PURSER

Volume 3:

Appendix 6.1

Decommissioning Plan (Ref: 2429-DOB-X-SI-RP-C-0005) dated February 2025

EIAR Addendum: Nua Bioenergy, Lisheen
P-2024-35-59

NUA BIOENERGY

Proposed Biomethane Production Facility, Lisheen, Co. Tipperary

Decommissioning Plan

2429-DOB-XX-SI-RP-C-0005

February 2025

DONNACHADH O'BRIEN

& ASSOCIATES CONSULTING ENGINEERS

A | Unit 5C Elm House, Millennium Park, Naas, Co. Kildare, W91P9P8

P | +353(0)45 984 042 **W** | www.doba.ie **E** | info@ww.doba.ie

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Document Control

Document:		Decommissioning Plan			
Project:		Biomethane Production Facility, Lisheen			
Client:		Nua Bioenergy			
Job Number:		DOBA2429			
File Origin:					
Document Checking:					
Author:		Andy Kotze		Signed:	
Issue	Date	Status	Issued to	Copies	Checked for Issue
S2.P01	21.01.2025	Draft	Design Team	1E	Richard Kiernan
S2.P02	27.02.2025	Issued	Local Authority	1E	Richard Kiernan

Contents

1 Introduction

Donnachadh O'Brien & Associates Consulting Engineers Ltd. (DOBA) have been instructed by the Client, Nua Bioenergy Ltd, to prepare a decommissioning plan to respond to Tipperary Council's Request for Further Information (RFI), Application Reg. Ref. 24/60936, dated Friday 03 January 2025 for a proposed biomethane and bio-based fertiliser production facility at lands located at the former Lisheen Mine Site, Killoran, Moyne, Thurles, Co. Tipperary.

The Decommissioning Plan is structured as follows;

- **Section 2** summarises the attributes of the **Existing Site**;
- **Section 3** provides a description of the proposed development works at the subject site,
- **Section 4** provides a description of the **Decommissioning Strategy,** which outlines the steps in which demolition and decommissioning will occur;
- **Section 5** outlines the Environmental factors that should be complied with in relation to the environment. These include site drainage, hazardous materials, dust, noise and waste management;

This document is a live document and the appointed contractor should ultimately provide a finalised version of same.

2 Existing Site

The subject site is located on the former Lisheen Mine Facility grounds, Kiloran, Moyne, Thurles, County Tipperary. The existing facility grounds are privately managed. The application site is approximately 5.50 ha in size and is principally bounded by lands associated with the former Lisheen Mine to the north south and east; and by agricultural lands to the west. An unnamed private road is located along the southern boundary of the subject site. The existing site is shown in **Figure 1** below.

The site topography is predominantly flat with a slight slope gradually rising from east to west with elevation ranging from approximately +126.65mOD in the east to +131.0mOD in the western corner. Along the west is an embankment and an existing hedgerow. A topographical survey of the existing site and adjacent roads is submitted with the application, planning application Reg. Ref. 2460936.

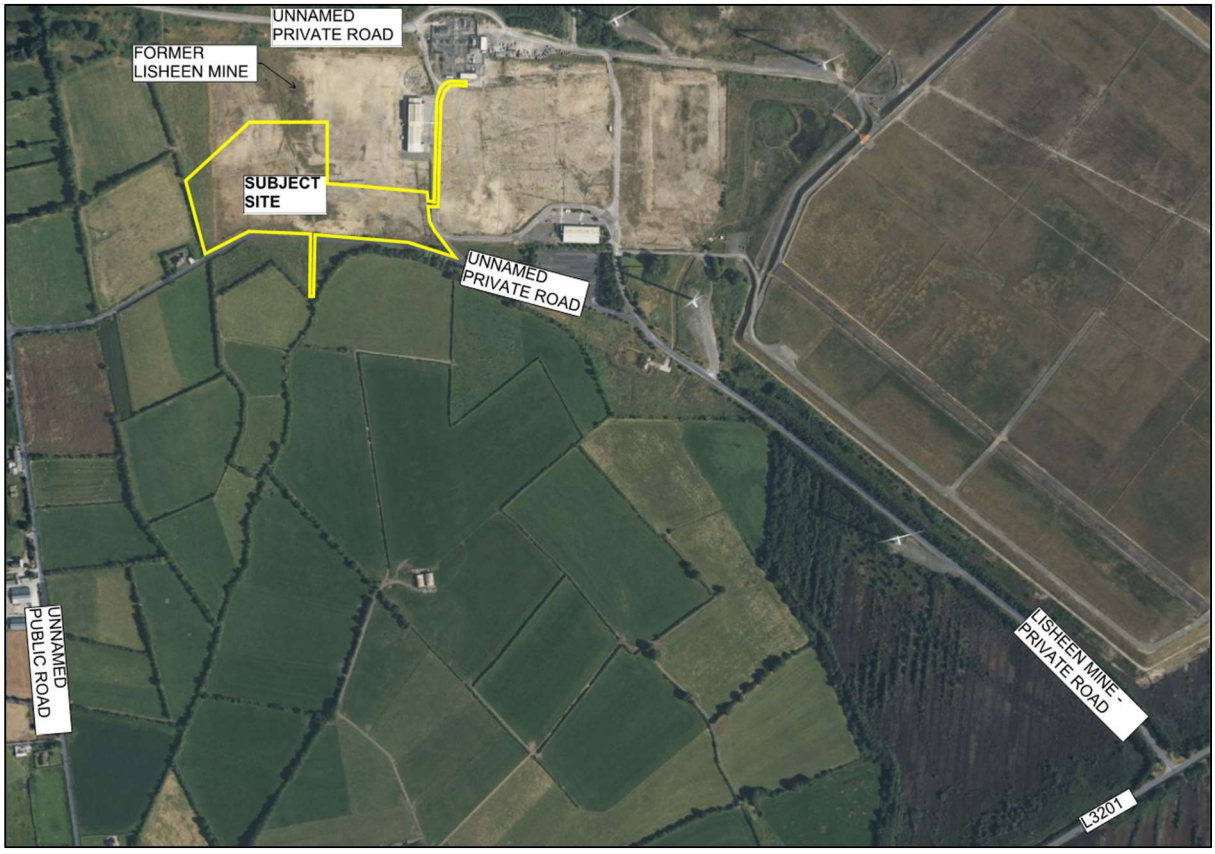


Figure 1: Existing Site Location (*Source: Irish Grid Reference Finder)*

3 Proposed Development

Nua Bioenergy Limited intends to apply for permission to construct a biomethane and bio-based fertiliser production facility, with an annual intake of up to 98,000 tonnes of feedstock per annum, at this site of c. 5.5 hectares at lands located at the former Lisheen Mine Site, Killoran, Moyne, Thurles, Co. Tipperary.

The application site is principally bounded by: lands associated with the former Lisheen Mine to the north south and east; and by agricultural lands to the to the west.

The development will consist of the construction of an anaerobic digestion plant comprising: 4 No. primary digester tanks (each measuring c. 7.6 m in height); 3 No. secondary digester tanks (each measuring c. 14.5 m in height); 4 No. feed hoppers; 4 No. technical rooms (ranging in size from c. 35 sq m to c. 85 sq m); 2 No. biogas conditioning units; process, storage and buffer tanks (comprising: 1 No. buffer digestate storage tank (c. 7.5 m in height), 1 No. suspension buffer tank (c. 8 m in height), 1 No. process area runoff storage tank (c. 4.5 m in height); 1 No. buffer digestate process tank (c. 4.5 m in height), 1 No. treated digestate liquids recycle storage tank (c. 4.5 m in height);

1 No. roofed liquids feed-mix tank (c. 3 m in height)); these components will be located within a containment bund constructed c. 3 m meters below ground level.

The proposed development will also consist of: feedstock storage (comprising 3 No. storage clamps (c. 1,050 sq m in area each) and 2 No. storage sheds (c. 500 sq m each)); a biomethane upgrading plant (including natural gas compression unit); a biomethane loading facility (comprising a 4 No. loading bays with associated gates and safety features measuring c. 490 sq m in area); a biomass boiler with its associated pellet storage silo (c. 12.5 m in height);Combined Heat and Power (CHP) plant and associated heat exchanger; a single storey bio-based fertiliser processing and storage unit (c. 3,630 sq m) (including digestate dewatering plant, fertiliser pasteurisation plant and bio-based fertiliser loading facilities); a single storey office building (c. 114.5 sq m) (including offices, meeting room, control room, laboratory, welfare facilities, storeroom and a first-aid facility); bin storage; 9 No. car parking spaces (including 5 No. standard parking spaces, 2 No. electric vehicle (EV) spaces and 1 No. accessible car parking space); electric vehicle (EV) charging infrastructure; 10 No. bicycle parking spaces; vehicular, cyclist and pedestrian access / egress and associated circulation routes; 2 No. weighbridges; a vehicle steam wash area; fuel storage tank and associated bund; an emergency flare (c. 7.6 m in height); a

process area runoff lagoon; an attenuation pond; an ESB sub-station; boundary treatments [including gates, piers and fencing]; site lighting; all hard and soft landscaping; provision of sustainable urban drainage systems (SUDS); and all other associated site excavation, infrastructural and site development works above and below ground, including changes in level and associated retaining features, and associated site servicing [water and electricity supply].

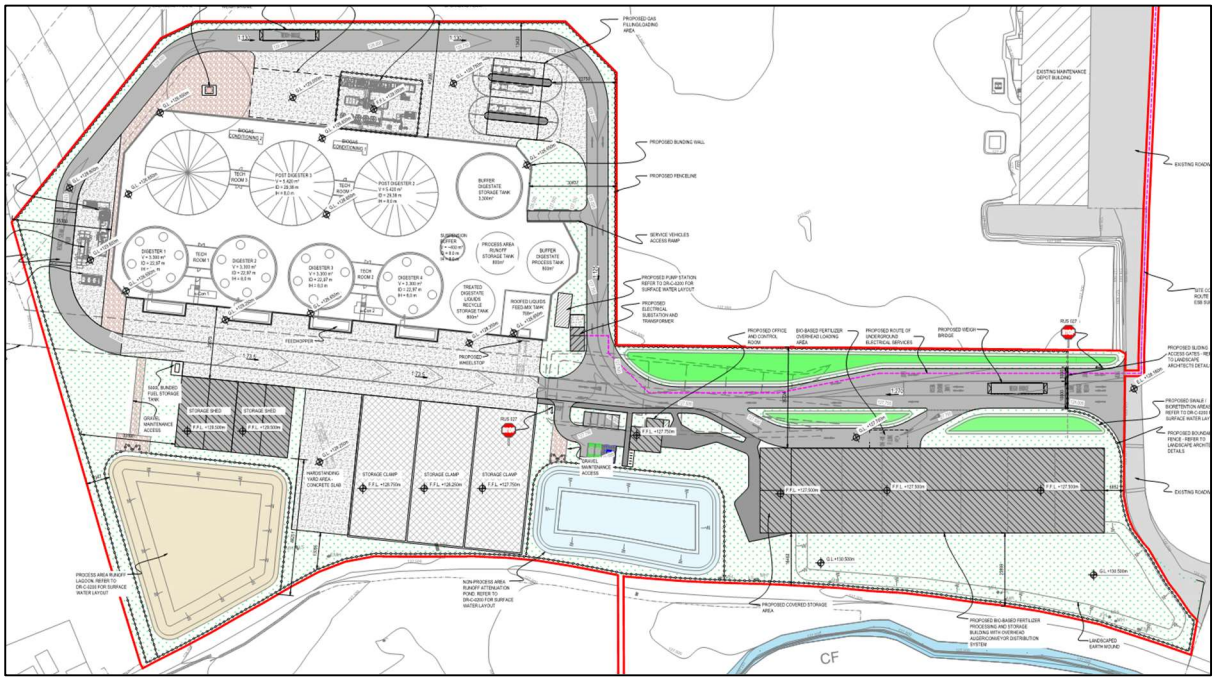


Figure 2: Subject Site Layout

4 Proposed Decommissioning Plan

The principal goal of this Decommissioning Plan is to provide an outline strategy for the decommissioning of the proposed biomethane and bio-based fertiliser production facility at Lisheen, Co. Tipperary and return of the site to pre-development conditions.

4.1 Decommissioning Aims and Objectives

The key aims of the decommissioning plan have been set out to stay in accordance with the Local Authority and the Environmental Impact Assessment Report:

- Ensuring that all proposed decommissioning works are in accordance with the mitigation measures set out in the Environmental Impact Assessment Report (EIAR) and Natura Impact Statement.
- Ensure that decommissioning operations and activities cause minimal disruption or inconvenience to local landowners and the surrounding community.
- Using suitable decommissioning contractors with trained personnel and providing training as required.

The subject site's key decommissioning objectives are:

- Using previously excavated, recycled material where possible for reinstatement works.
- Avoiding any possible pollution and exercising great care when dealing with potentially contaminated material.
- Keeping any watercourses clear of any debris/contamination.
- Air, noise and waste prevention methods to be implemented.
- Constantly monitoring the works to ensure no adverse effects on the subsoils and existing surrounding infrastructure.

4.2 Decommissioning Methodology Overview

A qualified main contractor will be selected to manage the decommissioning of the Proposed Development. This contractor will adhere to the principles of the Construction and Environmental Management Plan (CEMP) established for the construction phase. Below is an overview of the decommissioning methodologies that will be implemented:

- Disconnecting existing utilities
- Emptying digestors and storage facilities of all stored materials/products
- Removal of specialist equipment and plant
- Demolition and removal of buildings
- Removal of internal access roads and concrete yards
- Grubbing up underground drainage and services
- Backfilling and levelling of surfaces
- Re-Seeding of final surface

4.3 Decommissioning Strategy

4.3.1.1 Decommissioning Transport Route

In a similar fashion to the pre-development transport arrangements, the same proposed vehicular routes are proposed to be used by larger decommissioning HGV's.

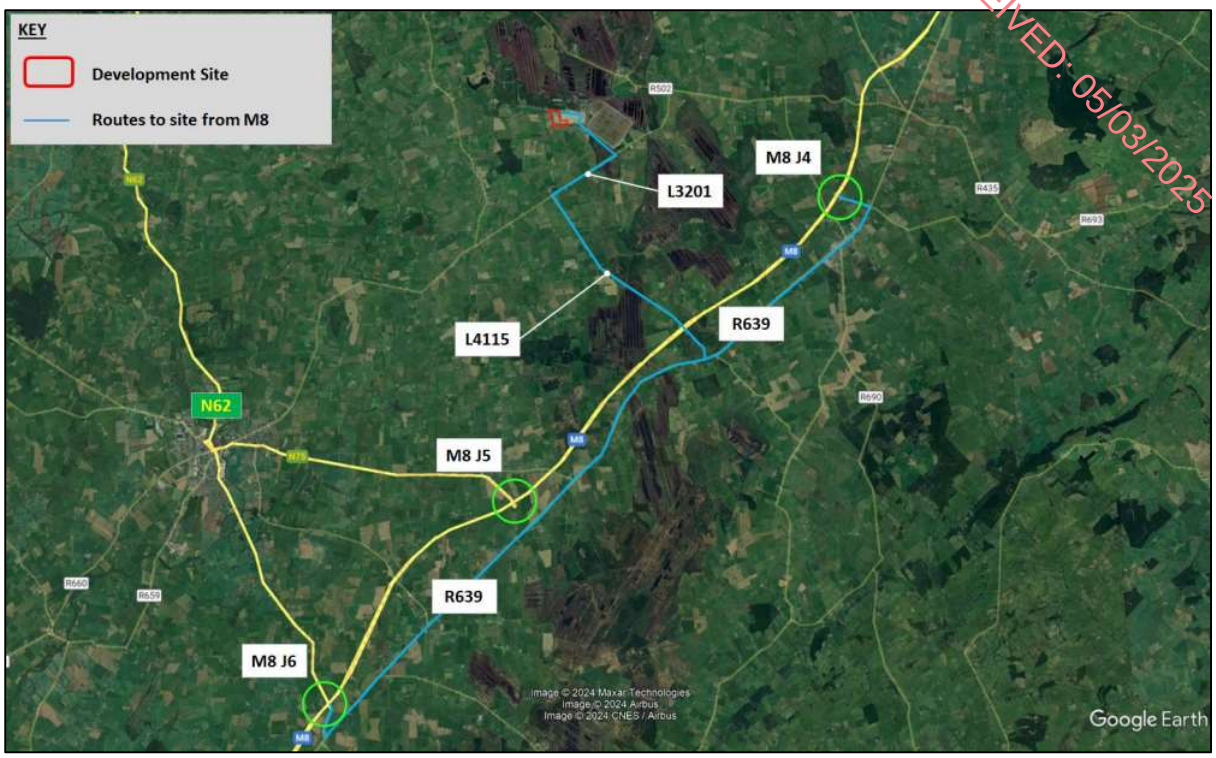


Figure 3: HGV Transport Routes

4.3.1.2 Disconnecting Existing Utilities

Prior to any decommissioning and demolition work commencing on-site, all live site services will be disconnected adequately. Any live pressurised mains, such as gas pipework, will be purged in such a manner that the environment is not impacted adversely.

The surface water for the subject site will remain in a working condition until later in the decommissioning phase, however, care shall be taken at the flow through ponds to ensure that any silt and debris settle or are removed prior to out falling into the stream. In this instance, settling ponds and silt traps/fences can be used in a similar fashion to that mentioned for the construction works.

For any underground cabling, such as the electricity feed from the grid, the ducting will remain in the ground, however, the cabling within the duct will be removed/pulled by a mechanical winch and be re-rolled to be reused.

4.3.1.3 Emptying Digestors and Storage Facilities of All Stored Materials/products

The Digestors and storage facilities may contain contaminated matter as part of the AD Processing. It will be the decommissioning contractor's responsibility to ensure that the storage structures are emptied out and raw materials carted off-site and disposed of in a safe and appropriate manner to a licensed waste facility. Similarly, all of the equipment/structures within the bund may contain process material which should be transported in an enclosed tanker to a licensed waste facility prior to the demolition of these structures.

4.3.1.4 Removal of Specialist Equipment and Plant

Specialist equipment, such as the gas upgrading units, CHP, Feed hoppers and other ancillary plant will be fully purged (where gas is applicable) and sprayed down to remove any possible debris. These will be disassembled and parts will be carted off-site to a licensed scrap metal, waste or recycling facility as required.

4.3.1.5 Demolition and Removal of Buildings

All buildings, sub-structures and foundations will be completely removed from the ground. This will include excavation of deeper foundations and bund walls and concrete crushing.

As part of the initial construction, soil will not be removed from the site, but stored in mounds and could be reused during the decommissioning phase.

It will be the intention that all of the concrete/building rubble generated during the demolition phase be crushed and disposed of off-site at an appropriately licensed waste disposal facility or used as recycled material in other construction projects if possible.

4.3.1.6 Removal of Internal Access Roads and Concrete Yards

All of the internal access roads will be utilised during the demolition and decommissioning stage of the project. At the end of the construction period, these roads will be fully reinstated and levelled as required. The external access roads, not in the ownership of the private development, will remain in full use as required.

4.3.1.7 Grubbing up underground drainage and services

The removal of the site drainage will be a phased removal, closely following the removal schedule of the buildings and yards. The phased process will ensure that the areas yet to be demolished will have live drainage and primary filtering prior to outfalling the stream to the south. Once the full site drainage has been removed, the ponds can be filled and levels brought to the original pre-development condition. The site-wide drainage pipes and manholes will be disposed of at a licensed waste facility.

4.3.1.8 Backfilling and Levelling of Surfaces

The development project has been carefully designed to balance the cut and fill. The excess fill will be stored and used as landscaped berms. As part of the decommissioning works, these landscaped berms will be levelled and the fill re-used for reinstatement and filling of the bund and deep storage ponds.

Following the levelling of the subject site to the pre-development condition, the full site is proposed to be reinstated and reseeded to match the natural growth of the local environs of the larger Lisheen area.

It is noted that imported soil will be required for seeding purposes in order to get the subject site back to the pre-development conditions.

4.3.1.9 Re-Seeding of Final Surfaces

The proposed final condition of the site is to be grass-seeded with ground levels reflecting the pre-development arrangement, essentially re-creating a green field condition. It is therefore considered that formal drainage of the final post-decommissioned site will not be required as the site will return to greenfield runoff conditions.

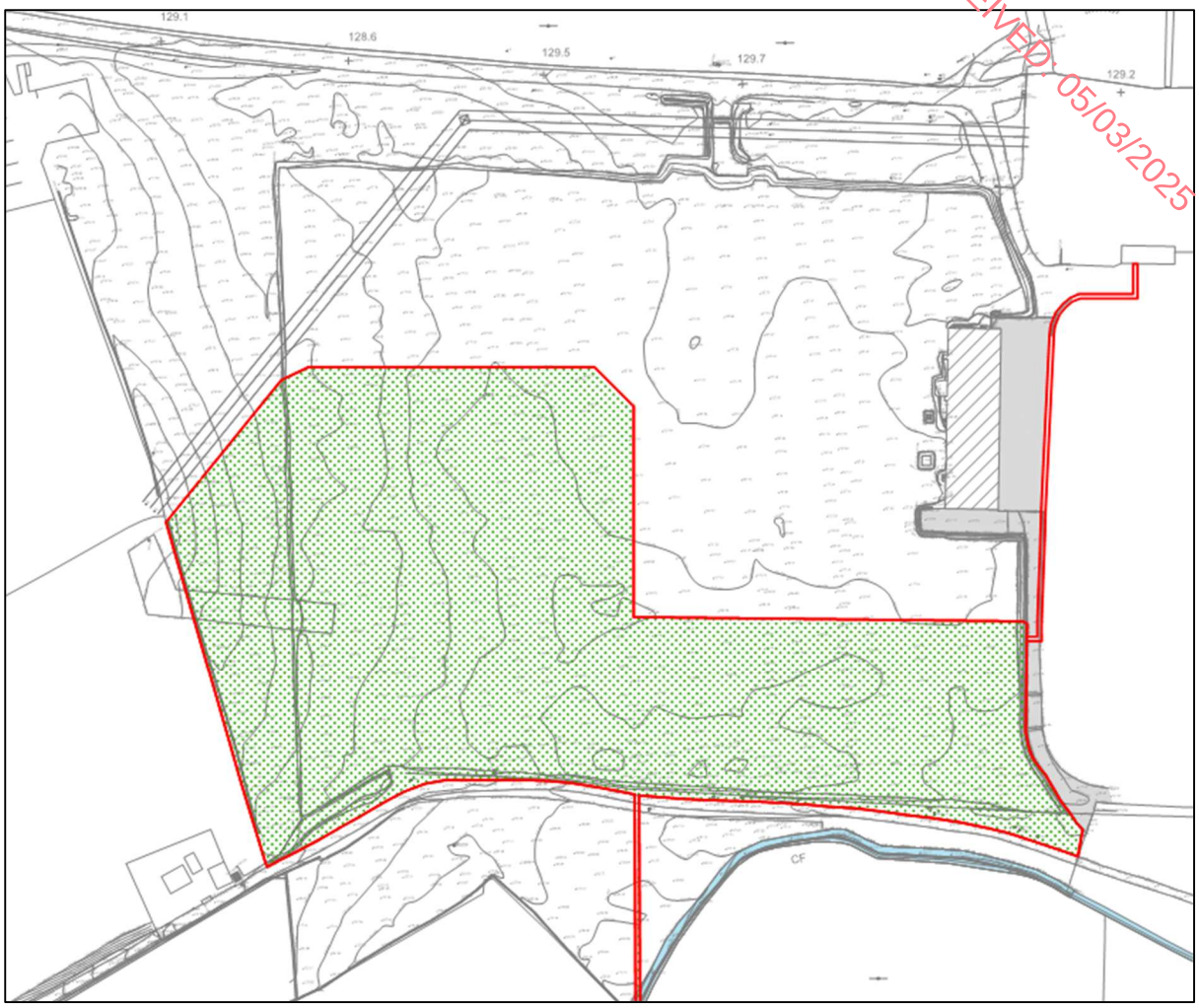


Figure 4: Subject Site Post Decommissioning

5 Environmental Management

5.1 Site Drainage

The site drainage features during both the construction and operational phases are detailed in the Infrastructure Design Report and outlined in the EIAR. This drainage infrastructure will remain in place until the removal of associated drained areas as part of the decommissioning process.

As the Decommissioning Plan is a working document, the drainage measures are not included in this document. Once the final plan is prepared prior to decommissioning and presented as a standalone document, all necessary drainage measures will be incorporated.

5.2 Refuelling, Fuel and Storage of Hazardous Materials

During the decommissioning phase of the project, site vehicles will be required to be refuelled. All fuel storage areas will be bunded in the compound and will be clearly marked. Fuel will be transported from the offsite compound to the plant and equipment in mobile units based on need. A dedicated fuel filling point will be set up on-site with all plant brought to this point for filling. Only designated and trained personnel will be authorised to refuel vehicles. An emergency plan for the decommissioning phase to deal with accidental spillages will be developed. Spill kits will be available to deal with any accidental spillage in and outside the refuelling area. Storage of fuel, or any other hazardous materials will be kept to a minimum.

5.3 Dust Control

Dust may be produced during decommissioning activities on-site, such as backfilling foundations and vehicle movement on site roads, particularly in prolonged dry weather conditions. The level of dust generation will vary depending on the type of activity, location, dust composition (e.g., soil), and weather conditions. External factors like wind speed, wind direction, and dry weather can also influence dust dispersion. Furthermore, dust may be generated by site traffic as vehicles travel along the haul route.

The following measures will be put in place:

- Prior to demolition, blocks shall be soft stripped inside buildings (retaining walls and windows in the rest of the building, where possible, to provide a screen against dust).
- During the demolition process, water suppression shall be used, preferably with a hand-held spray. Only the use of cutting, grinding or sawing equipment fitted or used in conjunction with a suitable dust suppression technique such as water sprays / local extraction should be used.
- Drop heights from conveyors, loading shovels, hoppers and other loading equipment shall be minimised, if necessary fine water sprays will be employed.
- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
- Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles exiting the site shall make use of a wheel wash facility prior to entering public roads.
- Vehicles using site roads will have their speed restricted, and this speed restriction will be enforced rigidly. A speed limit of 20 kmph will be enforced on on-site roads.
- Public roads and footpaths outside the site will be regularly inspected for cleanliness and cleaned, as necessary. If sweeping using a road sweeper is not possible due to the nature of the surrounding area, then a suitable smaller-scale street cleaning vacuum will be used.
- Material handling systems and temporary site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used, as required if particularly dusty activities are necessary during dry or windy periods.
- During the movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, all operations likely to cause dust emissions will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of demolition operations.

The mitigation measures put in place to control dust will also be considered as mitigation measures with respect to aspergillus as they will minimise the potential for the spread of the fungal spores. The Contractor shall undertake dust monitoring at a range of nearest sensitive receptors during the demolition and construction phases with the Technical Instructions on Air Quality Control (TA Luft) dust deposition limit set at 350 mg/m^2/day, averaged over one year and applied as a 30-day average. The TA-Luft standard has been applied for the purpose of this assessment based on recommendations from the EPA in Ireland in the document titled 'Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006). The document recommends that the Bergerhoff limit of 350 mg/(m^2*day) be applied to the site boundary of quarries. This limit value can be implemented with regard to dust impacts from demolition of the proposed development.

5.4 Noise Control

With regard to decommissioning activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2. Whilst noise and vibration impacts are expected to vary during the demolition and decommissioning phase depending on the distance between the activities and noise-sensitive buildings, the contractor will ensure that all best practice noise and vibration control methods will be used, as necessary in order to ensure impacts at off-site noise sensitive locations are minimized.

The best practice measures set out in BS 5228 (2009) Parts 1 and 2 include guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- noise control at source;
- screening;
- liaison with the public, and;
- monitoring.

5.5 Traffic Management

A Traffic Management Plan will be developed prior to the start of any decommissioning activities. The removal of development components from the site will be carried out by a specialist haulier. The traffic management arrangements will be agreed upon with the competent authority before decommissioning begins.

5.6 Waste Management

The principal objective of sustainable resource and Waste management is to use material resources more efficiently, where the value of products, materials and resources are maintained in the economy for as long as possible and the generation of Waste is minimised. To achieve resource efficiency there is a need to move from a traditional linear economy to a circular economy as indicated in the below figure.

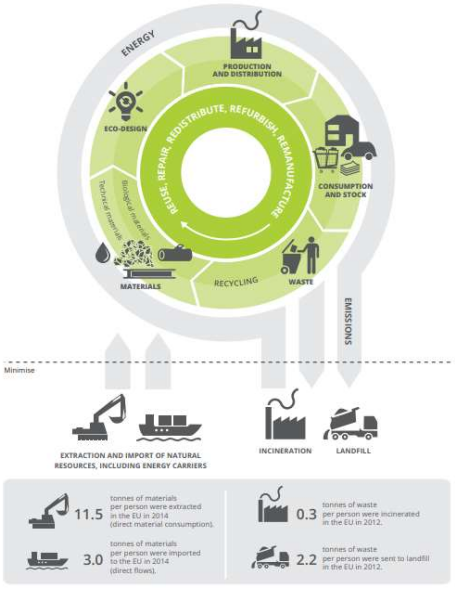


Figure 5: Circular Economy for Materials and Energy (source: European Environment Agency)

In December 2015, the European Commission adopted an ambitious Circular Economy Package, which includes revised legislative proposals on Waste to stimulate Europe's transition towards a circular economy. However, where residual Waste is generated, it should be dealt with in a way that follows the Waste hierarchy as indicated in the EU Commission Document and actively contributes to the economic, social and environmental goals of sustainable development.

The Waste management objectives for the proposed development are described in the following sections and will facilitate material reuse and recycling where possible and seek to divert waste from landfills.

5.6.1 Prevention

The Contractor shall prevent and minimise Waste generation where possible at each stage of the project.

5.6.2 Reuse

Reuse Wastes and surplus materials where feasible and in as many high-value uses as possible.

5.6.3 Recycle

Recycle Waste where possible such as introducing on-site crushers to produce Waste-derived aggregates which may, subject to appropriate testing and approvals, be re-used in the project.

5.6.4 Disposal

Where disposal of Waste is unavoidable this will be undertaken in accordance with the Waste Management Act 1996, as amended.

The relevant components will be removed from the site for reuse, recycling, or disposal. Any structural elements that are unsuitable for recycling will be disposed of in a proper manner. All lubrication fluids will be drained and reserved for safe collection, storage, transportation, and disposal. Materials that cannot be reused or recycled will be disposed of by a licensed contractor in accordance with regulations.

PURSER

Volume 3:

Appendix 7.1

Construction Management Plan (Ref: 2429-DOB-XX-SI-RP-C-0003) dated February 2025

EIAR Addendum: Nua Bioenergy, Lisheen
P-2024-35-59

NUA BIOENERGY

Proposed Biomethane Production Facility, Lisheen, Co. Tipperary

Construction Management Plan

2429-DOB-XX-SI-RP-C-0003

February 2025

DONNACHADH O'BRIEN

& ASSOCIATES CONSULTING ENGINEERS

A | Unit 5C Elm House, Millennium Park, Naas, Co. Kildare, W91P9P8

P | +353(0)45 984 042 **W** | www.doba.ie **E** | info@ww.doba.ie

DONNACHADH O'BRIEN
& ASSOCIATES CONSULTING ENGINEERS

Document Control

Document:		Construction Management Plan			
Project:		Biomethane Production Facility, Lisheen			
Client:		Nua Bioenergy			
Job Number:		DOBA2429			
File Origin:					
Document Checking:					
Author:		Andy Kotze	Signed:		
Issue	Date	Status	Issued to	Copies	Checked for Issue
S2.P01	27.09.2024	Draft	Design Team	1E	Richard Kiernan
S4.P01	27.09.2024	Issued for Planning	Design Team, Local Authority	1E	Richard Kiernan
S4.P02	27.02.2025	Issued	Local Authority	1E	Richard Kiernan

Contents

List of Figures and Tables

1 Introduction

Donnachadh O'Brien & Associates Consulting Engineers Ltd. (DOBA) have been instructed by the Client, Nua Bioenergy Ltd, to prepare a Construction Management Plan (CMP) to accompany a Planning Application to Tipperary County Council (TCC) for a proposed biomethane production facility in Lisheen at lands located at the former Lisheen Mine Site, Killoran, Moyne, Thurles, Co. Tipperary.

This updated CMP is being provided in Response to a Request for Further Information issued by Tipperary County Council in respect of Application Reg. Ref. 24/60936.

The CMP is structured as follows:

- **Section 2** summarises the attributes of the Existing Site. It outlines that the site is located on lands which were historically used by the Lisheen Mine.
- **Section 3** provides a description of the proposed development works at the subject site,
- **Section 4** outlines the general construction site layout and duration of works. This section provides further details on the Site Management during this stage of work,
- **Section 5** provides details on Construction Traffic Management and discusses the construction traffic routes and trips generated.
- **Section 6** describes the management of waste and highlights the reuse of excavated material in order to minimise off-site waste removal.

2 Existing Site

The subject site is located on the former Lisheen Mine Facility grounds, Moyne, Thurles, County Tipperary. The existing facility grounds are privately managed. The application site is approximately 5.50 ha in size and is principally bounded by lands associated with the former Lisheen Mine to the north south and east; and by agricultural lands to the west. An unnamed private road is located along the southern boundary of the subject site. The existing site is shown in **Figure 1** below.

The site topography is predominantly flat with a slight slope gradually rising from east to west with elevation ranging from approximately +126.65mOD in the east to +131.0mOD in the western corner. Along the west is an embankment and an existing hedgerow. A topographical survey of the existing site and adjacent roads is submitted with the application.

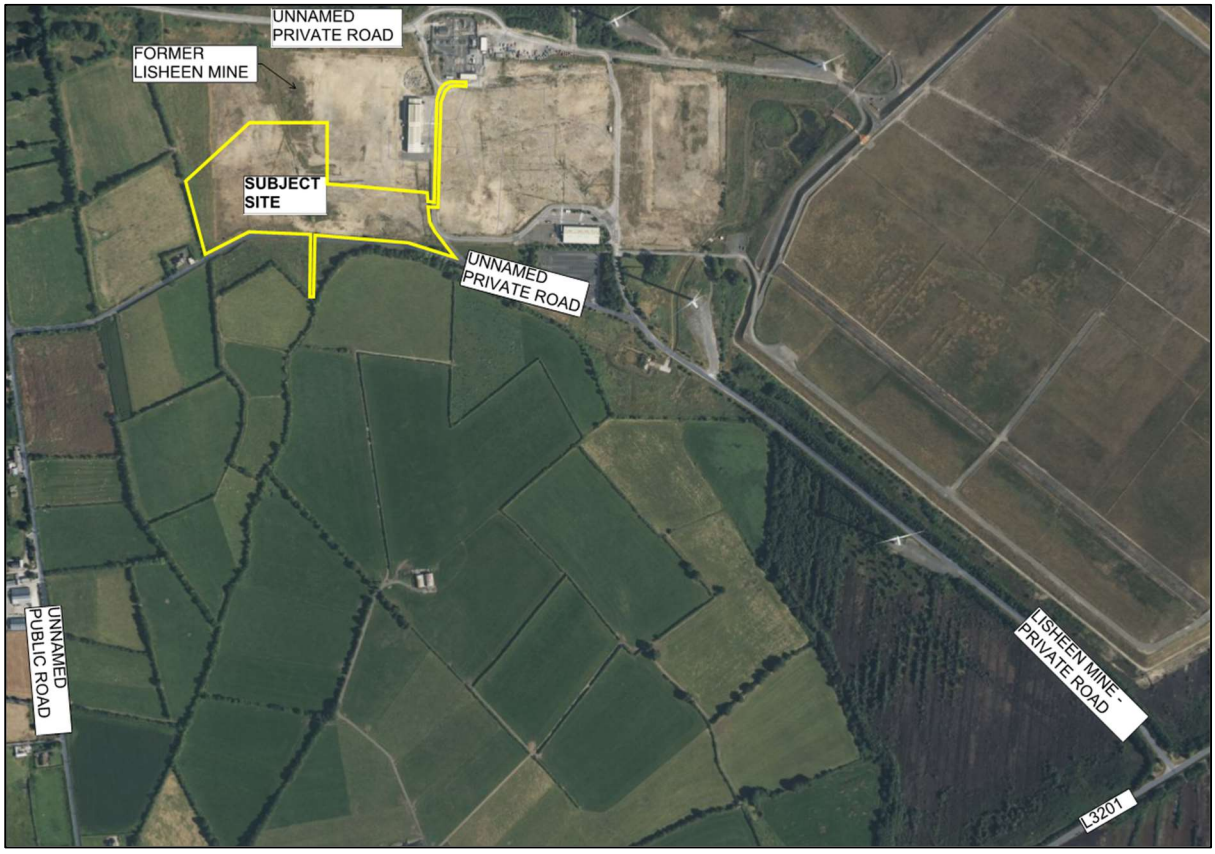


Figure 1: Existing Site Location (*Source: Irish Grid Reference Finder)*

3 Proposed Development

Nua Bioenergy Limited intends to apply for permission to construct a biomethane and bio-based fertiliser production facility, with an annual intake of up to 98,000 tonnes of feedstock per annum, at this site of c. 5.5 hectares at lands located at the former Lisheen Mine Site, Killoran, Moyne, Thurles, Co. Tipperary.

The application site is principally bounded by: lands associated with the former Lisheen Mine to the north south and east; and by agricultural lands to the to the west.

The development will consist of the construction of an anaerobic digestion plant comprising: 4 No. primary digester tanks (each measuring c. 7.6 m in height); 3 No. secondary digester tanks (each measuring c. 14.5 m in height); 4 No. feed hoppers; 4 No. technical rooms (ranging in size from c. 35 sq m to c. 85 sq m); 2 No. biogas conditioning units; process, storage and buffer tanks (comprising: 1 No. buffer digestate storage tank (c. 7.5 m in height), 1 No. suspension buffer tank (c. 8 m in height), 1 No. process area runoff storage tank (c. 4.5 m in height); 1 No. buffer digestate process tank (c. 4.5 m in height), 1 No. treated digestate liquids recycle storage tank (c. 4.5 m in height);

1 No. roofed liquids feed-mix tank (c. 3 m in height)); these components will be located within a containment bund constructed c. 3 m meters below ground level.

The proposed development will also consist of: feedstock storage (comprising 3 No. storage clamps (c. 1,050 sq m in area each) and 2 No. storage sheds (c. 500 sq m each)); a biomethane upgrading plant (including natural gas compression unit); a biomethane loading facility (comprising a 4 No. loading bays with associated gates and safety features measuring c. 490 sq m in area); a biomass boiler with its associated pellet storage silo (c. 12.5 m in height);Combined Heat and Power (CHP) plant and associated heat exchanger; a single storey bio-based fertiliser processing and storage unit (c. 3,630 sq m) (including digestate dewatering plant, fertiliser pasteurisation plant and bio-based fertiliser loading facilities); a single storey office building (c. 114.5 sq m) (including offices, meeting room, control room, laboratory, welfare facilities, storeroom and a first-aid facility); bin storage; 9 No. car parking spaces (including 5 No. standard parking spaces, 2 No. electric vehicle (EV) spaces and 1 No. accessible car parking space); electric vehicle (EV) charging infrastructure; 10 No. bicycle parking spaces; vehicular, cyclist and pedestrian access / egress and associated circulation routes; 2 No. weighbridges; a vehicle steam wash area; fuel storage tank and associated bund; an emergency flare (c. 7.6 m in height); a process area runoff lagoon; an attenuation pond; an ESB sub-station; boundary treatments [including gates, piers and fencing]; site lighting; all hard and soft landscaping; provision of sustainable urban drainage systems (SUDS); and all other associated site excavation, infrastructural and site development works above and below

ground, including changes in level and associated retaining features, and associated site servicing [water and electricity supply].

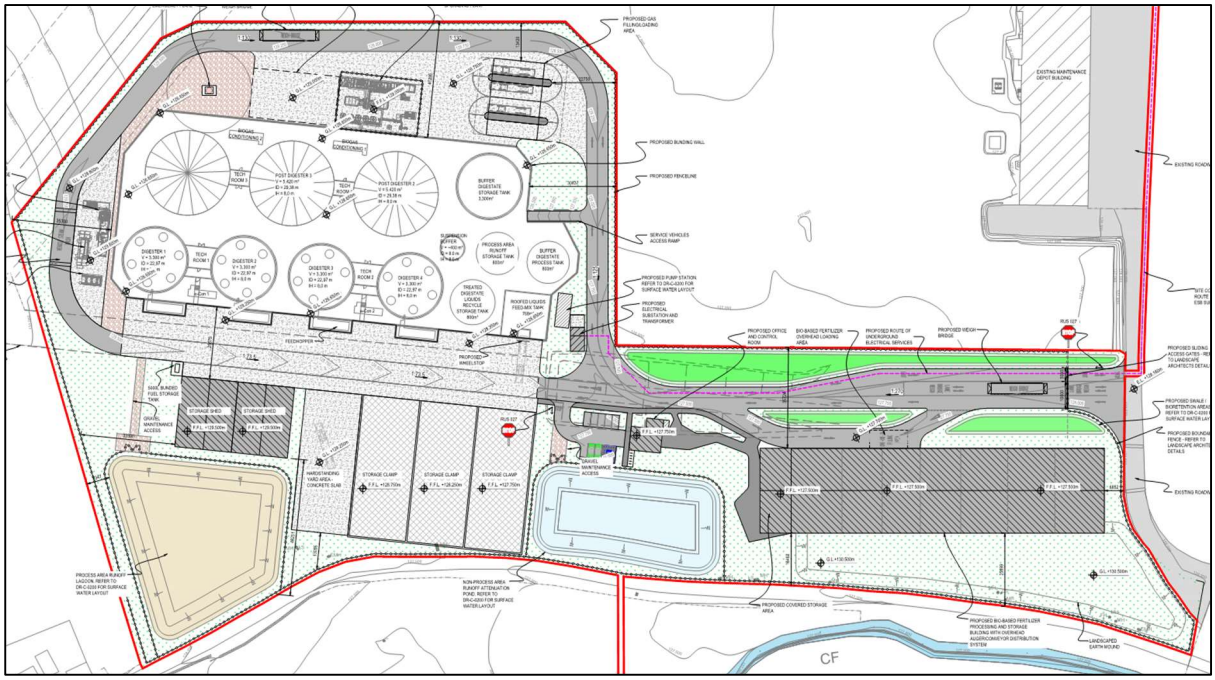


Figure 2: Subject Site Layout

4 Construction Environmental Management Plan

4.1 General

The following section outlines the Construction Environmental Management Plan (CEMP) and provides a framework that outlines how the appointed Contractor will manage and minimise, where possible, negative environmental effects during the construction of the proposed development where construction is considered to include all site preparation, enabling works, demolition works, construction activities, materials delivery, waste removal and associated engineering works.

This CEMP;

- Outlines an indicative programme for Construction,
- Describes the land-use requirements of the construction phase,
- Outlines the employment requirements, roles and responsibilities associated with the construction phase of the proposed development,
- Outlines all the measures which shall be implemented by the appointed contractor to ensure that no significant effects on the environment occur during the construction phase of the proposed development.

Following appointment, the Contractor, as part of the CEMP, shall be required to develop more specific Method Statements and submit a Project Specific CEMP that is cognisant of the proposed construction activities, equipment and plant usage and environmental monitoring plan for the proposed development. The Contractor's CEMP will not materially depart from this CEMP.

This CEMP outlines the range of potential types of construction methods, plant and equipment which may be used by any Contractor appointed in order to enable their impacts to be assessed by the competent authority for the purposes of the environmental impact assessment and appropriate assessment prior to determining whether to grant planning permission. This CEMP identifies the minimum requirements with regard to the appropriate mitigation, monitoring, inspection and reporting mechanisms that need to be implemented throughout construction. Compliance with this CEMP does not absolve the Contractor or its Sub-Contractors from compliance with all legislation and bylaws relating to their construction activities.

4.2 Duration and Sequencing

It is envisaged that the construction of the proposed development shall be a single-phased construction program, involving sub-phases / workflow events as follows;

Phase	Sub-Phase	Description	Duration	Cumulative Duration
Biomethane Development, Lisheen				
1	**1.1**	Site Set-up and Compound/Access	1 month	1 month
	1.2	Construction of Process Area Runoff Drainage Lagoon (acting as temporary settling pond during construction)	1 Month	1 Month
	1.3	Construction of new development buildings, car park and set down area and all external hardstandings and infrastructure,	18 Months	18 Months

4.2.1 Phase 1.1

Phase 1.1 will take approximately 1 month and the following sections describe the main activities that are planned to be undertaken during this phase.

4.2.1.1 Site Set up

- Site set up for the construction compound and erection of secure site hoarding and fencing around the site
- Implementation of Contractor's Health & Safety Plan for the enabling works
- Identification and cut-off, as required, to existing services. It is not anticipated that any services would require these due to the brownfield unused condition of the current lands.
- Create contractor access points off the unnamed private road. This is proposed to be the same access as per the permanent scenario.

4.2.2 Phase 1.2

Phase 1.2 will take approximately 1 month and the following sections describe the main activities that are planned to be undertaken during this phase.

- Primary dig of temporary settling pond to a depth of permanent lagoon,
- Implementation and installation of mitigation measures (Details further discussed in Section 4.5).
- Temporary storage of cut material to be reused for fill.
- Liaising with Local Authority Drainage Department as required,

4.2.3 Phase 1.3

Phase 1.3 will take approximately 18 months and the following sections describe the main activities that are planned to be undertaken during this phase:

4.2.3.1 Foundation Excavation

- Excavation of Building Foundations.
- Stockpiling of site-won material and appropriate temporary covering,
- Removal of surplus excavated material and storing of same at appropriate location,
- Placement of site-won material in areas at grade for build-up in site levels and as backfill to substructure, if appropriate for re-use. Lime stabilization to be used for areas under buildings and roads.

4.2.3.2 Construction

- Construction of in-situ reinforced concrete Ground Floor Slabs, requiring temporary formwork and propping.
- Installation of in-situ concrete vertical elements including columns, reinforced concrete walls,
- Construction of load-bearing masonry internal and external walls.
- Erection of perimeter scaffolding until the external envelope is complete,
- Completion of external envelope which comprises masonry construction and sheeting,
- Upon completion of the external envelope and the scaffolding removed, the construction of all new site service connections will commence including new Surface Water, Wastewater, Water supply, Electricity, Telecoms and Data.
- Construction of external site works including footpaths, internal roads
- Installation of building M&E services,

- Installation of the internal fit out comprising partition as required,
- Construction of sub-bases to roads & footpaths at grade
- Construction of hard and soft landscaping

4.3 Construction Compound

The Contractor's construction compound will be located on site for the duration of the project and shall primarily consist of

- Site Offices & associated welfare facilities,
- Car Parking facilities,
- Materials drop-off and storage areas;
- Set down areas for HGVs

Materials to be stored on site will be stored in a safe manner and will minimise the risk of any negative environmental effects and will be managed on a 'just-in-time' basis. All fuel storage areas will be bunded in the compound and will be clearly marked. Fuel will be transported from the offsite compound to the plant and equipment in mobile units based on need. A dedicated fuel filling point will be set up on site with all plant brought to this point for filling. Temporary toilets and wash facilities will be provided for construction workers which may require periodic waste pumping and waste offsite haulage and shall be carried out by an authorised sanitary waste contractor. The extent of the construction compound is indicated in **Figure 3** below.

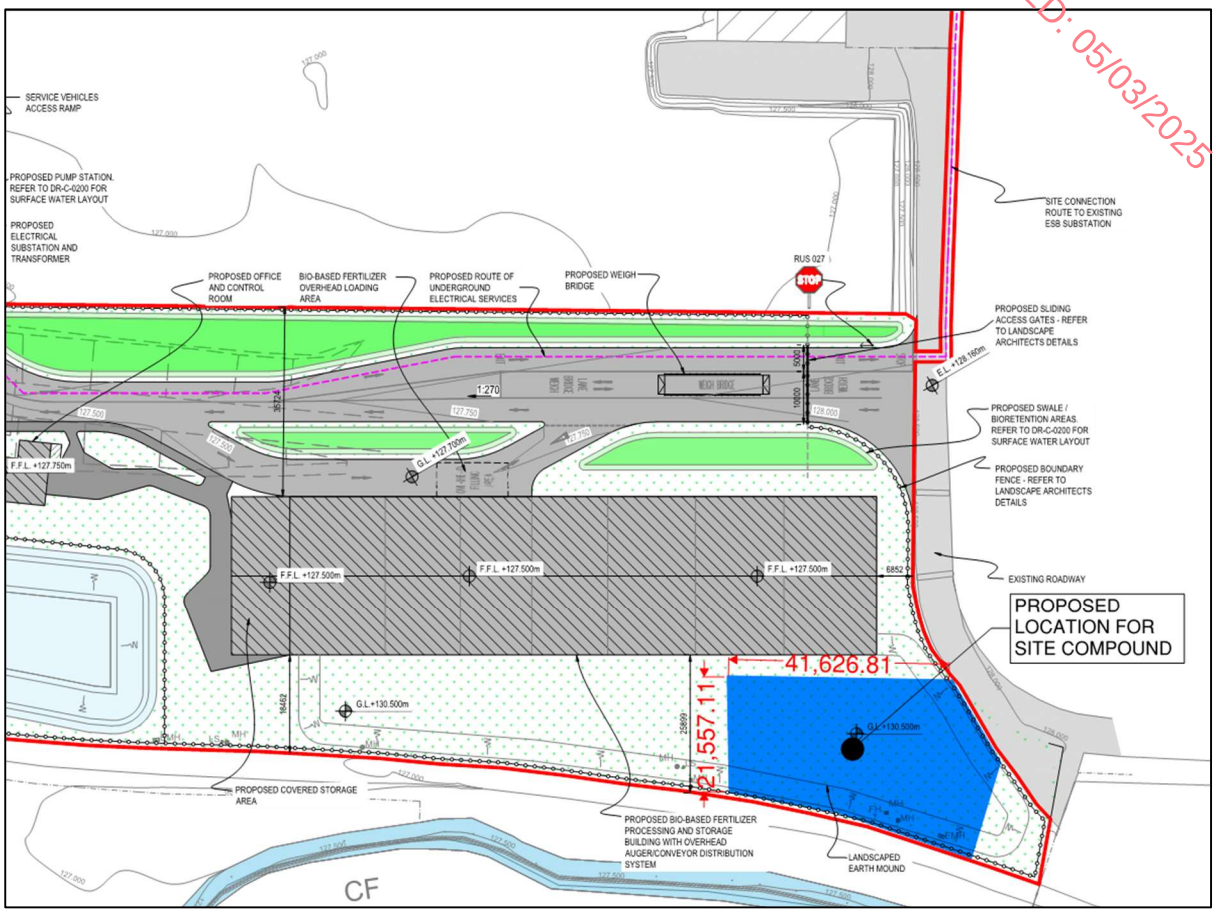


Figure 3: Contractor's Compound

4.4 Site Management

4.4.1 Hoarding

The Demolition and Enabling Works Contractor will establish a site boundary with the provision of appropriate signage, construction of hoarding, and welfare facilities, site office, and establishment of appropriate access and egress. The construction site hoarding will be provided as a secure site boundary to what can be a dangerous environment for people who have not received the proper training and are unfamiliar with construction operations established around the work area before any significant construction activity commences. Site hoarding minimises some of the potential environmental impacts associated with construction, namely:

- Noise,
- Visual impact,
- Dust.

Controlled access points to the site, in the form of gates or doors, will be kept locked for any time that these areas are not monitored (e.g., outside working hours). The hoarding shall be painted, well maintained and contain graphics relating to the proposed development.

4.4.2 Security

The Contractor shall ensure that the site hoarding and gates will avoid unauthorised entry to the site by trespassers and thus minimise the risk of vandalism. In addition, the Contractor shall always ensure suitable access control measures at all entry points which will prevent staff and students from accidentally accessing the live construction site and being at risk of injury.

4.4.3 Site Maintenance

The Contractor shall continuously maintain the site and its surround environs by carrying out the following: -

- Maintain work areas and ensure staff welfare facilities and material storage areas are kept clean,
- Provide site layout maps identifying key areas such as first aid posts, material storage, spill kits, material and waste storage and welfare facilities,
- Maintain all plant, material and equipment required to complete the construction work,
- Maintain construction compounds, access routes and designated parking areas free and clear of excess dirt, rubbish piles, scrap wood, etc. at all times,

- Prevention of the discharge of fuel & oil from bunded areas,
- Provision of appropriate waste management at each working area,
- Prevention of infestation from pests or vermin,
- Maintenance of wheel washing facilities,
- Prevention of site runoff or surface water discharge,
- Maintenance of public rights of way, diversions and entry/ exit areas around working areas for pedestrians and cyclists where practicable,
- Material handling and/or stockpiling of materials, where permitted, will be appropriately located to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.

4.4.4 Site Lighting

The Contractor shall implement the following measures in relation to site lighting: -

- Site lighting will be provided with the minimum luminosity sufficient for safety and security purposes to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas,
- Motion sensor lighting and low energy consumption fittings will be installed to reduce usage and energy consumption,
- Site lighting positioned and directed so as not to unnecessarily intrude on adjacent buildings and land uses, ecological receptors and to avoid causing distraction or confusion to passing motorists,
- Provide tower crane mounted 1000W metal halide floodlights which will be cowled and angled to minimise spillage to surrounding properties.

4.4.5 Working Hours

The proposed normal working hours, subject to Planning Permission, during the construction phase are as follows: -

Start	Finish	Day(s)
08 00	18 00	Monday to Friday
08 00	14 00	Saturday

No works are proposed on Sundays or Bank Holidays or after the hours noted above, however, it may be necessary to work outside of these hours in exceptional circumstances such as Night Works or Weekend Works during certain construction activities.

4.4.6 Employment

It is anticipated that at the peak of the construction phase, there will be an average workforce of 20 people.

4.4.7 Construction Health & Safety

The Contractor shall comply with the requirements of the Safety, Health and Welfare at Work Act 2005, the Safety, Health and Welfare at Work (Construction) Regulations and other relevant Irish and EU safety legislation at all times. The Contractor shall be appointed as Project Supervisor Construction Stage (PSCS). As required by the Regulations, a Health and Safety Plan will be formulated which will address health and safety issues following the design stage through to completion of the construction and maintenance phases. This plan will be reviewed and updated as required, as the development progresses. The Project Supervisor Construction Stage will assemble the Safety File as the project progresses and hand this over to the Project Supervisor Design Process.

4.4.8 Emergency Response

The Contractor will maintain an Emergency Response Action Plan which will cover all foreseeable risks, i.e., fire, spill, flood, etc. and will be developed in accordance with the site emergency plan. Appropriate site personnel will be trained as first aiders and fire marshals and be trained in environmental issues and spill response procedures.

4.4.9 Construction & Demolition Waste Management

The Contractor will be required to produce a Construction & Demolition Waste Management Plan (CDWMP) for approval by Tipperary Co. Council prior to commencing the Works. The Contractor shall refer to and refine the Outline Construction & Demolition Waste Management Plan prepared by DOBA which is in Section 6 of this report and shall include but not be limited to the following: -

- Description of the Project and details of the Contractor's Construction & Demolition Waste Manager
- Construction & Demolition Waste arising and proposals for waste minimisation, reuse and recycling
- Procedures for waste prevention & management
- Estimated costs of waste management

- Training & education proposals for the workforce regarding C&D Waste procedures
- Waste collection & disposal including licensing, permits and associated records
- CDWMP Auditing

4.4.10 Construction Surface Water Run-off

The Contractor shall provide site drainage during the Construction Phase to collect surface runoff prior to discharge to the local SW drainage network, the details of which shall be agreed with TCC.

4.5 Environmental Management

The following section summarises all construction-related mitigation and monitoring measures that must be implemented by the appointed Contractor during the construction phase of the proposed development.

4.5.1 Mitigation Measures

4.5.1.1 Traffic & Transport

A Construction Traffic Management Plan (CTMP) has been included as part of this CMP. The Contractor is required to develop a Site-Specific CEMP and CTMP in order to implement the requirements as outlined in this CEMP and shall be agreed with Tipperary County Council and An Garda Síochána prior to commencement.

4.5.1.2 Air Quality

The following are the Air Quality mitigation measures which are deemed appropriate to the proposed development:

- Spraying of exposed earthwork activities and site haul roads during dry weather;
- Provision of wheel washes,
- Covering of stockpiles,
- Control of vehicle speeds, speed restrictions and vehicle access;
- Sweeping of hard surface roads.

In addition, the following measures will be implemented during the construction phase of the proposed development:

- A min. 1.8m hoarding will be provided around the site works to minimise the dispersion of dust from the working areas,
- Any generators will be located away from sensitive receptors in so far as practicable,

4.5.1.3 Climate

As no significant impacts are predicted during the construction phase, no mitigation measures are proposed.

4.5.1.4 Noise

The Contractor shall implement the following mitigation measures during construction activities in order to reduce the noise and vibration impact to nearby noise-sensitive areas:

- Site compounds will be located away from noise sensitive receptors within the site constraints.
- The delivery and loading of materials within these areas will be restricted to normal working hours.
- For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover.
- For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- Demountable enclosures to screen operatives using hand tools and will be moved around site as necessary.
- All items of plant will be subject to regular maintenance to prolong the effectiveness of noise control measures.
- Construction site hoarding to be constructed around the site boundaries of a material with a mass per unit of surface area greater than 7 kg/m^2 to provide adequate sound insulation.
- Construction noise monitoring will be undertaken at periodic sample periods at the nearest noise sensitive locations to the development works to check compliance with the construction noise criterion and be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.

4.5.1.5 Vibration

The Contractor shall carry out construction activities on site below the recommended vibration criteria set out in BS 7385-2 (1993).

4.5.1.6 Protected Structures

There is no protected structure on or in the vicinity of the development site.

4.5.1.7 Biodiversity

The potential vector for impacts would be seen to be via surface water networks; Measures should be in place to protect the biodiversity of the watercourses downstream. The measures outlined are not necessary for the protection of Natura 2000 sites. No additional mitigation measures are required besides those outlined below, during the construction and operational phases of the development, to protect against potential negative impacts on designated conservation sites or species of conservation importance.

Additional measures to be carried out to prevent impacts on Habitats, Botany and Avian Ecology

- Relevant guidelines and legislation (Section 40 of the Wildlife Acts, 1976 to 2012) in relation to the removal of trees and timing of nesting birds will need be followed e.g. do not remove trees or shrubs during the nesting season (1st March to 31st August).
- Replanting of the perimeter treelines, hedgerows and wildflower meadows should be carried out in accordance with the Landscape Architect's recommendations.
- Construction operations outside of daylight hours should be kept to a minimum in order to minimise disturbance to fauna in addition to roosting bird species.
- Where possible, treelines and mature trees that are located immediately adjacent to planned construction areas, or are not otherwise directly impacted by the construction activities should be avoided and retained intact. Overall impacts on these sites should be reduced through modified design and sensitivity during construction. Retained trees should be protected from root damage by machinery by an exclusion zone. Such protected trees should be fenced off by adequate temporary fencing prior to other works commencing.
- Boundary vegetation. Linear features such as hedgerows and treelines may serve as commuting corridors for bats (and other wildlife) and the onsite boundary vegetation should be retained and/or replaced once construction ends. All planting / landscaping is to be in accordance with the Landscape Architect's (Purser) drawings and specifications.

- Lighting restrictions. In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) should be used to prevent overspill. This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only. Mature trees should not be directly lit during construction or operation of the proposed development.

Additional Mitigation

- All water leaving the site during construction will be desilted using standard techniques including silt buster/silt socks etc.
- During demolition and enabling works all surface water from site will go to the adjacent drainage channel only following desilting. All surface/pumped water will go to foul until the surface water infrastructure is complete, flow controls installed and inspected.
- Desilting and petrochemical interception of all surface runoff/pumped water will take place for the length of the construction project.
- A petrochemical interceptor will be placed on the surface water network prior to discharge.
- Local silt traps established throughout site.
- Mitigation measures on site include dust control, stockpiling away from watercourse and drains
- Stockpiling of loose materials will be a minimum of 20m from drains.
- Stockpiles and runoff areas following clearance will have suitable silt barriers to prevent runoff of fines into the drainage system.
- Fuel, oil and chemical storage will be sited within a bunded area. The bund will be at least 50m away from drains, excavations and other locations where it may cause pollution.
- Bunds will be kept clean and spills within the bund area will be cleaned immediately to prevent groundwater contamination. Any water-filled excavations, including the attenuation tank during construction, that require pumping will not directly discharge to the surface water network. Prior to discharge of water from excavations adequate filtration and petrochemical interception will be provided to ensure no deterioration of water quality and ensure compliance with the Water Pollution Acts.

- Site layout during excavation works will be designed to ensure vehicles do not enter the works area unless necessary for the excavation and soil removal processes. All machinery leaving the works area will be thoroughly cleaned before being allowed on to public roads. A road sweeper (including vacuum) will be in place (as required) to unsure cleanliness of nearby and haul roads (where necessary), particularly during enabling works.
- Dust may deposit on surrounding roads thus entering into the surface water network. Effective site management regarding dust emissions will be carried out.

4.5.1.8 Archaeology

There are no known archaeological features of note on the site.

4.5.1.9 Water

The Contractor shall implement the following to minimise the risk of pollution of soil, surface water and groundwater:-

- Earthworks operations shall be carried out such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe run-off and prevent ponding and flooding;
- Run-off will be controlled to minimise the water effects in outfall areas;
- All concrete mixing and batching activities will be located in areas away from watercourses and drains; and
- Good housekeeping (site clean-ups, use of disposal bins, etc.) will be implemented on the site.
- All hazardous materials will be stored within secondary containment designed to retain at least 110% of the storage contents and temporary bunds for oil/diesel storage tanks will be used on the site

The Contractor shall apply best practice standards which will follow the guidance set out in the following CIRIA documents:-

- C532 Control of Water Pollution from Construction Sites
- C692 Environmental Good Practice on Site
- ICE Earthworks, A Guide
- TII Specification for Road Works Series 600 - Earthworks

4.5.1.10 Land & Soils

- Precautionary measures will be taken to contain any areas within the planning boundary at risk of contaminated run-off. The Contractors CEMP shall include the following measures:-
- Provide adequate security to potential pollutants against vandalism,
- Provide procedures to ensure that any spillages will be immediately contained, and contaminated soil shall be removed from the proposed development and properly disposed of in an appropriately licensed facility,
- Minimise dust generation by wetting down haul roads,
- Store stockpiles of earthworks and site clearance material on impermeable surfaces and covered with appropriate materials,
- Place silt traps in road gullies to capture any excess silt in the run-off from working areas,
- Carry out earthworks operations such that surfaces shall be designed with adequate falls, profiling and drainage to promote safe runoff and prevent ponding and flooding,

The Contractors CEMP shall include a plan for responding to emergencies and shall include actions for dealing with potential pollution incidents such as:-

- Containment measures;
- Emergency discharge routes;
- List of appropriate equipment and clean-up materials;
- Maintenance schedule for equipment;
- Details of trained staff, location and provision for 24-hour cover;
- Details of staff responsibilities;
- Notification procedures to inform the EPA or Environmental Department of Tipperary County Council
- Audit and review schedule;
- Telephone numbers of statutory water consultees; and
- List of specialist pollution clean-up companies and their telephone numbers.

4.5.1.11 Hydrogeology

The Contractor's CEMP will take account of the recommendations of the CIRIA guidance Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors to minimise the risk of soil, groundwater and surface water contamination.

The Contractor shall implement the following measures to minimise the risk of spills and contamination of soils and waters: -

- Treat all excavated spoil to remove excess fluid prior to stockpiling and transportation where possible.
- Transfer excess soil materials from stockpile areas off-site during dry periods where feasible.
- Restrict stockpile and transfer of excess soil material to specified and impermeable areas that are isolated from the surrounding environment.
- Provide wheel washes at site entrances and exit points.
- Train staff to follow vehicle cleaning procedures.
- Train site managers, foremen and workforce, including all subcontractors, in pollution risks and preventative measures.
- Bund all fuel storage facilities away.
- Implement a regular vehicle inspection plan for fuel, oil and hydraulic fluid leaks.
- Provide suitable equipment to deal with spills on site.
- Minimise the use of cleaning chemicals.

4.5.1.12 Waste Management

As noted previously, the Contractor will be required to produce a Construction & Demolition Waste Management Plan (CDWMP) for approval by Tipperary County Council prior to commencing the Works.

4.5.1.13 Material Assets

The Contractor shall put measures in place to ensure that there are no interruptions to existing services and that all services and utilities are maintained, unless this has been agreed in advance with the relevant service provider and local authority. Where new services are required, the Contractor will apply to the relevant utility company for a connection permit where appropriate and will adhere to their requirements.

4.5.1.14 Major Accidents & Incidents

The construction phase of the proposed development will be carried out by the Contractor in compliance with best practice construction measures.

4.5.2 Monitoring Measures

4.5.2.1 Traffic & Transportation

Refer to the SYSTRA Construction Stage Traffic Management Plan submitted under separate cover.

4.5.2.2 Air Quality

The Contractor shall incorporate these measures into the overall Construction Environmental Management Plan (CEMP) for the site. In summary, some of the measures which will be implemented will include:

- Prior to demolition, blocks shall be soft stripped inside buildings (retaining walls and windows in the rest of the building, where possible, to provide a screen against dust).
- During the demolition process, water suppression shall be used, preferably with a hand-held spray. Only the use of cutting, grinding or sawing equipment fitted or used in conjunction with a suitable dust suppression technique such as water sprays / local extraction should be used.
- Drop heights from conveyors, loading shovels, hoppers and other loading equipment shall be minimised, if necessary fine water sprays will be employed.
- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.
- Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and / or windy conditions.
- Vehicles exiting the site shall make use of a wheel wash facility prior to entering public roads.
- Vehicles using site roads will have their speed restricted, and this speed restriction will be enforced rigidly. A speed limit of 20 kmph will be enforced on site roads.
- Public roads and footpaths outside the site will be regularly inspected for cleanliness and cleaned, as necessary. If sweeping using a road sweeper is not possible due to the nature of the surrounding area, then a suitable smaller scale street cleaning vacuum will be used.

- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used, as required, if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.
- Hoarding or screens shall be erected around works areas to reduce visual impact. This will also have an added benefit of preventing larger particles of dust from travelling off-site and impacting receptors.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, all operations likely to cause dust emissions will be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

The mitigation measures put in place to control construction dust will also be considered as mitigation measures with respect to aspergillus as they will minimise the potential for spread of the fungal spores. The Contractor shall undertake dust monitoring at a range of nearest sensitive receptors during the demolition and construction phases with the Technical Instructions on Air Quality Control (TA Luft) dust deposition limit set at 350 mg/m^2/day, averaged over one year and applied as a 30-day average. The TA-Luft standard has been applied for the purpose of this assessment based on recommendations from the EPA in Ireland in the document titled 'Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA, 2006). The document recommends that the Bergerhoff limit of 350 mg/(m^2*day) be applied to the site boundary of quarries. This limit value can be implemented with regard to dust impacts from construction of the proposed development.

4.5.2.3 Climate

As no significant impact is predicted to occur during the construction phase of the proposed development, no monitoring measures are required.

4.5.2.4 Noise & Vibration

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2. Whist construction noise and vibration impacts are expected to vary during the construction phase depending on the distance between the activities and noise sensitive buildings, the

contractor will ensure that all best practice noise and vibration control methods will be used, as necessary in order to ensure impacts at off-site noise sensitive locations are minimized.

The best practice measures set out in BS 5228 (2009) Parts 1 and 2 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- noise control at source;
- screening;
- liaison with the public, and;
- monitoring.

Detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise and vibration monitoring, where required.

Selection of Quiet Plant

This practice is recommended in relation to static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

Referring to the potential noise generating sources for the works under consideration, the following best practice migration measures should be considered:

- Site compounds will be located in excess of 30m from noise sensitive receptors within the site constraints. The use lifting bulky items, dropping and loading of materials within these areas should be restricted to normal working hours.
- For mobile plant items such as dump trucks, excavators and loaders, the installation of an acoustic exhaust and or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB. Mobile plant should be switched off when not in use and not left idling.
- For percussive tools such as pneumatic concrete breakers and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensure any leaks in the air lines are sealed. Erect localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries.
- For concrete mixers, control measures should be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- For compressors, generators and pumps, these can be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- Demountable enclosures can also be used to screen operatives using hand tools and will be moved around site as necessary.
- All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. Construction site hoarding will be constructed around the site boundaries as standard. The hoarding will be constructed of a material with a mass per unit of surface area greater than 7 kg/m2 to provide adequate sound attenuation.

In addition, careful planning of the site layout will also be considered. The placement of site buildings such as offices and stores will be used, where feasible, to provide noise screening when placed between the source and the receiver.

Liaison with the Public

A designated environmental liaison officer will be appointed to site during construction works. Any noise complaints should be logged and followed up in a prompt fashion by the liaison officer. In addition, where a particularly noisy construction activity is planned or other works with the potential to generate high levels of noise, or where noisy works are expected to operate outside of normal working hours etc., the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

Monitoring

The contractor will be required to ensure construction activities operate within the noise and vibration limits set out within this assessment. The contractor will be required to undertake regular noise and vibration monitoring at locations representative of the closest sensitive locations to ensure the relevant criteria are not exceeded.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.

Vibration monitoring should be conducted in accordance with BS 6472:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting (human disturbance) and BS ISO 4866:2010 Mechanical vibration and shock. Vibration of fixed structures. Guidelines for the measurement of vibrations and evaluation of their effects on structures (building damage).

Project Programme

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. During excavation/ piling or other high noise generating works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased so as to prevent unacceptable disturbance at any time.

Vibration

The vibration from construction activities will be limited to the values set out in Section 13.3.3. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Limit values have been provided for soundly constructed residential and commercial properties.

4.5.2.5 Biodiversity

The Contractor shall ensure that the discharge of treated surface water from dewatering activities will be monitored to ensure that the discharged treated water is compliant with the Irish Water agreed Discharge Licence. The Contractor shall employ a suitably qualified Site Environmental Manager to oversee the control of settlement and advise of silt bag replacement where required.

4.5.2.6 Water

The Contractor shall carry out visual monitoring of the proposed development to ensure existing surface water runoff is draining from the site and is not exposed to any contaminants. In addition, the contractor is required to monitor the weather forecasts to inform the programming of earthworks and stockpiling of materials.

4.5.2.7 Land & Soils

The Contractor shall employ a suitably qualified person to monitor excavations in made ground to ensure that any contaminated material is identified, segregated and disposed of appropriately. The Contractor shall monitor excavations to ensure consistency with the descriptions and classifications according to waste acceptance criteria testing carried out as part of the site investigations. Any identified hotspots shall be segregated and stored in an area where there is no possibility of runoff generation or infiltration to ground or surface water drainage. In addition, care shall be taken to ensure that the hotspots do not cross contaminate clean soils elsewhere.

4.5.2.8 Hydrogeology

The Contractor shall carry out visual monitoring to ensure the groundwater resource is not impacted by the proposed development.

4.5.2.9 Waste Management

The Contractor shall manage waste during the construction phase in accordance with the Contractors CDWMP. The data will be maintained to advise on future projects.

4.5.2.10 Material Assets

Construction phase mitigation measures have been proposed to ensure that significant negative effects on material assets will be avoided, prevented or reduced during the construction of the proposed development. As such, no monitoring measures are proposed during the construction phase.

4.5.2.11 Major Accidents & Incidents

No monitoring is proposed specific to reducing the risk of major accidents/ disasters during construction.

5 Construction Traffic Management Plan

The purpose of this document is to outline the construction traffic access provisions for the subject development and to describe measures by which the impact of construction-related vehicular traffic on the surrounding public road network may be minimised. It is noted that a dedicated Framework Construction Traffic Management Plan has been prepared by SYSTRA, which will be submitted under separated cover.

It is intended that the traffic management measures specified herein be adopted and refined by the lead Contractor appointed to the development's construction and that they will form part of the contractor's final Construction Management Plan.

5.1 Existing Transport Conditions

The subject site is located on the former Lisheen Mine footprint, to the northeast of Thurles. It is surrounded by private roads and unnamed public roads. **Figure 4** indicates the location of the site in comparison to its surroundings.

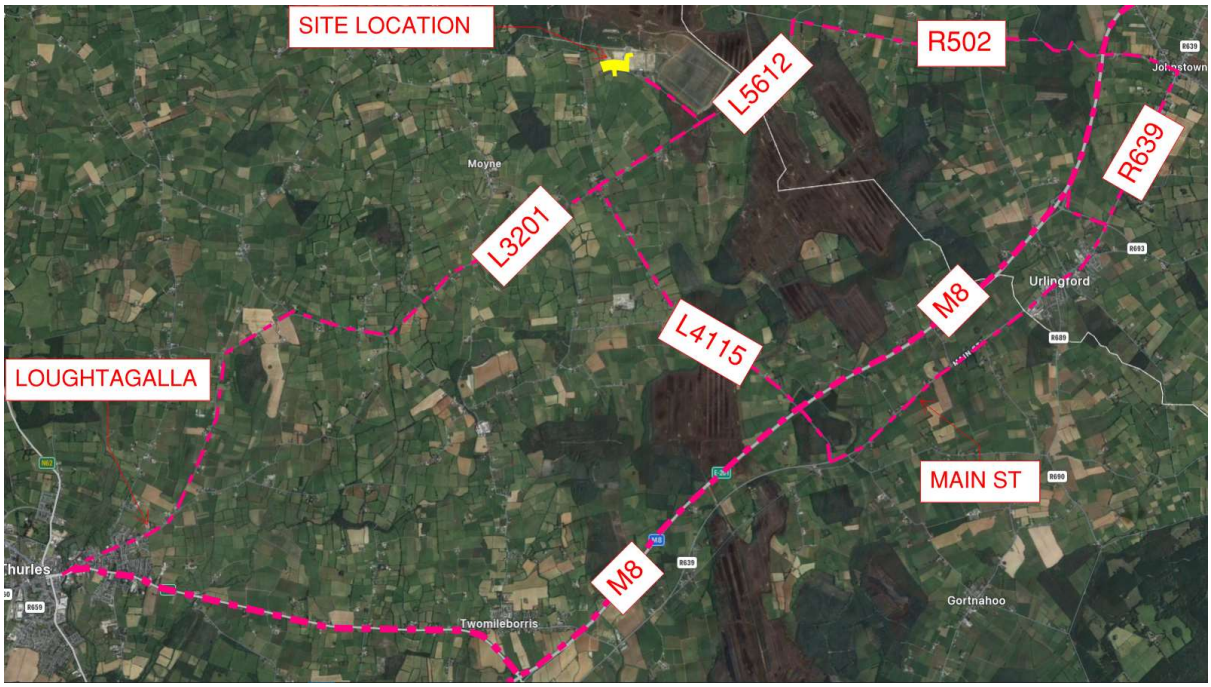


Figure 4: Site Location and Existing Roads

SYSTRA commissioned Nationwide Data Collection Ltd, a specialist survey company, to undertake traffic surveys in August 2024. Survey dates were agreed with TCC's Transport Planning team. These surveys comprised three Automatic Traffic Counters (ATC) that were in place for a three-day period, commencing Tuesday 13th August 2024. The ATC recorded hourly traffic flows, composition and speeds, at the following locations:

- On the L3201, 1.6km south-west of Clonsaul, close to the Lisheen Mine access junction;
- On the L4115, 3.6km north-west of the R639 junction; and
- On the R639, 500m west of the L4115 junction.

Figure 5 indicates the location of the traffic count.

Figure 5: ATC Traffic Count Locations

The traffic counts and assessment are in detail in the Transport Assessment, submitted under separate cover, however, in summary, the results indicate:

- Recorded traffic flows on the L3201 and L4115 were very low, with Average Annual Daily Flow (AADF) totals of 542 vehicles and 965 vehicles respectively;
- Recorded traffic flows on the R639 were slightly higher, with an AADF of 3,420 vehicles recorded; and

- Recorded HGV percentages were between 7% and 9% at each of the locations.

Recorded 'peak hour' traffic flows were extremely low. The recorded two-way flows in the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hours were:

- L3201 – 42 vehicles / 48 vehicles;
- L4115 – 80 vehicles / 108 vehicles; and
- R639 – 226 vehicles / 310 vehicles.

5.2 Construction Traffic Routes

The site is well-located to ensure that construction traffic travels along suitable routes to the site.

The nearest primary route roads infrastructure to the site is directly off the M8, from either Junction 4, Junction 5 or Junction 6, as shown in **Figure 6** below:

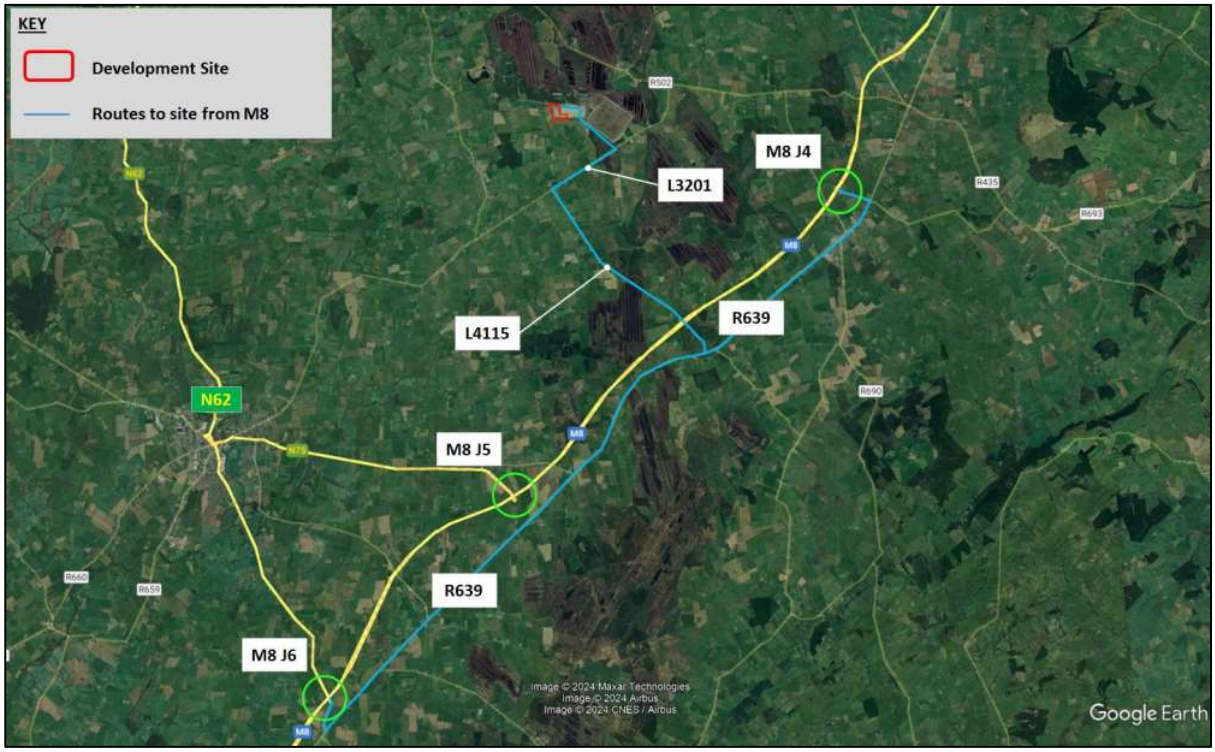


Figure 6: HGV Access Routes

Heavy Good Vehicle traffic (Vehicles 3.5t or over) to and from the construction site shall comprise primarily 3-axle and 4-axle lorries for the removal and delivery of spoil and aggregate.

All HGV construction traffic shall follow the same designated routes in place for all other construction traffic.

The proposed Routes are:

- To / from the north-east via the L4115, L3201, R639 and M8 J4; and
- To / from the south-west via the L4115, L3201, R630 and M8 J6.

The L3201 and L4115 were previously used as the HGV route between the Lisheen Mine and the R639. To support operations, a right-turn lane was added to the R639 at its junction with the L4115, and both the L4115 and L3201 were improved.

The R639, L4115 and L3201 are of suitable width and alignment to accommodate two-way HGV traffic, and currently experience low traffic flows.

The route between the site and the R639 is currently lightly trafficked, and passes through a semi-rural area, with no particularly sensitive receptors. To reach the M6, HGVs will either travel north-east to Junction 4, or south-west to J6. These sections of the delivery route pass through Urlingford and Littleton. The speed limit within these settlements is 50km/h, and construction traffic can be accommodated safely, and without noticeably affecting existing traffic levels.

The details of the proposed construction routing will be agreed with TCC, prior to commencement of construction works.

Use of the agreed vehicle routes, and delivery protocols, should be accepted by the contractor and should be communicated to all individuals associated with the works.

Any repeated non-compliance of the proposed construction route could result in disciplinary procedures or the termination of the workers / supplier's contract.

5.3 Construction Traffic Generation

5.3.1 Principal Construction Traffic

The major construction items include excavation and fill, substructure and superstructure construction. It is expected that the construction traffic to and from the site shall reach a peak during the preliminary earthworks of the construction. It is estimated that throughout the project duration;

- approximately 10,000 cubic metres of building/ construction material to be imported to site during the project,

Therefore, the total number of HGV trips throughout the project duration is approximately 834 trips based on an average HGV load of 12 cubic metres. The final programming and scheduling of this material transfer shall be determined by the lead contractor appointed to the project. In addition, there will be a small number of other deliveries (such as timer or manhole deliveries), which will bring the number of inbound deliveries to around 1,000 HGVs (2,000 two-way trips). No material will be exported from the site.

There will be a daily average of 3 HGV deliveries to the site, resulting in 3 inbound, and 3 outbound trips per day. HGV deliveries will be spread relatively evenly throughout the day. During periods of peak construction, it is anticipated that there could be 10 inbound and 10 outbound HGV trips to the site on a daily basis.

SYSTRA has assumed that all construction traffic will travel on the L3201 and L4115, and that flows on the R639 will be split evenly between east and west. The use of these designated routes can be written into Contractor obligations, and compliance can be assured through observations and monitoring.

In addition to HGV traffic, periodic deliveries of materials to site shall be made by light good vehicles. To the extent possible, these shall be scheduled to take place outside of peak traffic hours. Such trips are also unlikely to occur frequently during the stages of construction that require bulk excavation or the importation of fill material; LGV trips are therefore unlikely to occur in significant numbers at the same time as HGV trips take place.

Approximately 20 car parking spaces for construction personnel are to be provided on site during construction works. The parking will be located within the contractor's compound. Usage of this shall be strictly controlled and limited to those workers for whom no alternative mode of transport is practical. All construction personnel shall be encouraged to use public transport or to cycle to site, and shall be supported in this. It is also expected that the lead Contractor and/ or individual subcontractors shall arrange bus transport to site for a proportion of their works. No parking by construction personnel shall be permitted within the school car parks or on public roads in the vicinity of the site.

Assuming an average vehicle occupancy of two persons, the site will generate 10 inbound, and 10 outbound staff vehicle trips per day. Staff trips to and from the site will generally take place just in advance of the site working hours and following the site close in the evening.

Table 1 indicates the approximate No. of HGV Trips made per day and the associated impact it is anticipated to have on the local road infrastructure.

Table 1: Traffic Increases during Construction Stage

ID	Location	Base 2024 (AADF)			Construction Traffic (AADF)			% impact		
		Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1	L3201	496	46	542	20	20	40	4%	43%	8%
2	L4115	891	74	965	20	20	40	2%	27%	4%
3	R639	3,192	228	3,420	10	10	20	0%	4%	1%

The above Table shows that in absolute terms, the traffic impact during the construction stage will be modest. For example, on the L3201 there will be a daily increase of 40 two-way trips, an average increase of around 5 trips per hour during the working day.

In percentage terms, there will be a high percentage increase, particularly in HGV traffic, on the L3201 and L4115, but this is due to the small numbers of existing HGV trips.

The R639 will see a modest percentage increase in all trips, which will not be particularly noticeable compared to existing flows.

The details of the proposed construction routing will be agreed with TCC, prior to commencement of construction works, with the national road network being used as much as possible.

The L3201, L4115 and the majority of the R639 are assessed as being of Low sensitivity, and to experience a Minor traffic effect during the construction stage. The overall Significance of Effect on these roads is assessed as Likely, Negative, Slight, and Short-term (lasting just over a year).

Given the minor increases in traffic levels during the Construction stage (below 30%, 10% in sensitive locations), as per the IEMA Guidance, a more detailed assessment is not required.

Traffic impacts during the construction stage will be mitigated through the implementation of a Construction Traffic Management Plan (CTMP), which will be agreed upon with TCC. A Framework CTMP, which sets out the principles to be followed, is included as part of the application package.

A dedicated Framework Construction Traffic Management Plan has been prepared by SYSTRA, which will be submitted under separated cover.

5.4 Construction Traffic Management

A dedicated Framework Construction Traffic Management Plan has been prepared by SYSTRA, which will be submitted under separated cover.

5.4.1 Works-Specific Construction Traffic Management Plan

Prior to works commencing on site, the Contractor appointed to the project will be required to refine this Construction Traffic Management Plan and provide a detailed works-specific construction traffic management plan, reflecting the specifics of their final site management and construction methodologies. This plan shall be prepared in consultation with the Design Team, Tipperary County Council (TCC) and with An Garda Siochana, and shall be updated as required through the project.

The principal objective of the CTMP is to proactively manage the impacts of all construction traffic related to the proposed development, upon both the public and internal environments. It shall aim to ensure that the safety of the public, staff, patients and of construction workers is maintained at all times, that disruptions are minimised and that all operations are undertaken within a risk-controlled environment. It is noted that the impact of the construction works will be temporary in nature.

The final contractor CTMP will be prepared in accordance with the principles outlined below and shall always comply with

- Chapter 8 of the Department of Environment Traffic Signals Manual, current edition, published by the Stationary Office and available from the Government Publications Office, Sun Alliance House, Molesworth Street, Dublin 2;
- The Guidance for the Control and Management of Traffic at Road Works (June 2010) prepared by the local Government Management Services Board;
- The Construction Site Traffic Management Plan (SCTMP) Guidance prepared by the Health and Safety Authority; and
- Any additional requirements detailed in TII standards or in the Design Manual for Urban Roads and Street (DMURS).

Issues addressed in the CTMP shall include:

- Public, Staff & Patients Safety
- Construction Traffic Routes

- Deliveries Schedules
- Special Deliveries (Wide and Long Load)
- Traffic Flows
- Signage and Lighting
- Road Opening Requirements
- Road Closures
- Lighting

A liaison officer will be appointed as a point of contact with the local residents, TCC and the Gardai. Specific mitigation measures suggested for the inclusion in the CTMP include:

- Securely fencing off the site from adjacent properties, public footpaths and roads during the pre-construction phase;
- Providing signage on the surrounding road network to define the access and egress routes for the development;
- Strictly controlling the traffic generated by the constriction phase of the development in order to minimise the impact of this traffic on the surrounding road network;
- Adequately signposting and enclosing all road works to ensure the safety of all road users and construction personnel;
- Accommodating all unavoidable employees' and visitors' vehicle parking demands on site or within designated off-site parking areas;
- Implementing a programme of street cleansing as required;
- Making arrangements to facilitate the delivery of abnormal loads to the site; and
- Implementing measures to avoid queuing of construction traffic on the adjoining road network.

5.4.2 Vehicular Access Control Measures

Security personnel will be present at the entrance/exit of the site to ensure all exiting traffic will do so safely. A wheel wash may be installed at the exit from the site to prevent any dirt being carried out into public roads. If necessary, a road sweeper will be used to keep public roads around the site clean.

The vehicular access to the construction site shall include the following design elements:

- Sufficient entrance width to permit two rigid body vehicles to pass one another (i.e., one can enter while another waits to leave);
- An entrance gate set back a minimum of 18m from the public road edge, to ensure that vehicles may leave the road completely before having to stop;
- Appropriate sight lines for vehicles exiting from the site to be ensured by removing existing visual obstructions and by appropriate design of perimeter hoarding; and
- Directional signage for site traffic and advance warning signage for all other rad users

Access measures may be refined further as part of the final Construction Traffic Management Plan (CTMP) to be prepared by the contractor.

5.4.3 Minimisation of Construction Vehicle Movements

Construction vehicle movements will be minimised through:

- Consolidation of delivery loads to/ from the site and management of large deliveries on site to occur outside peak periods;
- Use of Pre-cast/ Prefabricated materials where possible;
- Reuse on site 'Cut' material generated by the construction works, where possible, through various accommodation works;
- Provision of adequate storage space on site;
- Development of a strategy to minimise construction material quantities as much as possible;
- Minimisation of construction staff' vehicle movements by promoting car sharing and the use of public transport.

The following headings identify some measures to be encouraged:

5.4.3.1 Cycling

Cycle parking spaces will be provided on the site for construction staff. In addition, lockers will be provided to allow cyclists to store their clothes.

5.4.3.2 Public Transport

Construction staff will be encouraged to use public transport for travel to and from the site. An information leaflet will be provided to all staff as part of their induction on site highlighting the location of various public transport services in the vicinity on the construction site.

5.4.3.3 Car Sharing

The contractor will provide organisational support and encouragement for car sharing amongst staff, particularly those for whom end-to–end public transport journeys are impractical. To the extent possible, the contractor will endeavour to arrange staff shift patterns to facilitate shared journeys by staff who would drive similar routes

5.4.3.4 Monitoring/ Public Roads

A visual condition survey (VCS) will be carried out of all surrounding streets prior to any site works commencing. The lead contractor will liaise with the environment & Transportation Department of Tipperary County Council to agree any changes to load restrictions and construction access routes for the site. All site entrances and temporary roads will be continuously maintained for emergency vehicle access. The following measures will be taken to ensure that site, public roads and surroundings are kept clean and tidy:

- A regular program of site tidying will be established to ensure a safe and orderly site;
- Scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind;
- Food waste will be strictly controlled on all parts of the site;
- Mud spillages on roads and footpaths outside the site will be cleaned regularly and will not be allowed to accumulate;
- Wheel wash facilities will be provided for vehicles exiting the site;
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed;

5.4.3.5 Site Parking

Approximately 20 car parking spaces for construction personnel are to be provided on site during construction works. The parking will be located within the contractor's compound. Usage of this shall be strictly controlled and limited to those workers for whom no alternative mode of transport is practical. All construction personnel shall be encouraged to use public transport or to cycle to site, and shall be supported in this. It is also expected that the lead Contractor and/ or individual subcontractors shall arrange bus transport to site for a proportion of

their works. No parking by construction personnel shall be permitted within the neighbouring Glanbia Facility's car parks or on the private roads in the vicinity of the site.

All construction personnel shall be encouraged to use public transport or to cycle when travelling to site, and all contractors shall be required to make reasonable provision for shared transport of workers to site (e.g., charter buses or car sharing arrangements). Information on local transportation services shall be posted on site.

5.4.3.6 Deliveries & Storage Facilities

It is proposed that unloading bays be provided for deliveries to the site within the hoarding perimeter. These should be accessible by crane and teleporters. Appropriately demarcated storage zones will be used to separate materials.

All deliveries to site will be scheduled to ensure their timely arrival and avoid need for storing large quantities of materials to site. Deliveries will be scheduled outside of peak traffic hours, to avoid disturbance to pedestrian and vehicular traffic in the vicinity of the site.

6 Construction & Demolition Resource & Waste Management

The content and headings used in this section of the CMP comply with the Department of the Environment, Heritage and Local Government (DoEHLG) Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects, 2021.

6.1 Definition of Waste

Waste, as defined in Section 4(1) of the Waste Management Act 1996, as amended, means any substance or object which the holder discards or intends or is required to discard.

6.2 Waste Management Objectives

The principal objective of sustainable resource and Waste management is to use material resources more efficiently, where the value of products, materials and resources are maintained in the economy for as long as possible and the generation of Waste is minimised. To achieve resource efficiency there is a need to move from a traditional linear economy to a circular economy as indicated the below figure.

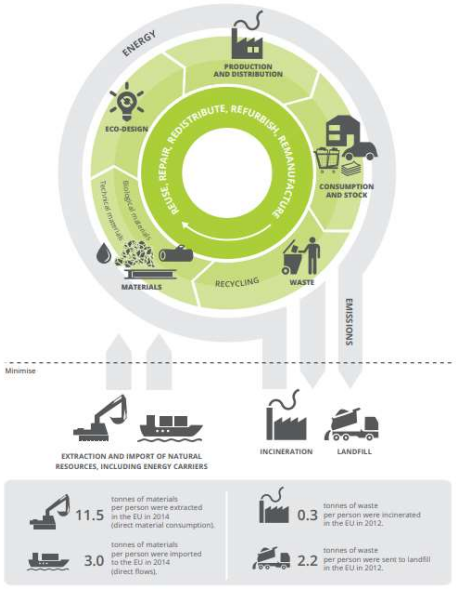


Figure 7: Circular Economy for Materials and Energy (source: European Environment Agency)

In December 2015, the European Commission adopted an ambitious Circular Economy Package, which includes revised legislative proposals on Waste to stimulate Europe's transition towards a circular economy. However, where residual Waste is generated, it should be dealt with in a way that follows the Waste hierarchy as shown

in the below figure and actively contributes to the economic, social and environmental goals of sustainable development.

Figure 8: EU Waste Hierarchy (source: European Commission)

The Waste management objectives for the proposed development are described in the following sections and will facilitate material reuse and recycling where possible and seek to divert Waste from landfill.

6.2.1 Prevention

The Contractor shall prevent and minimise Waste generation where possible by ensuring large surpluses of construction materials are not delivered to site through coordination with the suppliers, operate a just-in-time delivery system and ensure Sub-Contractors conform to the Construction Waste Management Plan (CWMP) for all operations on site.

6.2.2 Reuse

Reuse Wastes and surplus materials where feasible and in as many high-value uses as possible.

6.2.3 Recycle

Recycle Waste where possible such as introducing on-site crushers to produce Waste derived aggregates which may, subject to appropriate testing and approvals, may be re-used in the project.

6.2.4 Disposal

Where disposal of Waste is unavoidable this will be undertaken in accordance with the Waste Management Act 1996, as amended.

6.3 Waste Management Legislation & Policy

The key components of EU, national and local policy, legislation and guidance relevant to the proposed Construction works are summarised as follows:

- prevention and minimisation of Waste is the preferred option,
- where construction Waste is generated, it should be source separated to facilitate recycling and maximise diversion of Waste from landfill,
- where Waste may not be prevented or recycled it should be transported and disposed of in accordance with applicable legislation and without causing environmental pollution,
- Waste may only be transferred by a Waste collection permit holder and delivered to an authorised Waste facility.

6.3.1 Legislation

The following is a list of the legislation which governs Waste management in Ireland and are applicable to the proposed development: -

European

- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and repealing certain Directives
- National
- Waste Management Act 1996, as amended and Regulations Made under the Acts
- Waste Management (Collection Permit) Regulations, 2007, S.I. No 820 of 2008, as amended
- Waste Management (Shipments of Waste) Regulations 2007, S.I. No. 419 of 2007

6.3.2 Policy

The following is a list of the policy which governs Waste Management in Ireland and are applicable to the proposed development: -

European

- Circular Economy Package, European Commission (2018)
- Europe 2020 Strategy, European Commission (2010)
- Roadmap to a Resource Efficient Europe, European Commission (2011)
- 7th Environmental Action Programme, European Commission (2014)

National

- Department of the Environment, Heritage and Local Government (2012) A Resource Opportunity- Waste Management Policy in Ireland
- EPA National Waste Statistics and Bulletins
- EPA (2014) National Municipal Waste Recovery Capacity. An Assessment for the Department of the Environment, Community and Local Government
- Environmental Protection Agency (2014) National Hazardous Waste Management Plan, 2014-2020
- EPA (2015) Waste Classification – List of Waste and Determining if Waste is hazardous or Non Hazardous.
- EPA, "*Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for C&D Projects*", 2021

Regional

- The Eastern Midlands Region Waste Management Plan 2015-2021

6.4 Roles & Responsibilities

6.4.1 Waste Producer

In accordance with the Waste Management 1996, as amended, the Waste producer is responsible for Waste from the time it is generated through until it is legally recycled, recovered or disposed of. Therefore, the onus lies with the producer, i.e. the Client, to ensure that Waste is correctly managed or can face prosecution as a result of incidents of pollution as a result of incorrect management of Waste produced. Contractors appointed by the Client must ensure that facilities receiving Waste hold either a Certificate of Registration (COR) or Waste permit (granted by the Local Authority under the Waste Management (Facility Permit & Registration)

Regulations 2007) or Waste licence or Industrial Emissions licence (granted by the EPA) while transporters of Waste must hold a collection permit which is issued by a National Waste Collection Permit Office (NWCPO).

6.4.2 Contractor

The Contractor shall, prior to the commencement of the Works, nominate and appoint an adequately trained Construction Waste Manager (CWM) with overall responsibility for implementation of this CWMP. The Contractor's CWM shall be responsible for the following: -

- Instructing all site personnel to comply with the specific provisions of the CWMP, in particular the Objectives regarding the prevention, reduction, re-use and recycling.
- Ensuring that copies of the CWMP will be made available to all relevant personnel on site.
- Informing through regular training of all site personnel of the objectives of the plan and their responsibilities in relation to compliance with the plan.
- Ensuring that where training is required regarding the handling and management of Wastes on site that this is provided to staff as required to ensure they can: -
    - Distinguish reusable materials from materials suitable for recycling
    - Ensure maximum segregation at source
    - Co-operate with the Contractor's management regarding stockpiling of reusable material and ensure separation of materials for recovery
    - Identify and liaise with operates of recovery outlets
- Informing Contractor staff and Sub-Contractors of content of the plan and for maintaining and keeping detailed records.

In addition, an appropriate staff member from each Sub-Contractor on the site shall be assigned the direct responsibility to ensure that the discrete operations stated in the CWMP are performed on an on-going basis. In the event of the CWM leaving the project team, the Contractor will nominate a suitable replacement.

6.5 Construction Waste Arising

Construction Waste is defined as Waste which arises from construction activities. The following sections analyse the wastes arising from construction activities on site and provides methods for management of waste through prevention, reuse and recycling.

6.5.1 Construction Hazardous & Non-Hazardous Wastes

The typical types of Construction Hazardous and Non-Hazardous Wastes that may be expected on a typical project are as per the EPA List of Wastes (LOW) codes outlined in the following table.

Table 2: EPA Hazardous & Non-Hazardous EPA LoW & associated codes

Description	EPA LoW Codes
HAZARDOUS WASTE	
Wastes from Wood processing and the production of panels and furniture, pulp, paper and cardboard	**03**
Wastes from wood preservation	**03 02**
Non-halogenated organic wood preservatives	03 02 01
Organ chlorinated wood preservatives	03 02 02
Organometallic wood preservatives	03 02 03
Inorganic wood preservatives	03 02 04
Other wood preservatives containing hazardous substances	03 02 05
Wood preservatives not otherwise specified	03 02 09
Oil Wastes and Wastes of Liquid Fuels	**13**
Wastes of Liquid Fuels	**13 07**
Fuel oil and diesel	13 07 01
Petrol	13 07 02
Other fuels (including mixtures)	13 07 03
Wastes not otherwise specified in the list	**16**
Wastes from electrical and electronic equipment	**16 02**
Transformers and capacitors containing PCBs	16 02 09
Discarded equipment containing chlorofluorocarbons, HCFC, HFC	16 02 11
Discarded equipment containing free asbestos	16 02 12
Discarded equipment other than those mentioned in 16 02 09 to 16 02 13	16 02 14
Hazardous components removed from discarded equipment	16 02 15
Batteries & Accumulators	**16 06**

Lead Batteries	16 06 01
Ni-Cd Batteries	16 06 02
Mercury-containing batteries	16 06 03
Alkaline batteries (except 16 06 03)	16 06 04
Other batteries and accumulators	16 06 05
Separately collected electrolyte from batteries and accumulators	16 06 06
Construction Wastes **(Including excavated soil from contaminated sites)**	**17**
Mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances	17 01 06
Glass, plastic and wood containing or contaminated with hazardous substances	17 02 04
Metals (including their alloys)	**17 04**
Metal Waste contaminated with hazardous substance	17 04 09
Cables containing oil, coal tar and other hazardous substance	17 04 10
Soil (including excavated soil from contaminated sites), stones and dredging spoil	**17 05**
Soil and stones containing hazardous substances	17 05 03
Insulation materials and asbestos containing construction materials	**17 06**
Insulation materials containing asbestos	17 06 01
Other insulation materials consisting of or containing hazardous substances	17 06 03
Construction materials containing asbestos	17 06 05
Gypsum-based construction material	**17 08**
Gypsum-based construction materials contaminated with hazardous substances	17 08 01
Other construction Wastes	**17 09**
Construction Wastes containing mercury	17 09 01
Construction Wastes containing PCBs	17 09 02
Construction Wastes containing dangerous substances	17 09 03

Municipal Wastes (Household Waste & Similar Commercial Waste, Industrial & Institutional Waste) including separately collected fractions	**20**
Fluorescent tubes and other mercury containing Waste	20 01 21
Paint, inks, adhesives and resins containing hazardous substances	20 01 22
NON-HAZARDOUS WASTE	
Construction Wastes **(including excavated soil from contaminated sites)**	**17**
Concrete, bricks tiles and ceramics	**17 01**
Concrete	17 01 01
Bricks	17 01 02
Tiles and ceramics	17 01 03
Wood, glass & plastic	**17 02**
Wood	17 02 01
Glass	17 02 02
Plastic	17 02 03
Bituminous mixtures, coal tar and tarred products	**17 03**
Bituminous mixtures containing coal tar	17 03 01
Coal tar and tarred products	17 03 03
Metals (including their alloys)	**17 04**
Copper, bronze, brass	17 04 01
Aluminium	17 04 02
Lead	17 04 03
Zinc	17 04 04
Iron and steel	17 04 05
Tin	17 04 06
Mixed metals	17 04 07

Municipal Wastes (Household Waste & Similar Commercial Waste, Industrial & Institutional Waste) including separately collected fractions	**20**
Separately collected fractions	**20 01**
Paper and cardboard	20 01 01
Glass	20 01 02
Biodegradable kitchen and canteen Waste	20 01 08
Textiles	20 01 11
Edible oil and fat	20 01 25

6.5.1.1 Invasive Species

An Invasive Species Survey will be required on the site prior to commencing the construction works.

6.5.2 Excavation Waste Management

A suite of ground investigations, refer to **Appendix A** of **the Engineering Infrastructure Design Report**, has been carried out on site which includes the following;

- Trial Pits & BRE365 soakaway tests
- Rotary Cores
- Ground Water monitoring
- Geotechnical Laboratory Testing
- Geo-environmental Testing

In summary,

- The underlying strata consists of predominately silty sandy gravelly CLAYS.

6.5.2.1 Landfill Disposal of Excavated Soils

Prior to commencement of the works on site, a RILTA Suite of Geo-Environmental Tests will be carried out and compared with the European limits for inert landfills as set out in the European Council Decision 2003/33/EC Establishing Criteria and Procedures for the Acceptance of Waste at Landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC. The results of the WAC analyses will determine compliance with the inert landfill limits as stipulated in the European Landfill Directive and the excavated soils will be classified prior to removal from site.

6.5.2.2 Estimated Excavation Waste Arising

Any potentially contaminated material encountered during construction, will require testing and classification as either non-hazardous or hazardous in accordance with the EPA publication entitled 'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous' 13 using the HazWasteOnline application. The material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the EC Council Decision 2003/33/EC. The Contractor will be responsible for determining how excavation material from the proposed development will be managed and a full list of all facilities to which hazardous and non-hazardous waste excavation soil and stones will be sent will be provided in the detailed CMP prepared by the Contractor.

The proposed development will require excavation for the following which is a non-exhaustive list:-

- Service trenches including stormwater, wastewater, water supply, SuDS features, ESB, etc.
- Foundations and ground floor slabs for buildings
- Boundary walls/treatments to surrounding properties

The re-use of clean, inert / non-hazardous excavation material as landscaping or engineering fill will also be considered following appropriate material testing and risk assessment to ensure the material is suitable for its proposed end use. Where excavation material may not be re-used within the proposed works the Contractor will endeavour to send material for recovery or recycling so far as is reasonably practicable or disposal to an appropriate licensed landfill in accordance with the Landfill Decretive. The above figures do not allow for bulking or for the additional dig required for temporary/construction slopes, services, utilities, etc.

6.5.2.3 Reuse

The reuse of excavated material must be certain. There must be no intention or requirement for it to be discarded. In addition, there must be no further processing required in order for it to be reused. Soil, rock and naturally occurring material excavated in the course of construction activities can be reused within the proposed development where feasible, subject to further testing to determine if materials meet the specific engineering standards for their proposed end-use. Where naturally occurring, material is used for the purpose of construction in its natural state within the proposed development this material is not deemed to be a Waste in accordance with Article 2 of the Waste Directive 2008/98/EC, the European Communities (Waste Directive) Regulations, 2011 and Section 3 of the Waste Management Act 1996, as amended. Where a certificate of registration, Waste facility permit or Waste licence is required by the Contractor in order to reuse excavation material within the proposed development this will be obtained from either the local authority or the EPA.

6.5.2.4 Article 27

Article 27 of the EC Waste Directive Regulations 2011 permits surplus excavation material to be declared as a by-product for use in one of more known construction projects. An Article 27 notification to the EPA under Article 27 of the EC Waste Directive Regulations 2011 is required to achieve by-product status for soil and stones. By-product notifications to the EPA provide an opportunity for reuse of surplus clean soil & stone material arising from construction activity which bring significant economic benefits while facilitating beneficial re-use of by-products. Prior to the commencement of construction, the CMP will be updated to reflect specific measures to minimise waste generation and resource consumption during construction, including providing details of proposed waste contractors and destinations of each waste stream while the CMP will be fully implemented during the proposed construction phase. This may include the importation/exportation of topsoil & sub soil while the Site Investigation (SI), Waste Acceptance Criteria Testing (WAC testing) and Soil Analysis will be used to classify and determine the suitability of soil. Furthermore, a layer of approx. 200mm of granular material, currently being used to facilitate the construction compound for the adjacent development, will need to be removed from site to facilitate the proposed development. Any soil (topsoil & sub soil) identified as 'contaminated' or not equivalent to virgin greenfield for by-product soil and stone, will be treated as waste and will be segregated on-site, stored in skips or other suitable receptacles in designated areas and will be removed from site to a suitable waste facility by a registered waste contractor. All waste leaving the site will be transported by suitably permitted contractors and taken to suitably registered, permitted or licenced facilities. Where soil and stone can be re-used as fill, and is considered to be a By-Product, it will be imported/ exported under notification of Article 27 to the EPA, in accordance with Article 27 of the EC (Waste Directive) Regulations (2011). EPA approval will be obtained prior to moving material as a By-Product. Finally, a log of all By-Product material movements will be recorded and maintained.

6.5.2.5 Licenced Waste Facilities

Where removal of Wastes from the proposed development is unavoidable it will be delivered by the Contractor to licensed Waste facilities which are authorised under the Waste Management Act 1996, as amended, and which hold the appropriate certificate of registration, Waste facility permit or EPA licence. Activity in relation to soil recovery facilities described in Class 5 Third Schedule, Part 1 of the Waste Management (Facility Permit and Registration) Regulations 2007, as amended, notes

> "*Recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert Waste, through deposition for the purposes of the*

improvement or development of land, where the total quantity of Waste recovered at the facility is less than 100,000 tonnes."

EPA licensed Waste activities authorised to accept soil and stones for recovery and disposal include soil recovery sites, landfills, transfer stations and materials recovery facilities which typically handle a larger tonnage of Wastes than facilities holding certificates of registration of Waste facility permits.

Where the Contractor proposes to deliver excavated materials from the proposed development to facilities holding a certificate of registration, Waste facility permit or EPA Waste licence the Contractor is responsible for ensuring the authorisation is valid and allows acceptance of the relevant List of Waste Code. A copy of the authorisation will be included in the CWMP and evidence will be provided that the proposed facility will have capacity to accept the required quantity of Waste from the proposed development.

6.5.3 Estimate of Construction Waste Arising

The Building Research Establishment (BRE) UK have produced benchmarks derived from data out of the BRE SMARTWaste Plan issued in June 2012 as outlined in the **Figure** below.

Project Type	Number of projects data relates to	Average $m^3/100m^2$	Number of projects data relates to	Average $m^3/£100K$
Residential	677	18.1	669	12.3
Public Buildings	49	20.9	55	10.7
Leisure	71	14.4	69	9.2
Industrial Buildings	54	13.0	55	10.8
Healthcare	86	19.1	85	9.1
Education	263	20.7	272	10.0
Commercial Other	4	17.4	2	9.7
Commercial Offices	60	19.8	56	9.3
Commercial Retail	123	20.9	122	15.0
Total number of projects	**1387**		**1385**	

Figure 9: BRE SMARTWaste benchmark data by project type

The table below is a breakdown of the quantities of Construction Waste which will be produced based on the BRE data outlined above.

Table 3: Quantities of Proposed Construction Waste

Type	Proposed Gross Developable Floor Area (m^2)	Average m^3/ 100m^2	Construction Waste (m^3)
Industrial Buildings	c. 23,673	13	3,077

Therefore, the total Waste from new buildings to be generated during the construction phase of the project is estimated at c. 3,077m^3. The Contractor will ensure that Waste generation on site is minimised and that Waste removed from site for recovery or disposal is reduced where feasible.

6.5.4 Sitewide Cut/Fill

The subject site has been designed in such a way that the sitewide cut and fill is balanced. In order to minimise the off-site waste / soil disposal, it is proposed to re-use the excavated material and lime-stabilize it where used under buildings or roads. In addition to this, it is proposed to have c. 10,000m^3 of selected structural stone/material imported for placement under roads and building platforms.

6.5.5 Construction Waste Management

The Contractor shall as a minimum implement the following measures to prevent Waste generation, facilitate Waste recycling and minimise Waste disposal during the construction phase:

6.5.5.1 Source Segregation

Metal, timber, glass and other recyclable material will be segregated and removed off site to a permitted/licensed facility for recycling. Waste stream colour coding and photographs will be used to facilitate segregation. Office and food Waste arising on site will be source separated at least into dry mixed recyclables, biodegradable residual Wastes. Paints, sealants and hazardous chemicals etc. will be stored in secure, bunded locations. All hazardous Waste will be separately stored in appropriate lockable containers prior to removal from site by an appropriate Waste collection holder. Waste bins, containers, skip containers and storage areas will be clearly labelled with Waste types which they should contain, including photographs as appropriate. The site will be maintained to prevent litter and regular litter picking will take place throughout the site.

6.5.5.2 Material Management

"Just in time" delivery will be used so far as is reasonably practicable to minimise material wastage. Waste generated on site will be removed as soon as practicable following generation for delivery to an authorised

Waste facility. The Contractor will ensure that any off-site interim storage facilities for excavated material have the appropriate Waste licences or Waste facility permits in place.

6.5.5.3 Further Detailed Development of the CWMP by the Contractor

The Contractor will be required to further develop and detail this CWMP prior to commencement of the proposed works and, as a minimum, include the following: -

- Details of the Contractor including the nominated project manager,
- names, roles, responsibilities and authority of key personnel involved in Waste management in the design team and on site,
- Estimates of Waste generation including the types and quantity of Wastes generated,
- Types and quantities of excavation material, if any,
- Measures to reduce Waste generation,
- The amounts of material intended to be stored temporarily on site and the location of such storage,
- Measures to prevent nuisances etc.,
- Authorised Waste hauliers with appropriate and up to date Waste Collection Permits,
- Recycling and disposal sites, including copies of permits/licences for Waste facilities,
- Any other relevant item during the works, which may be brought to the attention of the design team or the Contractor which should be reasonably addressed and inserted into the detailed Construction Waste management Plan.

The following procedures, as a minimum, should be included in the plan where relevant: -

- Control of Sub-Contracts, if applicable, which must include the assessment of the sub-Contractor's Waste management policies and control capabilities, and the identification and implementation of additional controls needed on such Sub-Contractors to fulfil the design teams and Contractor's obligations in respect of Waste management,
- Waste management including liaison with third parties, statutory bodies, Waste hauliers, Waste disposal facilities and other companies,
- Excavation and handling of Waste materials to prevent nuisance,
- Segregation and proper storage of materials on site to facilitate reuse and recycling,
- Management of any hazardous or contaminated Waste,
- Control of all documentation relating to the handling, transportation and disposal of Waste,
- Management review/audits to monitor and demonstrate control over the implementation of the detailed Construction Waste Management Plan.

6.6 Collection of Construction Waste

Waste from Construction will be transported by authorised Waste collectors in accordance with the Waste Management (Collection Permit) Regulations 2007, as amended. An up-to-date list of all Waste collectors used to transport Waste from site during the proposed development will be maintained on site and updated by the Contractor and be similar to the sample Waste Collection Permit table below. The Contractor shall hold valid Waste collection permits on site.

Table 4: Sample Waste Collection Permit Table (*form is left blank intentionally*)

Name of Authorised Waste Collector	Company Address	National Waste Collection Permit Number	Waste Types Collected (Text Description)	Waste Types Collected (EPA LoW Codes)

6.7 Offsite Disposal of Construction Waste

Waste from Construction will be delivered to authorised Waste facilities in accordance with the Waste Management Act 1996, as amended. The Contractor shall maintain an up-to-date list, similar to the sample Table below, of all Waste facilities to which Waste from the site will be delivered and copies of valid appropriate facility Certificates of Registration, Waste Facility Permits and Waste Licences.

Table 5: Sample Authorised Waste Facilities (*form is left blank intentionally*)

Name of Authorised Waste Facility	Waste Facility Address	Number of Waste Licence/ Waste Permit/ Certificate of Registration	Regulatory Authority	Waste Types to be delivered (Text Description)	Waste Types to be delivered (EPA LoW Coes

6.8 Construction Waste Management Costs

As required by the Department of the Environment, Heritage and Local Government Best Practice Guidelines on the Preparation of Waste Management Plans for Construction Projects this section addresses costs of Waste management. The total cost of implementation of the CWMP will be measured by the Contractor and will take into account handling costs, storage costs, transportation costs, revenue from rebates and disposal costs.

6.8.1 Reuse/ Recovery

By reusing materials on site, there will be a reduction in the transport and disposal costs associated with the requirement for a Waste Contractor to take the material away to landfill. Clean and inert soils, gravel, stones etc. which cannot be reused on site may be classified as a by-product (under Article 27 of the 2011 Waste Directive Regulations), used as capping material for landfill sites, or for the reinstatement of quarries etc. subject to approvals by EPA. This material is often taken free of charge for such purposes, or when used as capping in landfills will not attract the landfill tax levy, thereby reducing final Waste disposal costs.

6.8.2 Recycling

Salvageable metals will earn a rebate which can be offset against the cost of collection and transportation of the skips. Clean, uncontaminated cardboard and certain hard plastics can be recycled. Waste Contractors will charge considerably less to take segregated Wastes such as recyclable Waste from a site than mixed Waste. Timber can be recycled as chipboard. Again, Waste Contractors will charge considerably less to take segregated Wastes, such as timber from a site than mixed Waste.

6.8.3 Disposal

Landfill charges are currently at approximately €160/tonne (includes a €75 per tonne landfill levy introduced under the Waste Management (Landfill Levy) (Amendment) Regulations 2012) for non-hazardous Waste and €25/tonne for inert Waste. In addition to disposal costs, Waste Contractors will also charge a collection fee for skips. Collection of segregated C&D Waste usually costs less than municipal Waste. Specific C&D Waste Contractors take the Waste off-site to a licensed or permitted facility and, where possible, remove salvageable items from the Waste stream before disposing of the remainder to landfill. Clean soil, rubble, etc. is also used as fill/capping material wherever possible.

6.9 CMWP Auditing

The Contractor's CWMP shall carry out regular Waste Audits in accordance with the Contractors Project Specific Waste Audit Plan which shall be a systematic study of the Waste management practices applied in the project to highlight the problems that Waste can cause and the benefits of prevention and minimisation. The CWMP's Audits shall allow the Contractor to monitor the quantity and type of Waste produced by different Sub-Contractors and identify opportunities for Waste reduction throughout each stage of the project. The Audit should identify details of raw material inputs and the quantity, type and composition of all Waste form the site. The Contractor will record the quantity in tonnes and types of Waste and materials leaving the site during the works. The name, address and authorisation details of all facilities and locations to which Waste and materials are delivered will be recorded along with the quantity of Waste in tonnes delivered to each facility. Records will show material which is recovered and disposed of. The Audit shall highlight corrective actions that may be taken in relation to management policies or site practice in order to bring about further Waste reductions which shall be supplemented with a tracking system to determine the success or failure of the corrective actions. Finally, summary audit reports outlining types, quantities of Waste arising's and their final treatment method should be sent to the relevant Authority for their information.

6.10 References

- Department of the Environment, Heritage and Local Government (DoEHLG), 2006a. Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects (latest edition)
- Environmental Protection Agency (EPA), 2017. Construction and Demolition Waste Statistics for Ireland. Latest Reference Year: 2014
- EPA, 2016. Ireland's Environment 2016 – An Assessment. EPA, Wexford, Ireland
- EPA, 2015. Waste Classification, List of Waste & Determining if Waste is Hazardous or Non-hazardous.
- EPA, 2014. National Waste Report 2012. EPA, Wexford, Ireland

PURSER

Volume 3:

Appendix 7.2

COMAH Land Use Planning Assessment of Anaerobic Digester Plant (Ref: 247501.0417RR01a) dated 28 February 2025

awnconsulting

The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Ireland.

T: + 353 1 847 4220
F: + 353 1 847 4257
E: info@awnconsulting.com
W: www.awnconsulting.com

COMAH LAND USE PLANNING ASSESSMENT OF ANAEROBIC DIGESTER PLANT, LISHEEN, CO. TIPPERARY

Technical Report Prepared For

Purser

Technical Report Prepared By

Matthew Michie, Senior Risk Consultant

Our Reference

247501.0417RR01a

Date of Issue

8th January 2025

Dublin Office
The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Ireland.
T: + 353 1 847 4220
F: + 353 1 847 4257

AWN Consulting Limited
Registered in Ireland No. 319812
Directors: F Callaghan, C Dilworth,
T Donnelly, T Hayes, D Kelly, E Porter

Document History

Document Reference		Original Issue Date	
247501.0417RR01a		25th October 2024	
Revision Level	Revision Date	Description	Sections Affected
a	8th January 2025	Updated in response to comments from Health and Safety Authority	All

Record of Approval

Details	Written by	Approved by
Signature		
Name	Matthew Michie	Maeve McKenna
Title	Senior Risk Consultant	Associate
Date	8th January 2025	8th January 2025

EXECUTIVE SUMMARY

AWN Consulting Ltd. were requested by Purser, on behalf of Nua Bioenergy Limited, to complete a land use planning assessment for a proposed Anaerobic Digester facility located at Lisheen Mine, Co. Tipperary.

The proposed development will be classified as a “lower tier” COMAH establishment and as such will be subject to the provisions of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, S.I. No. 209 of 2015.

The Land Use Planning assessment was completed in accordance with guidance published by the HSA (HSA, 2023). The following major accident scenarios were assessed:

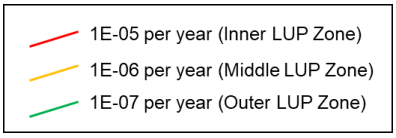
Installation	LOC scenario	Consequence/Event
Indoor equipment (Energy Centre)	Instantaneous failure	VCE
	Continuous leak over 10 minutes	VCE
	10 mm pipe leak over 10 minutes	VCE
Indoor equipment (Compressor)	Instantaneous failure	VCE
	Continuous leak over 10 minutes	VCE
	10 mm pipe leak over 10 minutes	VCE
Indoor equipment (Bay Trailer)	Instantaneous failure	VCE
	Loss of entire contents	VCE
Biogas Pipeline	Rupture of Pipeline	Fireball/Jet fire
		VCE
		Flash fire
	Pipeline Leak of 0.1D	Fireball/Jet fire
		VCE
		Flash fire
Anaerobic Digester Tanks	Instantaneous Failure	Fireball
		VCE
		Flash fire
	Continuous Leak over 10 minutes	Jet fire
		VCE
		Flash fire
		Pool fire
Bay Trailer Refilling	Rupture of unloading hose	Jet fire
		VCE
		Flash fire
	Leak of unloading hose of 10% of diameter	Jet fire
		VCE
		Flash fire

Major Accidents to the Environment

There are no substances stored on site that have environmental hazard phrases. Therefore, a major accident to the environment is not considered in the study.

Land Use Planning Contours

The Figure below illustrates individual risk of fatality contours based on a hypothetical residential population, outdoors for 10% of the time and indoors in buildings of CIA Category 3 overpressure vulnerability (typical residential dwelling) for 90% of the time.

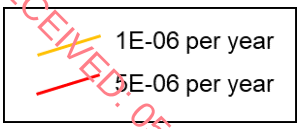


Land Use Planning Risk-based Contours

The following is concluded for the individual risk arising from the proposed development:

- The individual risk contours corresponding to the inner, middle and outer zone extends over the proposed development boundary. There are no occupied buildings in these areas.
- The land use planning contours do not extend to the nearest residential development and do not extend to the Irish Bioeconomy and Acorn Recycling Building.
- The individual risk contour corresponding to the outer zone extends to the Substation Access road. Personnel are only present at the Substation for routine maintenance; therefore, this road is not commonly used. Therefore, the level of individual risk at this location is acceptable.

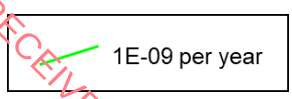
The Figure below illustrates location based individual risk contours for new COMAH establishments based on a hypothetical residential population, outdoors for 10% of the time and indoors in buildings of CIA Category 3 overpressure vulnerability (typical residential dwelling) for 90% of the time.



Individual Location-Based Risk Contours for New Establishments

It is concluded that the individual location-based risk contours do not extend to an off-site work location or to an area where the public are present. It is also concluded that the Land Use Planning zones do not extend to sensitive receptors. Therefore, it is concluded that the criteria in Table 1 of the *Guidance on Technical Land Use Planning advice (HSA, 2023)* is met and level of off-site risk at the proposed development is acceptable.

The Figure below illustrates the individual risk contour corresponding to 1E-09 per year (1 in-a-billion). This is the level of individual risk the HSA have requested for new establishments as a proposed consultation distance.



Proposed Consultation Distance

CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

AWN Consulting Ltd. was requested by Purser Development Consultants Ltd., on behalf of Nua Bioenergy Limited, to complete a COMAH Land Use Planning assessment for a proposed Anaerobic Digester facility located at Lisheen Mine, Co. Tipperary.

The proposed development will be classified as a “lower tier” COMAH establishment and as such will be subject to the provisions of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, S.I. No. 209 of 2015.

This report identifies risk based land use planning contours for the proposed development. The individual risk contours are based on consequence assessment and risk modelling of major accident scenarios identified for the proposed development and the assessment has been completed in accordance with the Health and Safety Authority’s *Guidance on technical land-use planning advice for planning authorities and COMAH establishment operators* (HSA, 2023)

This report details the following:

- Description of development
- Background to risk assessment and land use planning context
- Land Use Planning assessment methodology and criteria
- Identification of Major Accident Hazards
- Land Use Planning Assessment of Major Accident Scenarios
- Land Use Planning Contours
- Societal Risk Assessment
- Conclusions

2.0 DESCRIPTION OF DEVELOPMENT

2.1 Site Description

2.1.1 Overview of Operations

The proposed development will take in manure / slurry, whole crop, belly grass, and other organic material and use this to produce renewable biomethane (a direct replacement for fossil fuel natural gas), thereby improving the carbon intensity of gas used for everyday domestic and industrial processes around the country. The proposed development will also produce high quality biobased fertiliser (the digestate which is an output of the anaerobic digestion process).

The location and layout of the proposed development is illustrated on Figure 1.

The proposed development will consist of the construction of an anaerobic digestion plant comprising:

- 4 No. primary digestor tanks
- 3 No. secondary digestor tank (gas domes)
- 4 No. feed hoppers
- 4 No. technical rooms
- 2 No. biogas conditioning units
- 1 No. buffer digestate storage tank
- 1 No. suspension buffer tank
- 1 No. site dirty water storage tank
- 1 No. separated digestate liquids buffer storage tank
- 1 No. roofed liquids feed-mix tank
- 1 No. treated digestate liquids recycle storage tank

The proposed development will also consist of:

- Feedstock storage (comprising 3 No. storage clamps and 2 No. storage sheds)
- Biomethane upgrading plant
- Biomethane loading facility (comprising a 4 No. bay gated trailer areas)
- 2 No. CO_2 tanks and CO_2 auxiliaries,
- CO_2 liqueufactor, a CO_2 compressor, pre-treatment skid, backup boiler
- Biogas compression unit (separate building)
- Single storey energy building including Combined Heat and Power (CHP) plant
- 1 No. biogas pipeline (above ground), *ca.* 100m long, from the digestor tanks to the energy building
- 1 No. biogas pipeline (above ground), *ca.* 88m long, from the digestor tanks to the biogas upgrading facility
- Biofertilizer processing plant and storage (comprising dewatering plant, pasteurisation unit, a single storey shed and associated biofertilizer loading facilities
- Single storey office building (including offices, meeting room, control room, welfare facilities, storeroom and a first-aid facility)
- Vehicular, cyclist and pedestrian access / egress and associated circulation routes

- 9 No. car parking spaces (including 1 No. accessible car parking space); electric vehicle (EV) charging infrastructure;
- 1 No. ESB sub-station; roof-mounted solar photovoltaic (PV) panels
- 2 No. weighbridges
- Vehicle steam wash area
- An emergency biomethane flare
- Lagoon and attenuation pond
- Boundary treatments [including gates, piers and fencing]

The control building, which oversees operations, is centrally located for optimal site management (see Figure 1). The facility will operate 24 hours per day, 7 days a week, as Anaerobic Digestion is a continuous biological process. However, feedstock will only be accepted between the hours of 07:00 and 19:00 Monday to Friday, and 07:00 to 16:00 on Saturday.

2.1.2 Anaerobic Digestion

Anaerobic Digestion (AD) is a natural biological decomposition process which takes place in an oxygen-free environment, where micro-organisms (bacteria and archaea) break down organic matter. There are four main stages to this process:

- Hydrolysis - large, complex polymers like carbohydrates, cellulose, proteins, and fats are broken down by hydrolytic enzymes into soluble monomers i.e., amino acids from proteins, long chain fatty acids from lipids, and simple sugars from complex carbohydrates.
- Acidogenesis – these soluble monomers are further broken down into short chain volatile fatty acids (VFAs), alcohols, carbon dioxide and hydrogen.
- Acetogenesis - the products of acidogenesis are broken down into acetate, releasing hydrogen and carbon dioxide.
- Methanogenesis – In this final stage of AD, various groups of methanogenic bacteria consume acetate, hydrogen and carbon dioxide and convert these intermediate products into methane.

2.1.3 Biogas

Biogas is the product of this complex biological decomposition of organic materials, mainly consisting of 55-70% by volume methane (CH_4), 30-45% carbon dioxide (CO_2), together with traces of other gases, i.e., nitrogen (N_2), hydrogen (H_2), hydrogen sulphide (H_2S), ammonia (NH_3), as well as water vapour. The target concentration of biogas at the proposed facility is 57%.

Biogas can be 'upgraded' to pure methane, often called biomethane, by removing CO_2, H_2S, moisture and other trace gases. The biogas upgrading process produces a purified stream of biomethane. The proposed development will export the purified biomethane in Bay Trailers, there will be no direct injection to the national grid.

The Biomethane loading facility has the capacity to have 4 No. bay gated trailers; however, a maximum of 2 No. trailers will contain biogas at any one time. Each trailer will contain 114 No. 0.35 m^3 cylinders and a total mass of 8.45 tonnes per trailer and the biogas will be stored at ambient temperature and at 250 barg.

There will be 4 No. primary digesters, each with a 3,300 m^3 capacity and 3 No. secondary digesters, each with a 5,420 m^3 capacity.

The primary digesters will contain mostly organic material (substrate), and the gas produced will be immediately transferred to the gas domes within the secondary digesters. The gas domes have a capacity of 1,900 m^3. There will be a gas dome within each of the digesters; therefore, a total of 5,700 m^3 of biogas can be stored in the digesters. The density of the biogas, at 43% CO_2 and 57% CH_4, will be 1.259 kg/m^3.[1] This equates to 2.33 tonnes per secondary digester and a total of 6.98 tonnes of biogas at the facility.

There could be up to 500 mm of head space at the top of the primary digesters. The tank radius of the primary digesters is 11.5m. This equates to 207.7 m^3 of biogas per primary digester or 0.254 tonnes. Therefore, there could be up to 1 tonne of biogas in the head spaces of all of the primary digesters.

2.1.4 Bay Trailer Filling

The Bay Trailer filling area is a concrete surfaced area where 4 No. bay trailer filling trucks will be able to fill up to transport Biogas off-site. There will be up to 2 No. bay trailers on-site that could contain upgraded biogas. Each bay trailer will contain 114 No. 0.35 m^3 cylinders at *ca.* 250 bar(g).

The area will be equipped with the following:

- hoses;
- connections for the bay trailer filling for the bay trailer transport trucks; and
- various instruments to monitor the pressure and safety of the dispenser.

Bay trailer filling will be carried out by trained personnel only and a Standard Operating Procedure (SOP) will be followed.

[1] 57% CH_4 with a density of 0.657 kg/Nm³ plus 43% CO_2 with a density of 1.977 kg/Nm³ gives a total density of (0.57*0.717 + 0.43*1.977) kg/Nm³ = 1.2246 kg/Nm³. This value has been updated from the original Land Use Planning submission (ref. 247501.0417RR01) as more accurate information was available on the composition of the biogas.

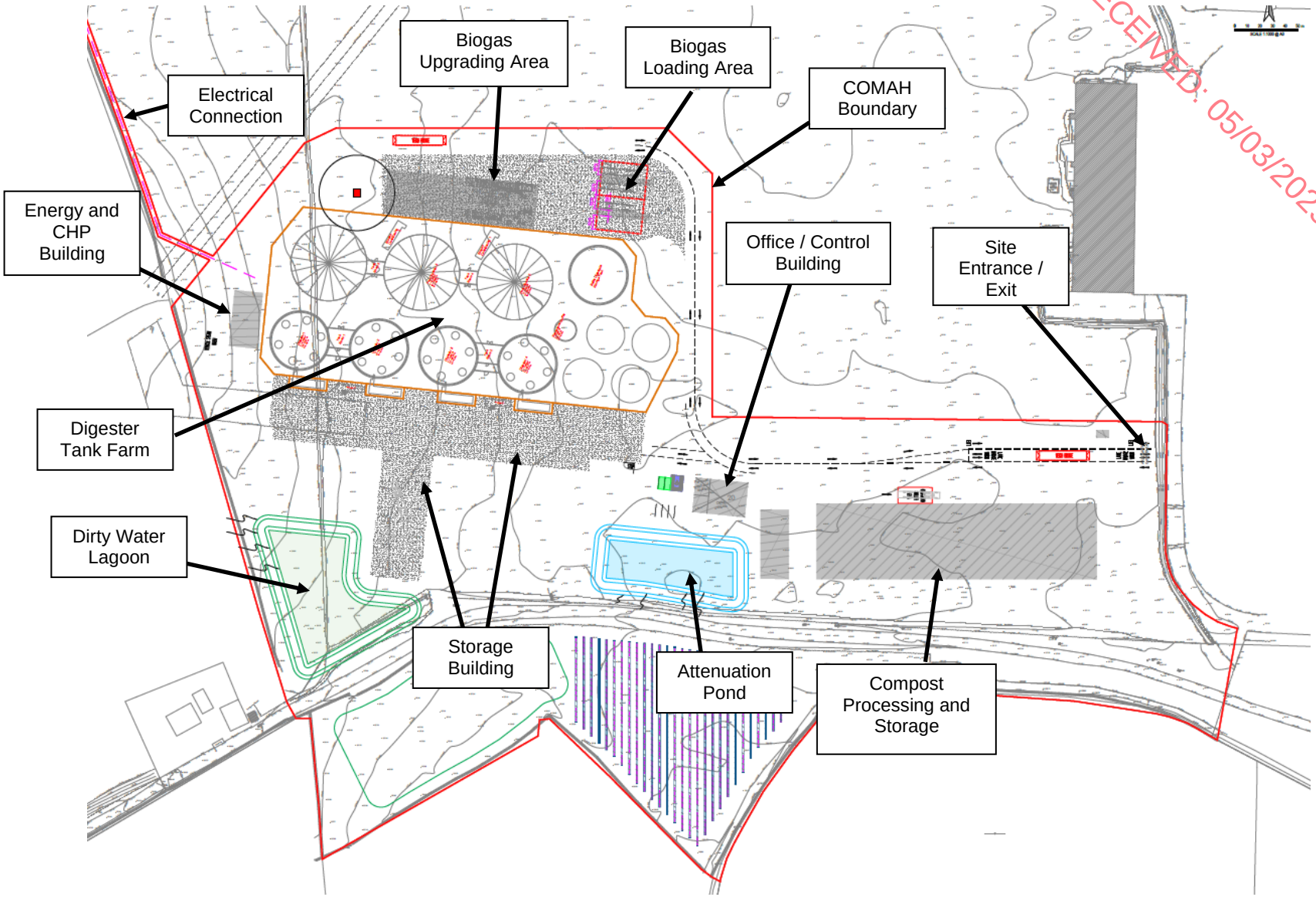


Figure 1 Proposed Development COMAH Boundary (red line) and Site Layout

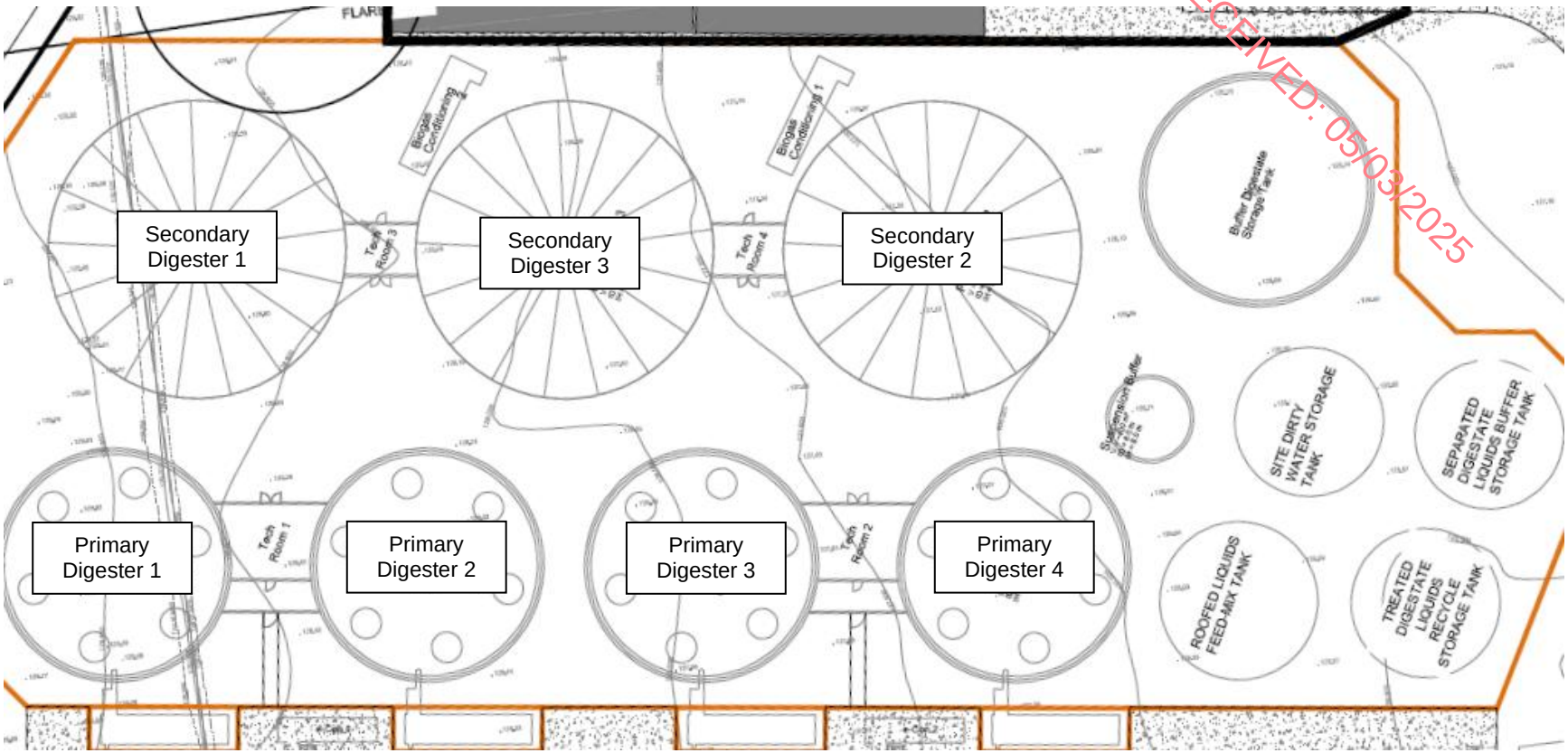


Figure 2 Digester Tank Farm Layout

2.2 Surrounding Area

The site of the proposed development is within a rural area and is surrounded by agricultural land. The proposed development is located in Lisheen Mine. The overall character of the surrounding area is a low density population and rural in nature and can be described as a 'brownfield' and the land in the immediate vicinity of the proposed development is zoned for industrial use.

To the north of the proposed development is an unmanned Wind Farm. To the northeast of the proposed development is an unmanned Substation. To the east of the proposed development is the Irish Bioeconomy Foundation and Acorn Recycling Building, this building is occupied by up to 31 No. employees and is *ca.* 190m from the proposed development COMAH boundary. To the west of the proposed site are residential developments, the closest residential development is *ca.* 300m from the proposed development COMAH boundary.

A planning search was conducted to determine existing and consented off-site receptors.

Table 1 details the consented projects with 500m of the vicinity of the proposed development.

Figure 3 illustrates the existing off-site receptors in the immediate vicinity of the proposed development and Figure 4 illustrates the existing developments and consented projects in the vicinity of the proposed development.

Figure 4 Reference	Project Name	Planning Reference	Project Description
1	Acorn Recycling Workshop and Truck Washout	Tipperary Co. Co. Reg. Ref. 2360281	Permission for development consisting of Workshop Building (1242 sq m), Truck Washout Building (64 sq m), commercial yard area, new boundary fence and entrance gates, an on-site Wastewater Treatment System and associated polishing filter bed percolation area, attenuation tank, bored well & water storage tank, rainwater harvesting tank, emergency storage tank, solar panels to roof of existing building and all associated siteworks.
2	Irish Bioeconomy Foundation Research and Development Unit	Tipperary Co. Co. Reg. Ref. 211171	Permission for the Change of use of the former Lisheen Mine maintenance depot to an agri-food sector Research and Development Unit for light industrial use with ancillary office space. The permitted development includes demolition of the existing loading bay canopy, Extension of the existing first floor accommodation by 169 sqm, Construction of an external stair to the rear, additional windows to the front and rear elevations with an external perforated printed mesh screen fixed to the front and south gable elevation, canopy over the front entrance door and an array of PV Panels fixed to the roof, Landscape works including a waste water treatment plant and car parking with 4 no. electric vehicle chargers.
3	Glanbia Biorefinery (1)	Tipperary Co. Co. Reg. Ref. 18601296	A 10-year planning permission for a biorefinery facility comprising of a process building with processing areas, plant rooms, stores, personnel & administrative areas; external bunded process & storage areas; vessels and tanks; CHP plant; an effluent & water treatment plant which includes bunded tanks & a building; sewage treatment plant; water storage tanks & site development works including demolition of an existing electrical building, roads, paved areas, parking areas, drains and services, bore well, lighting, fire water retention tank, attenuation pond, site fencing, alterations to the discharge pipeline from the sewage treatment plant, weighbridges & weighbridge office, connection to an existing outfall pipeline and landscaping works. The application is accompanied by an Environmental Impact Assessment Report. This application relates to development which comprises or is for the purpose of an activity requiring an Integrated Pollution Prevention and Control License.
4	Glanbia Biorefinery (2) (Modifications to	Tipperary Co. Co. Reg. Ref. 20129	A 10-year planning permission for modifications to Condition No. 1 of previously granted planning permission Ref. No. 18/601296. The modifications comprise an outfall drain and associated pumping station and monitoring chambers to discharge surface water and treated wastewater from the Biorefinery site through

Figure 4 Reference	Project Name	Planning Reference	Project Description
	Biorefinery permitted under Application Reg. Ref. 18601296)		the townlands of Cooleeny and Derryfadda to the Drish River; a water supply pumphouse and associated site works including access road and security fencing in the townland of Derryville and a water supply pipeline from the pumphouse to the Biorefinery facility site. A Natura Impact Statement (NIS) will accompany the application. This application relates to development which comprises or is for the purpose of an activity requiring an Industrial Emissions License.
5	Soleirtricity Solar PV Farm	Tipperary Co. Co. Reg. Ref. 211128	Permission for a Solar PV development with a maximum export capacity (MEC) of up to 122MW comprising of ca. 214,800 no. photovoltaic panels laid out in arrays, the construction of a 38kV substation, (ca.57.31m2 x 4.45m tall) along with associated ancillary development including 30 no. Transformer Stations (ca. 7.27m2 x 2.6m) with an integrated bund, 716 string Inverters, 1 no. DNO Substation Building (16.28m2 x 5.42m), 1 No. Storage and maintenance building (ca. 57.31m2 x 4.45m tall), 38 no. CCTV cameras mounted on ca. 3.8m high poles, perimeter security fencing and all ancillary works, the total development area will be ca. 77ha.
6	Revive Environmental	Tipperary Co. Co. Reg. Ref. 21709	Permission for a light industrial building consisting of a mechanical assembly workshop including an administration block and all associated site works at Cooleeny, Moyne, Thurles, Co. Tipperary. Permission includes for a building (3657 sq m) with a car park and access road, commercial yard area and access road, truck prep building (110 sq m), 2 m high boundary architectural fence, signage, public lighting, solar panels to the building roof, an on-site waste water treatment system and associated polishing filter bed percolation area, rainwater harvesting tank, emergency storage tank, attenuation tank, bored well and all associated site works - application is accompanied by a Natura Impact Statement (NIS)

Table 1 Consented Projects in Vicinity of Proposed Development

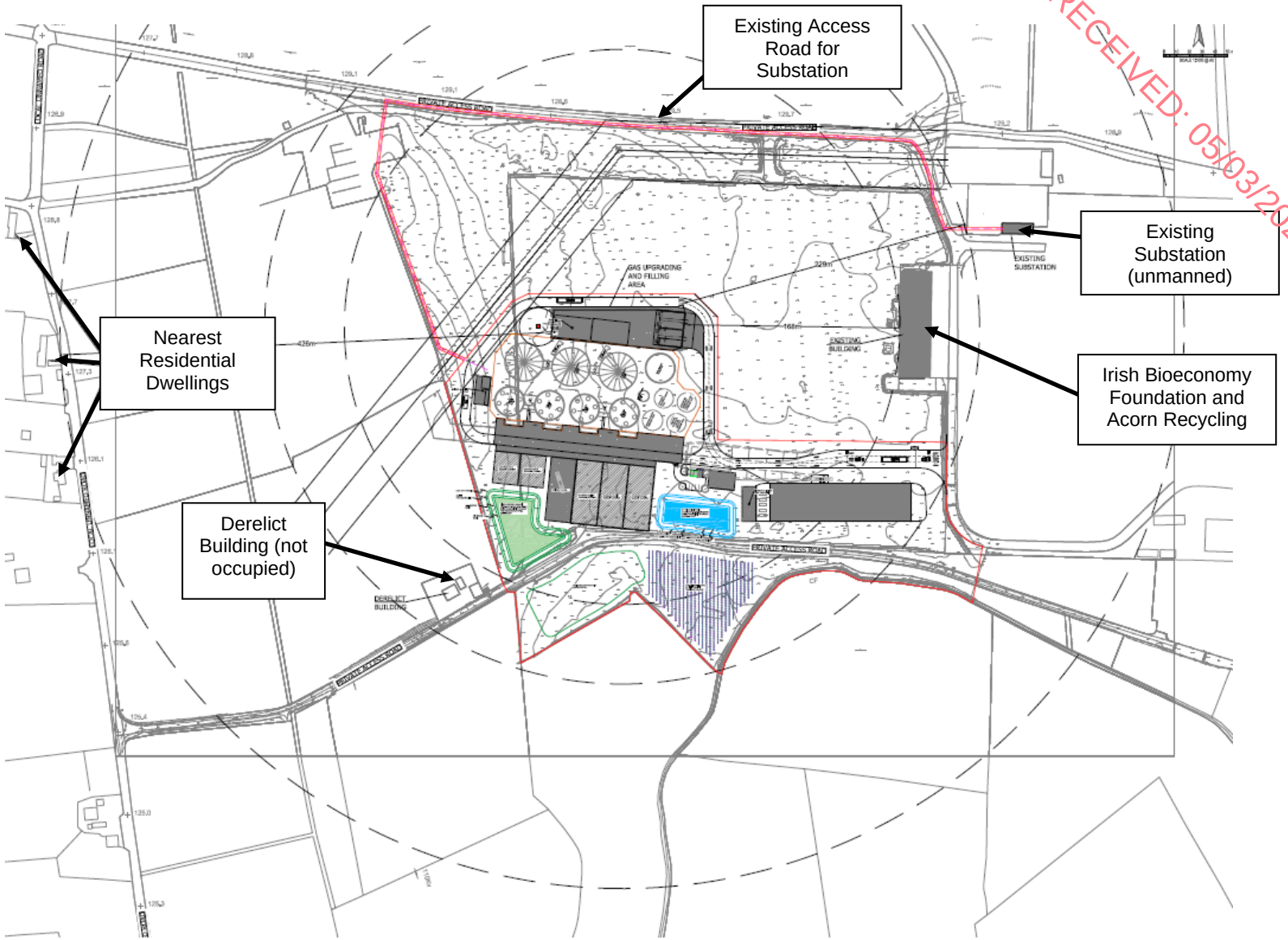


Figure 3 *Proposed Development Immediate Surrounding Environment*

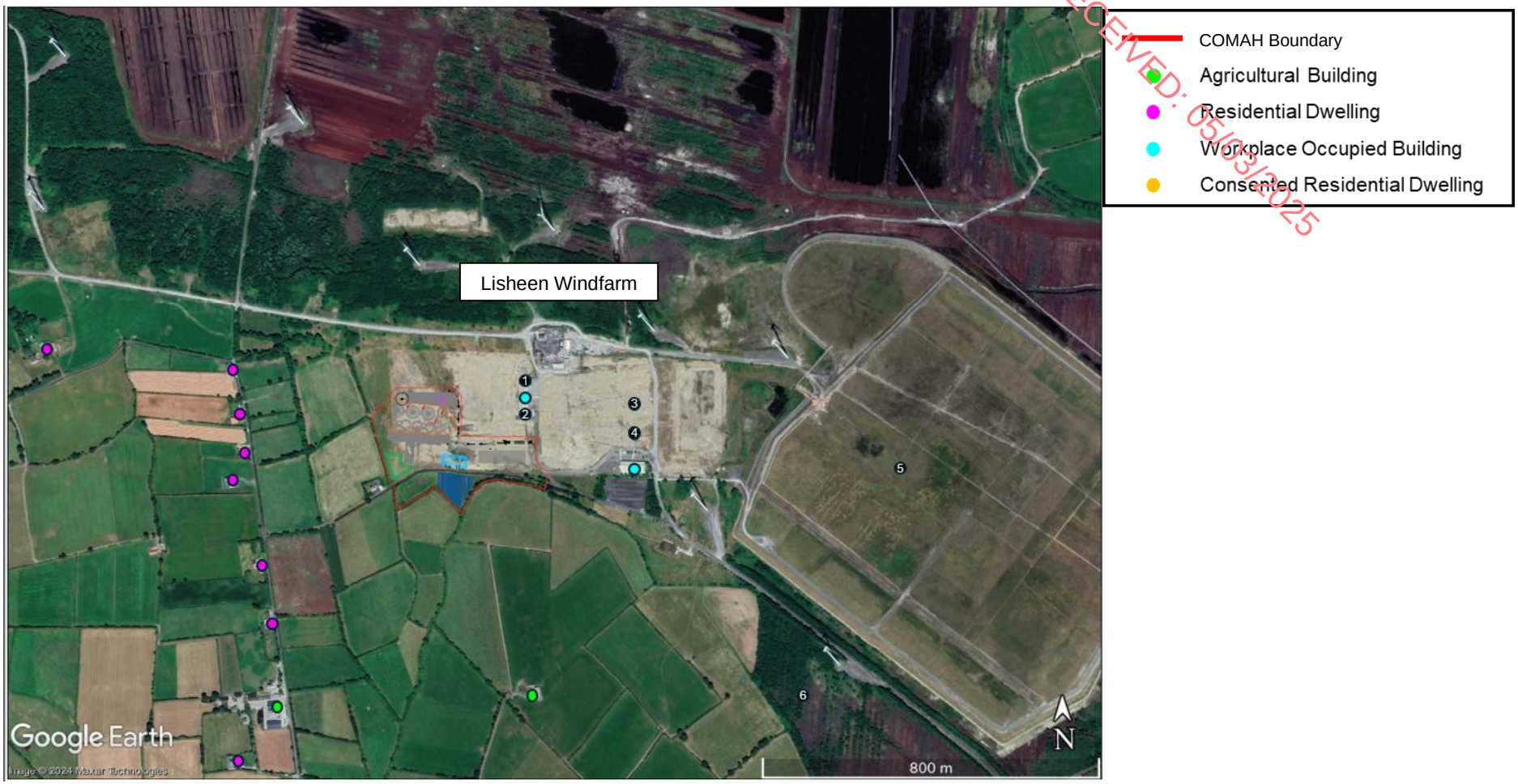


Figure 4 *Site Location and Surrounding Establishments Existing and Consented*

2.3 Surface Water Drainage

The subject site has been subdivided into 2 overall catchment areas for attenuation purposes. These catchment areas define the site as:

- Surface water runoff originating from all areas not directly relating to the biomethane process (Non-Process Area Runoff) such as roofs and entrance roads and,
- Surface water runoff originating from areas directly relating to the biomethane production process (Process Area Runoff), such as the bund, yard areas and certain internal roads used by process equipment might consist of excess material.

The Process Area Runoff Runoff will be kept completely separate and routed by a network of underground pipes to a separate above-ground storage lagoon. The runoff will be recirculated into the process to be reused. There is no outfall required for this surface water catchment.

The Non-Process Area Runoff is proposed to be kept separate and attenuated within its own aboveground attenuation basin. The non-process surface water system has been designed for 1 in a 100-year flood event plus 20% for climate change.

2.4 COMAH Status

Schedule 1 to the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I.209 of 2015) (COMAH Regulations 2015) describes the application of the regulations. Part 2 of Schedule 1 specifies the qualifying quantities of named dangerous substances to which lower tier status and upper tier status apply.

Dangerous substance	**COMAH Classification**	**Maximum Quantity, q** tonnes	**Q1 Lower tier threshold** (Column 2, Part 1, Schedule 1, S.I. 209 of 2015) (tonnes)	**Q2 Upper tier threshold** (Column 3, Part 1, Schedule 1, S.I. 209 of 2015) (tonnes)	**q/Q1 Fraction of Lower tier threshold**	**q/Q2 Fraction of Upper tier threshold**
Named Substances						
Natural Gas (Upgraded Biogas)	P2	16.9	50	200	0.338	0.0845
Category P2 Flammable Gases						
Untreated Biogas	P2	8.00	10	50	0.8	0.16

Table 2 Application of COMAH Regulations[2]

Table 3 details the COMAH status calculation.

[2]The quantities in this table has been updated from the previous Land Use Planning submission (ref. 247501.0417RR01) to reflect that a maximum of 2 No. Trailers (previously 4 No. trailers) could be used at any one time (see Section 2.1.3). The values in this table have also been updated to reflect the changes to the biogas density.

Group	COMAH Categories	Lower Tier Fraction	Upper Tier Fraction
H (Health)	Part 1: H1, H2, H3 and Part 2: Acute Category 1, 2 or 3 (inhalation route), STOT SE Category 1	0	0
P (Physical)	Part 1: P1 to P8 and Part 2: Explosives, flammable gases, flammable aerosols, oxidising gases, flammable liquids, self-reactive substances and mixtures, organic peroxides, pyrophoric liquids and solids, oxidising liquids and solids	1.138	0.245
E (Environment)	Part 1: E1 and E2 and Part 2: hazardous to the aquatic environment acute category 1, chronic category 1 or chronic category 2	0	0

Table 3 Calculation of COMAH Status at the Proposed Development

The proposed development will store hazardous substances in excess of the Lower Tier threshold; therefore, the site will be classified as a Lower Tier Seveso facility.

3.0 ASSESSMENT METHODOLOGY AND CRITERIA

3.1 Risk Assessment – An Introduction

The Centre for Chemical Process Safety (CCPS) has defined risk as (CCPS 2000): "Risk is a measure of human injury, environmental damage, or economic loss in terms of both the incident likelihood and the magnitude of the loss or injury."

Risk is a function of the consequences of an undesired event and how likely it is to occur. It is often expressed as the product of the likelihood and the consequences:

Risk = consequence x likelihood

In this form, risk has the units of losses per year.

Risk assessment in the chemical process sector seeks answers to the following questions:

- What are the hazards?
- What can go wrong (scenario)?
- How severe could it be (consequence)?
- How likely is it to happen (frequency)?
- How do consequence and frequency combine (risk)?
- Is the current level of risk tolerable, considering existing safeguards?
- If not, what needs to be done to reduce and manage the risk?

Risk assessment may be qualitative, semi-quantitative or quantitative, with the level of detail and analysis increasing from qualitative through to quantitative approaches. For COMAH establishments, the HSA Safety Report Assessment Guidelines (HSA, 2017) indicate that the depth of analysis should be proportionate to:

- the scale and nature of the major accident hazards presented by the establishment.
- the risk posed to neighbouring populations and the environment.

3.2 Land Use Planning and Risk Assessment

This land use planning assessment has been carried out in accordance with the HSA's Guidance on technical land-use planning advice (HSA, 2023). This approach involves delineating three zones for land use planning guidance purposes, based on the potential risk of fatality from major accident scenarios resulting in damaging levels of thermal radiation (e.g., from pool fires), overpressure (e.g., from vapour cloud explosions) and toxic gas concentrations (e.g., from an uncontrolled toxic gas release).

The HSA has defined the boundaries of the Inner, Middle and Outer Land Use Planning (LUP) zones as:

1E-05/year	Risk of fatality for Inner Zone (Zone 1) boundary
1E-06/year	Risk of fatality for Middle Zone (Zone 2) boundary
1E-07/year	Risk of fatality for Outer Zone (Zone 3) boundary

The process for determining the distances to the boundaries of the inner, middle and outer zones is outlined as follows:

- Determine the consequences of major accident scenarios using the modelling methodologies described in the HSA's Guidance on technical land-use planning advice (HSA, 2023).
- Determine the severity (probability of fatality) using the Probit functions specified by the HSA.
- Determine the frequency of the accident (probability of event) using data specified by the HSA.
- Determine the individual risk of fatality as follows:

Risk = Frequency x Severity ***(Equation 1)***

The HSA's Guidance on technical land-use planning advice (HSA, 2023) provides guidance on the type of development appropriate to the inner, middle and outer LUP zones. The methodology sets four levels of sensitivity, with sensitivity increasing from 1 to 4, to describe the development types in the vicinity of a COMAH establishment.

The Sensitivity Levels used in the Land Use Planning Methodology are based on a rationale which allows progressively more severe restrictions to be imposed as the sensitivity of the proposed scheme increases. The sensitivity levels are:

Level 1	Based on normal working population;
Level 2	Based on the general public – at home and involved in normal activities;
Level 3	Based on vulnerable members of the public (children, those with mobility difficulties or those unable to recognise physical danger); and
Level 4	Large examples of Level 3 and large outdoor examples of Level 2 and Institutional Accommodation.

Table 4 details the matrix that is used by the HSA to advise on suitable development for technical LUP purposes:

Level of Sensitivity	Inner Zone (Zone 1)	Middle Zone (Zone 2)	Outer Zone (Zone 3)
Level 1	✓	✓	✓
Level 2	✗	✓	✓
Level 3	✗	✗	✓
Level 4	✗	✗	✗

Table 4 LUP Matrix

3.3 Individual Risk Criteria for New COMAH Establishments

In relation to new establishments, the HSA's Guidance on technical land-use planning advice (HSA, 2023) states that it will be necessary for them to demonstrate that they do not present a risk of fatality greater than 5E-06 (per year) to a person at an off-site work location or a risk of fatality greater than 1E-06 (per year) to a member of the public.

3.4 Environment and Land Use Planning

The HSA's Generic TLUP Guidelines (HSA, 2023) outline that the prevention of MATTEs is the primary objective and it is expected that accident pathways will be prevented. Where this is not practicable, the assessment of major accidents to the environment focuses on the specific risks to sensitive receptors within the local environment, the extent of consequences to such receptors and the ability of such receptors to recover.

Assessment is based on a Source-Pathway-Receptor model. For new establishments, the CCA will focus on the removal of accident pathways to receptors (through the use of additional technical measures: appropriate containment, within the confines of current good practice and ALARP, for example).

4.0 LAND USE PLANNING ASSESSMENT METHODOLOGY AND CRITERIA

This COMAH land use planning assessment has been completed in accordance with a risk-based approach set out in the HSA's *Guidance on technical land use planning advice* (HSA, 2023). LUP assessments are completed in the following steps:

- Identify major accident scenarios with reference to the HSA guidance document (HSA, 2023).
- Consequence modelling of major accident scenarios with physical consequences.
- Assign frequencies to major accident scenarios with reference to frequency values outlined in the HSA's Guidance document (HSA, 2023).
- Assessment of individual risk and generation of individual risk contours.
- Where necessary, assessment of societal risk using societal risk indices.
- Source-pathway-receptor model for major accident scenarios with environmental consequences, environmental receptor categorisation, assessment of MATTE harm and duration, compare MATTE frequency with tolerability criteria.

4.1 Assessment Methodology

4.1.1 Physical Effects Modelling

The impacts of physical and health effects on workers and the general public outside of the establishment boundary were determined by modelling accident scenarios using Gexcon Effects version 12.4.0 modelling software and DNV PHAST Version 9.0.

4.1.2 Risk Assessment Methodology

Gexcon RiskCurves version 12.4.0 modelling software is used in this assessment to calculate individual risk of fatality contours and risk-based land use planning zones associated with major accident scenarios.

4.1.3 Thermal Radiation Criteria

Fire scenarios have the potential to create hazardous heat fluxes. Therefore, thermal radiation on exposed skin poses a risk of fatality.

In relation to persons indoors, the HSA have specified the thermal radiation consequence criteria (from an outdoor fire) detailed in Table 5 (HSA, 2023).

Thermal Flux (kW/m^2)	Consequences
> 25.6	Building conservatively assumed to catch fire quickly and so 100% fatality probability
> 25.6	People are assumed to escape outdoors, and so have a risk of fatality corresponding to that of people outdoors
< 12.7	People are assumed to be protected, and therefore there is a 0% fatality probability

Table 5 Heat Flux Consequences Indoors

In relation to property and equipment damage, the HSA have specified the thermal radiation consequence criteria (from an outdoor fire) detailed in Table 6 (HSA, 2023).

Thermal Flux (kW/m^2)	Consequences
37.5	Building conservatively assumed to catch fire quickly and so 100% fatality probability
25.6	People are assumed to escape outdoors, and so have a risk of fatality corresponding to that of people outdoors
14.7	People are assumed to be protected, and therefore there is a 0% fatality probability

Table 6 Heat Flux Consequences to Property and Equipment

Thermal Dose Unit (TDU) is used to measure exposure to thermal radiation. It is a function of intensity (power per unit area) and exposure time:

$$\text{Thermal Dose} = I^{1.33}\, t \qquad \text{(Equation 2)}$$

where the Thermal Dose Units (TDUs) are $(kW/m^2)^{4/3}.s$, I is thermal radiation intensity (kW/m^2) and t is exposure duration (s).

The HSA recommends that the Eisenberg Probit function (HSA, 2023) is used to determine probability of fatality to persons outdoors from thermal radiation as follows:

$$\text{Probit} = -14.9 + 2.56 \ln (I^{1.33}\, t) \qquad \text{(Equation 3)}$$

I Thermal radiation intensity (kW/m^2)
t exposure duration (s)

Probit (Probability Unit) functions are used to convert the probability of an event occurring to percentage certainty that an event will occur. The Probit variable is related to probability as follows (CCPS, 2000):

$$P = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{Y-5} \exp\left(-\frac{u^2}{2}\right) du \qquad \text{(Equation 4)}$$

where P is the probability of percentage, Y is the Probit variable, and u is an integration variable. The Probit variable is normally distributed and has a mean value of 5 and a standard deviation of 1.

The Probit to percentage conversion equation is (CCPS, 2000):

$$P = 50\left[1 + \frac{Y-5}{|Y-5|} erf\left(\frac{|Y-5|}{\sqrt{2}}\right)\right] \qquad \text{(Equation 5)}$$

The relationship between Probit and percentage certainty is presented in **Table 7** (CCPS, 2000).

%	0	1	2	3	4	5	6	7	8	9
0	—	2.67	2.95	3.12	3.25	3.36	3.45	3.52	3.59	3.66
10	3.72	3.77	3.82	3.87	3.92	3.96	4.01	4.05	4.08	4.12
20	4.16	4.19	4.23	4.26	4.29	4.33	4.36	4.39	4.42	4.45
30	4.48	4.50	4.53	4.56	4.59	4.61	4.64	4.67	4.69	4.72
40	4.75	4.77	4.80	4.82	4.85	4.87	4.90	4.92	4.95	4.97
50	5.00	5.03	5.05	5.08	5.10	5.13	5.15	5.18	5.20	5.23
60	5.25	5.28	5.31	5.33	5.36	5.39	5.41	5.44	5.47	5.50
70	5.52	5.55	5.58	5.61	5.64	5.67	5.71	5.74	5.77	5.81
80	5.84	5.88	5.92	5.95	5.99	6.04	6.08	6.13	6.18	6.23
90	6.28	6.34	6.41	6.48	6.55	6.64	6.75	6.88	7.05	7.33
%	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
99	7.33	7.37	7.41	7.46	7.51	7.58	7.65	7.75	7.88	8.09

Table 7 Conversion from Probit to Percentage

For long duration fires, such as pool fires, it is generally reasonable to assume an effective exposure duration of 60 seconds to take account of the time required to escape (HSA, 2023). It is noted that this is a conservative estimation of the time taken to escape and is used in consequence assessment as the maximum exposure duration for heat radiation.

With respect to exposure to thermal radiation outdoors, the Eisenberg Probit relationship implies:

- 1% fatality – 963 TDUs (8.02 kW/m^2 for 60 s exposure duration)
- 10% fatality – 1450 TDUs (10.9 kW/m^2 for 60 s exposure duration)
- 50% fatality – 2399 TDUs (15.9 kW/m^2 for 60 s exposure duration)

4.1.4 Overpressure Criteria

Explosions scenarios can result in damaging overpressures, especially when flammable vapour/air mixtures are ignited in a congested area.

Combustion of a flammable gas-air mixture will occur if the composition of the mixture lies in the flammable range and if an ignition source is available. When ignition occurs in a flammable region of the cloud, the flame will start to propagate away from the ignition source. The combustion products expand causing flow ahead of the flame. Initially this flow will be laminar. Under laminar or near laminar conditions the flame speeds for normal hydrocarbons are in the order of 5 to 30 m/s which is too low to produce any significant blast over-pressure. Under these conditions, the vapour cloud will simply burn, causing a flash fire. In order for a vapour cloud explosion to occur, the vapour cloud must be in a turbulent condition.
Turbulence may arise in a vapour cloud in various ways:

- By the release of the flammable material itself, for instance a jet release from a high-pressure vessel.
- By the interaction of the expansion flow ahead of the flame with obstacles present in a congested area.

Table 8 below describes blast damage for various overpressure levels (HSA, 2023).

Side-on Overpressure (mbar)	Description of Damage
1.5	Annoying noise
2	Occasional breaking of large windowpanes already under strain
3	Loud noise; sonic boom glass failure
7	Breakage of small windows under strain
10	Threshold for glass breakage
20	“Safe distance”, probability of 0.95 of no serious damage beyond this value; some damage to house ceilings; 10% window glass broken
30	Limited minor structural damage
35 – 70	Large and small windows usually shattered; occasional damage to window frames
>35	Damage level for “Light Damage”
50	Minor damage to house structures
80	Partial demolition of houses, made uninhabitable
70 – 150	Corrugated asbestos shattered. Corrugated steel or aluminium panels fastenings fail, followed by buckling; wood panel (standard housing) fastenings fail; panels blown in
100	Steel frame of clad building slightly distorted
150	Partial collapse of walls and roofs of houses
150-200	Concrete or cinderblock walls, not reinforced, shattered
>170	Damage level for “Moderate Damage”
180	Lower limit of serious structural damage 50% destruction of brickwork of houses
200	Heavy machines in industrial buildings suffered little damage; steel frame building distorted and pulled away from foundations
200 – 280	Frameless, self-framing steel panel building demolished; rupture of oil storage tanks
300	Cladding of light industrial buildings ruptured
350	Wooden utility poles snapped; tall hydraulic press in building slightly damaged
350 – 500	Nearly complete destruction of houses
>350	Damage level for “Severe Damage”
500	Loaded tank car overturned
500 – 550	Unreinforced brick panels, 25 – 35 cm thick, fail by shearing or flexure
600	Loaded train boxcars completely demolished
700	Probable total destruction of buildings; heavy machine tools moved and badly damaged
830	Damage level for ‘total destruction’

Table 8 *Blast Damage Overpressures*

The HSA recommends that the Hurst, Nussey and Pape Probit function (HSA, 2023) is used to determine probability of fatality to persons outdoors from overpressure as follows:

Probit = 1.47 + 1.35ln P

P Blast overpressure (psi)

The Hurst, Nussey and Pape Probit relationship implies:

- 1% fatality – 168 mbar
- 10% fatality – 365 mbar
- 50% fatality – 942 mbar

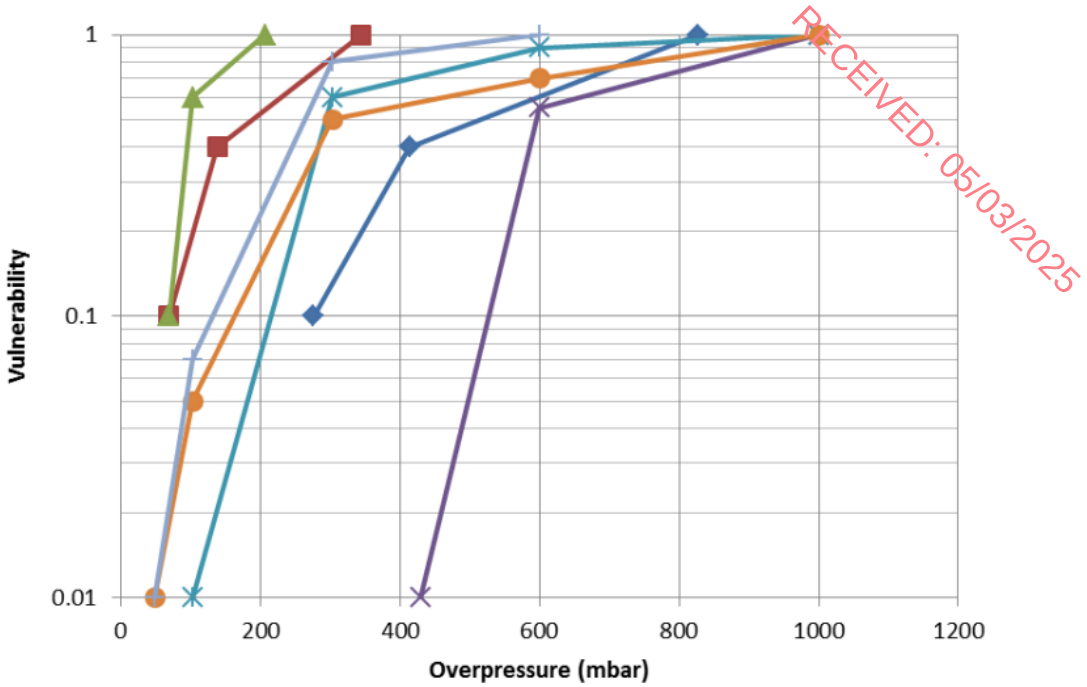
The HSA uses relationships published by the Chemical Industries Association (CIA) and the American Petroleum Institute (API) to determine the probability of fatality for building occupants exposed to blast overpressure. The CIA has developed relationships for 4 categories of buildings (CIA, 2020):

- CIA 1: hardened structure building (special construction, no windows).
- CIA 2: typical office block (four storey, concrete frame and roof, brick block wall panels).
- CIA 3: typical domestic dwelling (two storey, brick walls, timber floors); and
- CIA 4: 'portacabin' type timber construction, single storey.

The API has developed relationships for 5 categories of buildings (EIGA, 2014):

- API B1: Wood frame trailer or shack
- API B2: Steel frame/metal siding or pre-engineered building
- API B3: Unreinforced masonry bearing wall building
- API B4: Steel or concrete reinforced masonry infill or cladding
- API B5: Reinforced concrete or reinforced masonry shear wall building

Figure 5 illustrates the probability of occupant vulnerability to overpressure in CIA building categories CIA 1 – 4 and in API building types B1 – B5.



Graph Key:	
	CIA 1: Hardened structure building: special construction, no windows
	CIA 2: Typical office block: four story, concrete frame and roof, brick block wall panels
	CIA 3: Typical domestic buildings: two story, brick walls, timber floors
	CIA 4: Portacabin: timber construction, single story
	API B5: Reinforced concrete or reinforced masonry shear wall building
	API B3: Unreinforced masonry bearing wall building
	API B1, B2, B4: Wood frame trailer or shack, steel-frame/metal siding or pre-engineered building, steel or concrete reinforced masonry infill or cladding
NOTE—Building key items 1 - 4 are defined by CIA; items B1 - B5 are defined by API RP 752 (2003) [5, 3].	

Figure 5 API Probability of Occupant Vulnerability

The CIA and API relationships imply the overpressure levels corresponding to probabilities of fatality of 1%, 10% and 50% detailed in Table 9 below.

Probability of fatality	Overpressure Level, mbar						
	CIA 1	CIA 2	CIA 3	CIA 4	API B1 B2 and B4	API B3	API B5
1% fatality	435	100	50	50	-	-	-
10% fatality	519	183	139	115	69	69	276
50% fatality	590	284	300	242	172	97	483

Table 9 Blast Overpressure Consequences Indoors

For TLUP purposes, it is assumed that buildings in the vicinity of the proposed development will be classified, by default, as CIA Cat. 3 (HSA, 2023).

4.1.5 Flash Fire Criteria

A flash fire comprises the combustion of a flammable vapour and air mixture in which the flame passes through that mixture at less than sonic velocity, such that negligible damaging overpressure is generated.

The flash fire envelope is the lower flammable limit (LFL) concentration, determined using the unified dispersion model in PHAST Version 9.0 consequence modelling software.

For flash fires, fatality levels of 100% are assumed inside the lower flammable limit (LFL) envelope, with 0% fatalities outside that envelope. For flash fire, within the flash fire envelope, indoor fatality levels are conservatively assumed to be 10%. (HSA, 2023)

4.2 Modelling Parameters

4.2.1 Weather Conditions

Weather conditions at the time of a major-accident have a significant impact on the consequences of the event. Typically, high wind speeds slightly increase the impact of fires, particularly pool fires.

Atmospheric Stability Class and Wind Speed

In order to adequately assess the consequences of a major-accident, weather conditions must be selected that represent the weather experienced at the site. The standard atmospheric stability classes are listed in Table 10**.**

A-G Stability	Conditions	Typically observed during
A	Very unstable – Sunny with light winds	Day-time
B	Unstable – Less sunny or more windy than A	Day-time
C	Moderately unstable – Very windy/sunny or overcast/light wind	Day-time
D	Neutral – little sun and high wind or overcast/windy night	Day or Night-time
E	Moderately stable – Less overcast and less windy than D	Night-time
F	Stable – Night with moderate clouds and light/moderate winds	Night-time
G	Very Stable – Possibly Fog	Night-time

Table 10 Atmospheric Stability Classes

For TLUP purposes, the HSA specifies that D_5 conditions are assumed to occur 80% of the time, with F2 occurring for the remaining 20% (HSA, 2023).

4.2.2 Wind Direction

The nearest weather station to the proposed development at which hourly wind speed and direction measurements are taken is at Gurteen Met Station. Figure 6 illustrates a wind rose based on hourly wind speed and direction data for Gurteen Weather Station (2008 – 2024). Data was obtained from the Met Eireann website. It can be seen that the prevailing wind direction is from the south west (210 ^{o}).

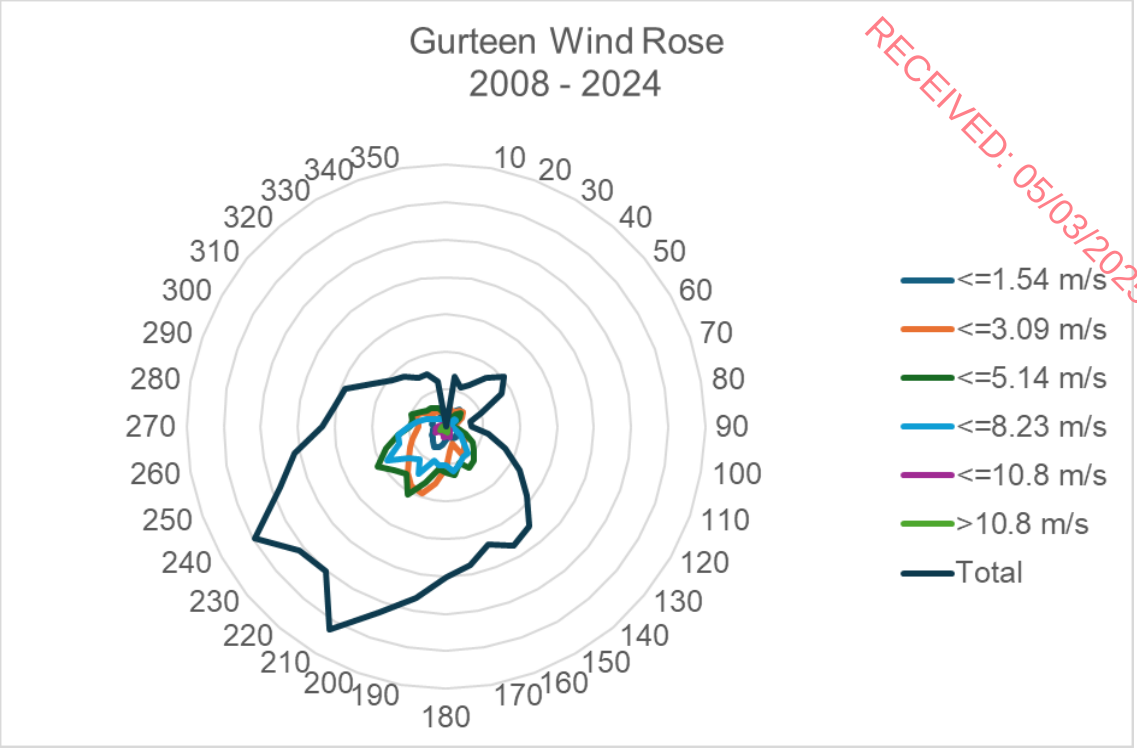


Figure 6 Wind Rose Gurteen Met Station 2008 - 2024

4.2.3 Ambient Temperature

For TLUP purposes the HSA specifies that Outdoor storage vessel contents are assumed to be at ambient atmospheric temperatures. Ambient temperatures vary throughout the day and the seasons. For TLUP purposes, a temperature of 15 °C is used in D5 conditions and 10 °C for F2 conditions. (HSA, 2023).

4.2.4 Ambient Humidity

For TLUP purposes, a humidity of 60% is used.

4.2.5 Surface Roughness

For TLUP purposes a surface roughness value of 0.1 m will be used as default (HSA, 2023).

4.3 Societal Risk Assessment Methodology

Where a large population is potentially exposed to the consequences of a major accident, and there is the potential for multiple fatalities from a single event, societal risk is taken into account.

To take account of societal risk, the HSA will initially obtain an estimate of the expectation value.

Expectation Value and FN Curve

The Expectation Value (EV) is the average number of persons receiving a specified level of harm. Hirst and Carter (Hirst et al., 2000) shows that:

$$EV = F \times N$$

Where F is the cumulative frequency of all events leading to N fatalities

HSE (2001) provides an upper limit value for an intolerable societal risk criterion: for a predicted accident occurring no more frequently than once in 5,000 years, there should be no more than 50 fatalities. This has gained international acceptance as an anchor point for a line (of slope -1) to create an intolerable societal risk criterion for single accidents. HSA Guidance on Technical Land Use Planning recommended using points at 200 cpm / 50 fatalities and 1000 cpm/10 fatalities to create that line. An acceptable societal risk single risk criterion line can then be drawn at frequencies that are two orders of magnitude below the intolerable line (so a frequency of 1×10^{-4} on the intolerable line becomes 1×10^{-6} on the acceptable line).

Some establishments will have the potential for fatalities to arise from a multiplicity of accident scenarios (or there may be other establishments in the vicinity, adding to the EV). In such situations, the total off-site EV should not exceed the criterion upper limit EV of 10,000. Between EVs of 100 and 10,000, it should be demonstrated that all practicable efforts have been made to reduce the risk to a level that is as low as reasonably practicable (above a developmental EV level of 450, an FN curve will be required as part of the demonstration).

5.0 IDENTIFICATION OF MAJOR ACCIDENT HAZARDS

A major accident is defined in the 2015 COMAH Regulations as:

> *"an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by these Regulations, and leading to serious danger to human health or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances"*

Table 11 details the major accident scenarios identified in the *Guidance on Technical Land Use Planning Advice* (HSA, 2023) that are relevant to the proposed development.

Installation	LOC scenario	Consequence/Event
Indoor equipment (Energy Centre)	Instantaneous failure	VCE
	Continuous leak over 10 minutes	VCE
	10 mm pipe leak over 10 minutes	VCE
Indoor equipment (Compressor)	Instantaneous failure	VCE
	Continuous leak over 10 minutes	VCE
	10 mm pipe leak over 10 minutes	VCE
Indoor equipment (Bay Trailer)	Instantaneous failure	VCE
	Loss of entire contents	VCE
Biogas Pipeline	Rupture of Pipeline	Fireball/Jet fire
		VCE
		Flash fire
	Pipeline Leak of 0.1D	Fireball/Jet fire
		VCE
		Flash fire
Anaerobic Digester Tanks	Instantaneous Failure	Fireball
		VCE
		Flash fire
	Continuous Leak over 10 minutes	Jet fire
		VCE
		Flash fire
		Pool fire
Bay Trailer Refilling	Rupture of unloading hose	Jet fire
		VCE
		Flash fire
	Leak of unloading hose of 10% of diameter	Jet fire
		VCE
		Flash fire

Table 11 Major Accident Scenarios at Proposed Development

5.1 Major Accidents to the Environment

There are no substances stored on site that have environmental hazard phrases. Therefore, a major accident to the environment is not considered in the study.

6.0 ASSESSMENT OF MAJOR ACCIDENT HAZARDS FOR BAY TRAILERS

6.1 Bay Trailer VCE Model Inputs

The bay trailer will contain 114 No. 0.35 m^3 cylinders. The volume of the bay trailer is 77 m^3 (12.2 m *x* 2.44 m *x* 2.59 m); therefore, the volume of available space within the container is 37.1 m^3.

In order for a vapour cloud explosion to occur, the concentration of natural gas must lie between the lower and upper flammable limits. It is assumed that concentration within the bay trailer is a stoichiometric mixture of air and flammable gas. The complete combustion equation for methane is:

$$CH_4 + 2O_2 = CO_2 + 2H_2O$$

The volume of available space within the bay trailer will be 37.1 m^3. The mass fraction of methane within this volume was calculated as 0.056.

The VCE model inputs are detailed in Table 12:

Parameter	Units	Value	Source
Chemical name		methane	-
Temperature	°C	10	HSA 2023
Volume of container	m^3	37.1	Trailer available volume
Flammable mass	kg	2.46	See Appendix A for calculation
Fraction of flammable cloud confined	-	1	Confined VCE within bay trailer
Curve number	-	7	Very Strong Deflagration: Confined conditions and low ignition energy

Table 12 *VCE in Cylinder Container: Model Inputs*

6.2 Bay Trailer VCE Model Outputs

The TNO Multi Energy model in Effects Version 12.4.0 consequence modelling software was used to model the overpressure consequences. The model assumes a curve strength of 7 and 100% confinement.

Figure 7 illustrates the overpressure vs distance profile for a VCE at the Bay Trailer area.

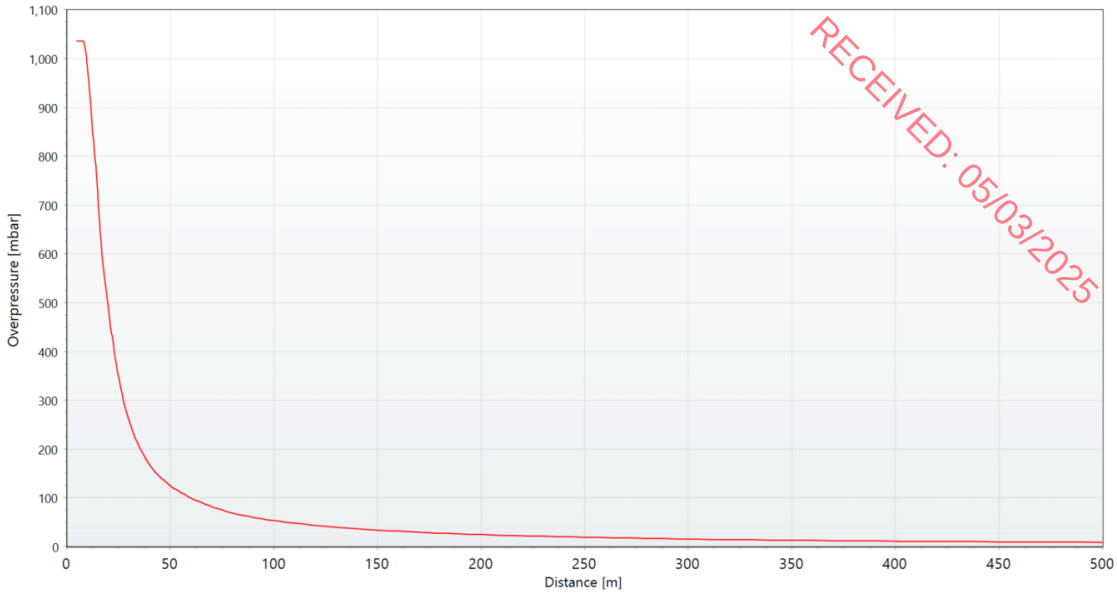


Figure 7 Bay Trailer VCE: Overpressure vs Distance

Table 13 details the distances to specified overpressure endpoints.

Peak overpressure (mbar)	Consequences	Distance (m)
168	1% mortality outdoors	21
50	1% mortality indoors CIA Category 3	57

Table 13 Bay Trailer VCE: Distances to Specified Overpressure Endpoints

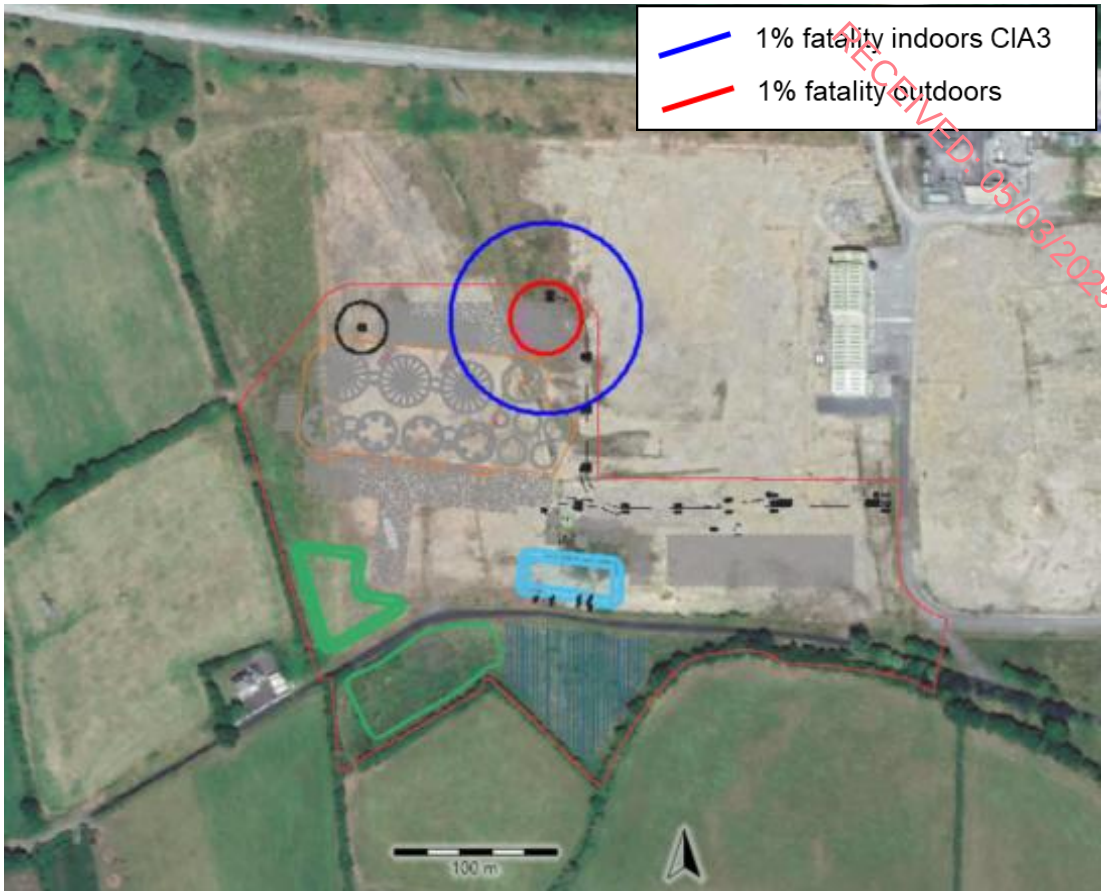


Figure 8 Bay Trailer VCE: Overpressure Contours Corresponding to Indoor and Outdoor Fatality

It is concluded for a VCE at the Bay Trailer Loading Area:

- The overpressure corresponding to 1% fatality outdoors does not extend over the site boundary
- The overpressure corresponding to 1% fatality indoors CIA Cat. 3, extends over the site boundary but does not extend to any occupied building.

6.3 Bay Trailer Refilling Station Model Inputs

The proposed development will export biogas to bay trailers. There are 4 No. bay trailer loading docks. The outlet pressure at each dispenser is 250 barg.

The following loss of containment scenarios are considered for loading operations at road transport units:

- Rupture of loading hose (jet fire/fireball, VCE or flash fire)
- Leak of loading hose 10% of diameter (Jet fire/fireball, VCE or flash fire)

6.3.1 Bay Trailer Filling Hose Release: Model Inputs

The current indicative model inputs are provided, these will be confirmed during the detailed engineering design phase. Any significant change to these inputs will be assessed appropriately.

The model inputs are detailed in Table 14 below.

Parameter	Hose rupture	Hose leak, 10% of diameter	Source/Assumption
Material	Methane	Methane	-
Hose diameter	25mm	25 mm	Hose Dimensions
Relative breach aperture (fraction)	1	0.1	-
Pipe inflow	1013 kg/hr	1013 kg/hr	Plant designer
Pressure	250 barg	250 barg	Pressure at outlet of dispenser
Averaging time	Flammable – 18.75 s	Flammable – 18.75 s	DNV PHAST
Short Duration Effects	30 second cut off time for flammable effects	30 second cut off time for flammable effects	Assumed
Exposure duration	60 s	60 s	HSA recommended (HSA, 2023)
Release height	1.5 m	1.5 m	Assumed, worst case consequences
Release direction	Vertical Horizontal	Vertical Horizontal	HSA guidance Requested by HSA
Effect height	1.5 m	1.5 m	Average height of person
Wind speed	5 m/s (day time), 2 m/s (night time)	5 m/s (day time), 2 m/s (night time)	Recommended by HSA as representative modelling conditions
Pasquill Stability Factor	D (day time conditions) F (stable night time conditions)	D (day time conditions) F (stable night time conditions)	
Temperature	10 degC (F2) 15 degC (D5)	10 degC (F2) 15 degC (D5)	HSA guidance (HSA 2023)

Table 14 Bay Trailer Filling Station Hose Release Scenarios: Model Inputs

6.3.2 Bay Trailer Filling Hose Release: Predicted Phenomena

The unified dispersion model in DNV PHAST Version 9.0 predicts the following phenomena for each release scenario:

- Rupture of Loading Hose (vertical): Jet fire
- Rupture of Loading Hose (horizontal): Jet fire and Flash Fire
- Leak of Loading Hose (vertical): Jet fire
- Leak of Loading Hose (horizontal): Jet fire and Flash Fire

6.3.3 Bay Trailer Filling Hose Release: Jet Fire Model Outputs

The jet fire cone model in DNV PHAST Version 9.0 consequence modelling software was used to model the consequences of a jet fire.

The following Figures illustrate the results of a Jet Fire following release at the Bay Trailer filling area, for a receiver height of 1.5m:

- Figure 9 Filling Station Hose Rupture and Horizontal Release and Jet Fire: Thermal Radiation vs Distance
- Figure 10 Filling Station Hose Rupture and Vertical Release and Jet Fire: Thermal Radiation vs Distance
- Figure 11 Filling Station Hose Leak and Horizontal Release and Jet Fire: Thermal Radiation vs Distance
- Figure 12 Filling Station Hose Leak and Vertical Release and Jet Fire: Thermal Radiation vs Distance

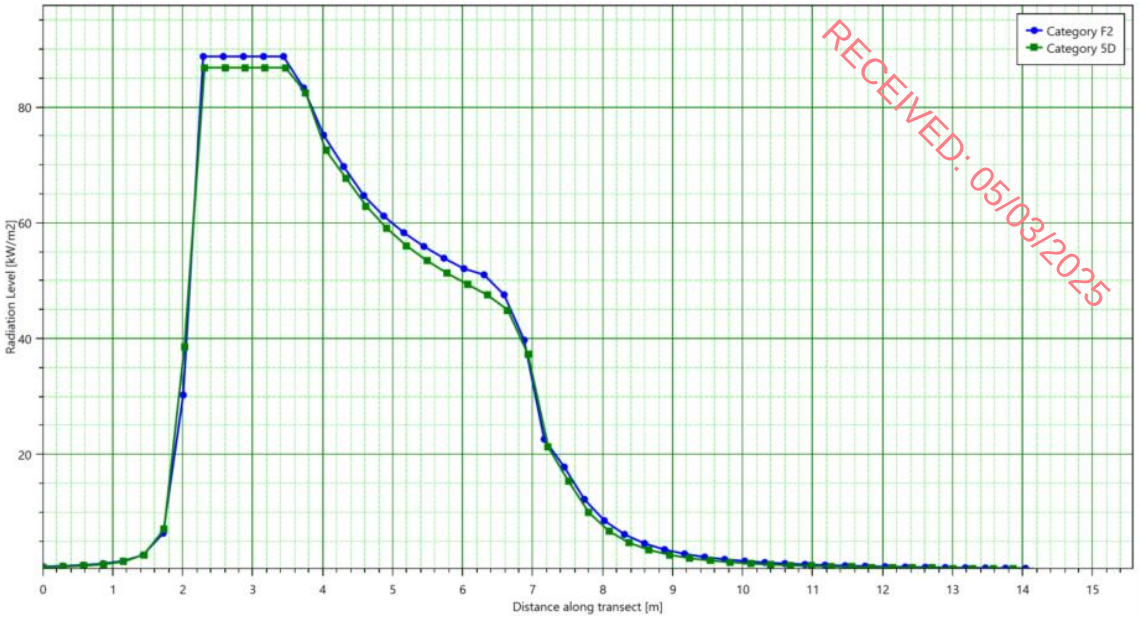


Figure 9 Filling Station Hose Rupture and Horizontal Release and Jet Fire: Thermal Radiation vs Distance

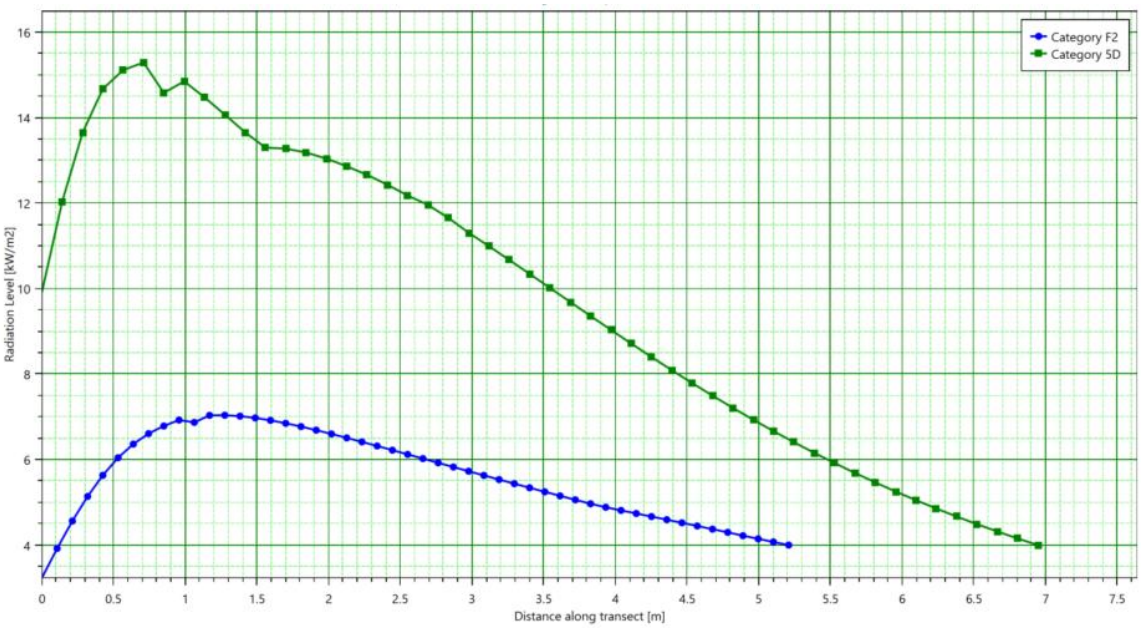


Figure 10 Filling Station Hose Rupture and Vertical Release and Jet Fire: Thermal Radiation vs Distance

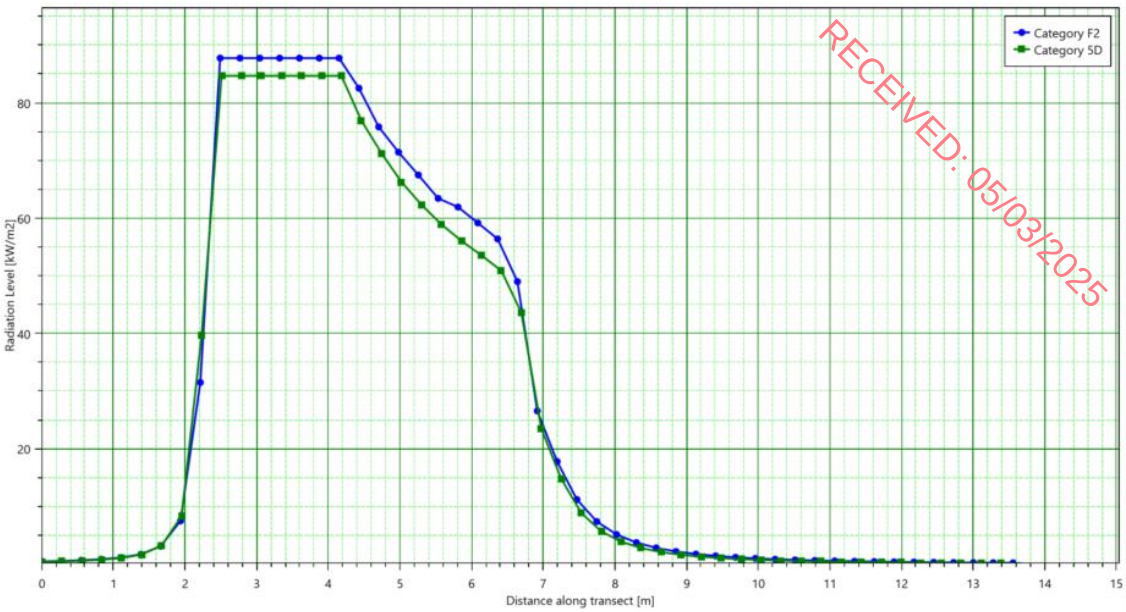


Figure 11 Filling Station Hose Leak and Horizontal Release and Jet Fire: Thermal Radiation vs Distance

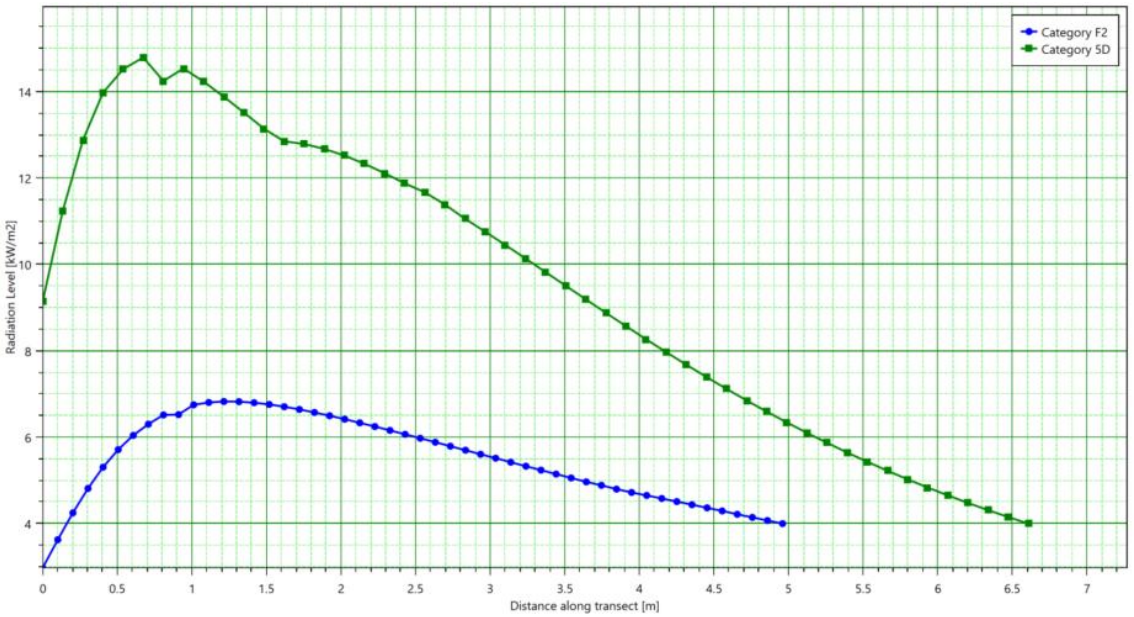


Figure 12 Filling Station Hose Leak and Vertical Release and Jet Fire: Thermal Radiation vs Distance

Table 15 details distances to specified thermal radiation levels, at a receiver height of 1.5m, associated with

- 1%, mortality outdoors
- 0% mortality and 100% mortality indoors

Consequence	Thermal Radiation (kW/m^2)	Horizontal Rupture (m)		Vertical Rupture (m)		Horizontal Leak		Vertical Leak	
		Cat. D5	Cat. F2	Cat. D5	Cat. F2	Cat. D5	Cat. F2	Cat. D5	Cat. F2
1% mortality outdoors	8.02	8	8	4	-	8	8	4	-
0% mortality indoors	12.7	7	7	2	-	7	7	2	-
100% mortality indoors	25.6	7	7	-	-	7	7	-	-

Table 15 Filling Station Release and Jet Fire: Calculated Distances at Specified Thermal Radiation Levels (receiver height 1.5m)

It is concluded that in the event of a jet fire following a release from the Filling Station:

- The thermal radiation level corresponding to 1% mortality outdoors could extend up to 3m from the pipeline. There are no expected off-site consequences.

6.3.4 Bay Trailer Filling Hose Release: Flash Fire Model Outputs

The DNV PHAST Version 9.0 unified dispersion model predicts the flash fire footprints illustrated on the following figures for natural gas pipeline release scenarios.

The flash fire footprints are illustrated on the following Figures:

- Figure 13 Filling Station Rupture and Horizontal Release: Flash Fire Footprint
- Figure 14 Filling Station Leak and Horizontal Release: Flash Fire Footprint

It is noted that the PHAST unified dispersion model does not predict a flash fire footprint for the vertical release scenario.

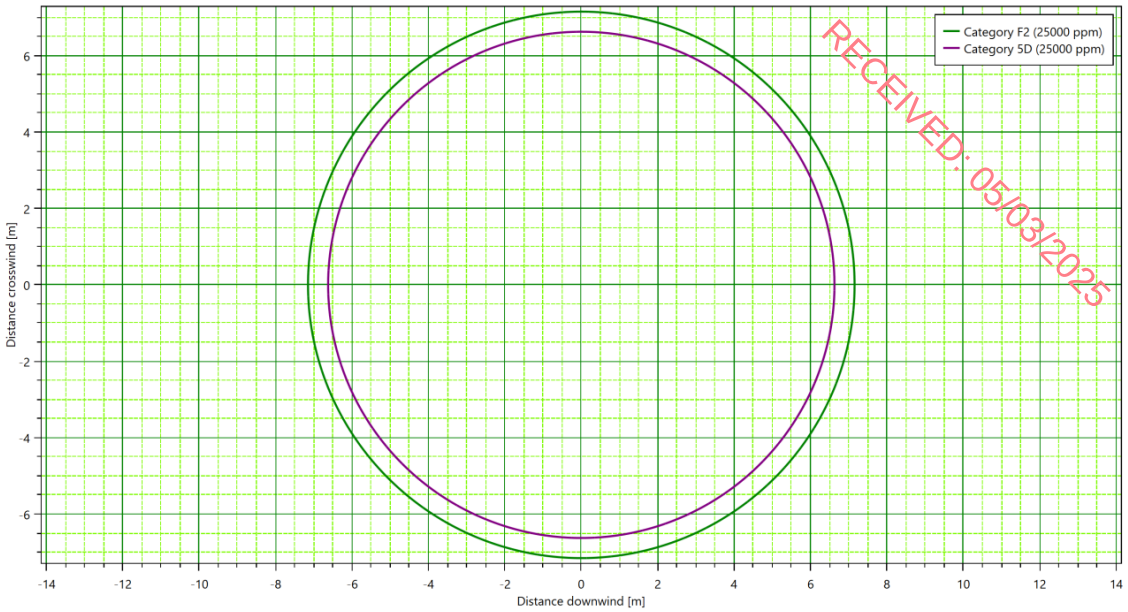


Figure 13 Filling Station Rupture and Horizontal Release: Flash Fire Footprint

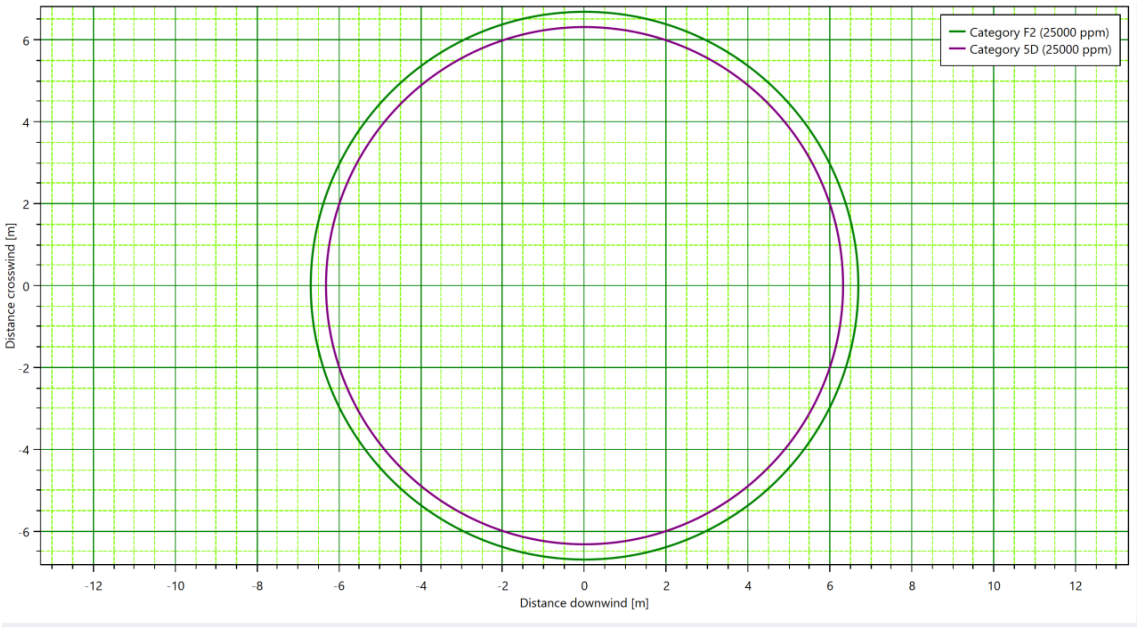


Figure 14 Filling Station Leak and Horizontal Release: Flash Fire Footprint

It is concluded that in the event of a flash fire following a release from the Filling Station:

- The flash fire envelope could extend up to 7 m from the hose. There are no expected off-site consequences.

7.0 ASSESSMENT OF MAJOR ACCIDENT HAZARDS FOR ENERGY CENTRE

The model inputs were provided by the project engineers, and these will be confirmed during the detailed engineering design phase. Any significant change to these inputs will be assessed appropriately.

7.1 Energy Centre VCE Model Inputs

The Energy Centre is a pitched-roof building with a volume of 1626 m^3 ((6.3 m *x* 21.8 m *x* 11.1m) + 102m^3 for pitched roof volume). The volume occupied by the gas generator is 152 m^3 (12.2 m *x* 3.6 m *x* 3.5 m); therefore, the volume of available space within the Energy Centre is 1474 m^3.

In order for a vapour cloud explosion to occur, the concentration of natural gas must lie between the lower and upper flammable limits. It is assumed that concentration within the turbine enclosure is a stoichiometric mixture of air and flammable gas. The complete combustion equation for methane is:

$$CH_4 + 2O_2 = CO_2 + 2H_2O$$

The volume of available space within the Energy Centre will be 1474 m^3. The mass fraction of methane within this volume was calculated as 0.056.

The VCE model inputs are detailed in Table 16.

Parameter	Units	Value	Source
Chemical name		methane	-
Temperature	°C	10	HSA 2023
Volume of container	m^3	1474	Energy Centre available volume
Flammable mass	kg	97.8	See Appendix A for calculation
Fraction of flammable cloud confined	-	1	Confined VCE within energy centre
Curve number	-	7	Very Strong Deflagration: Confined conditions and low ignition energy

Table 16 *Energy Centre VCE: Model Inputs*

7.2 Energy Centre VCE Model Outputs

The TNO Multi Energy model in Effects Version 12.4.0 consequence modelling software was used to model the overpressure consequences. The model assumes a curve strength of 7 and 100% confinement.

Figure 15 illustrates the overpressure vs distance profile for a VCE at the Energy Centre.

Figure 15 *Energy Centre VCE: Overpressure vs Distance*

Table 17details the distances to specified overpressure endpoints.

Peak overpressure (mbar)	Consequences	Distance (m)
168	1% mortality outdoors	72
50	1% mortality indoors CIA Category 3	193

Table 17 *Energy Centre VCE: Distances to Specified Overpressure Endpoints*

Figure 16 illustrates the overpressure contours for a VCE at the Energy centre.

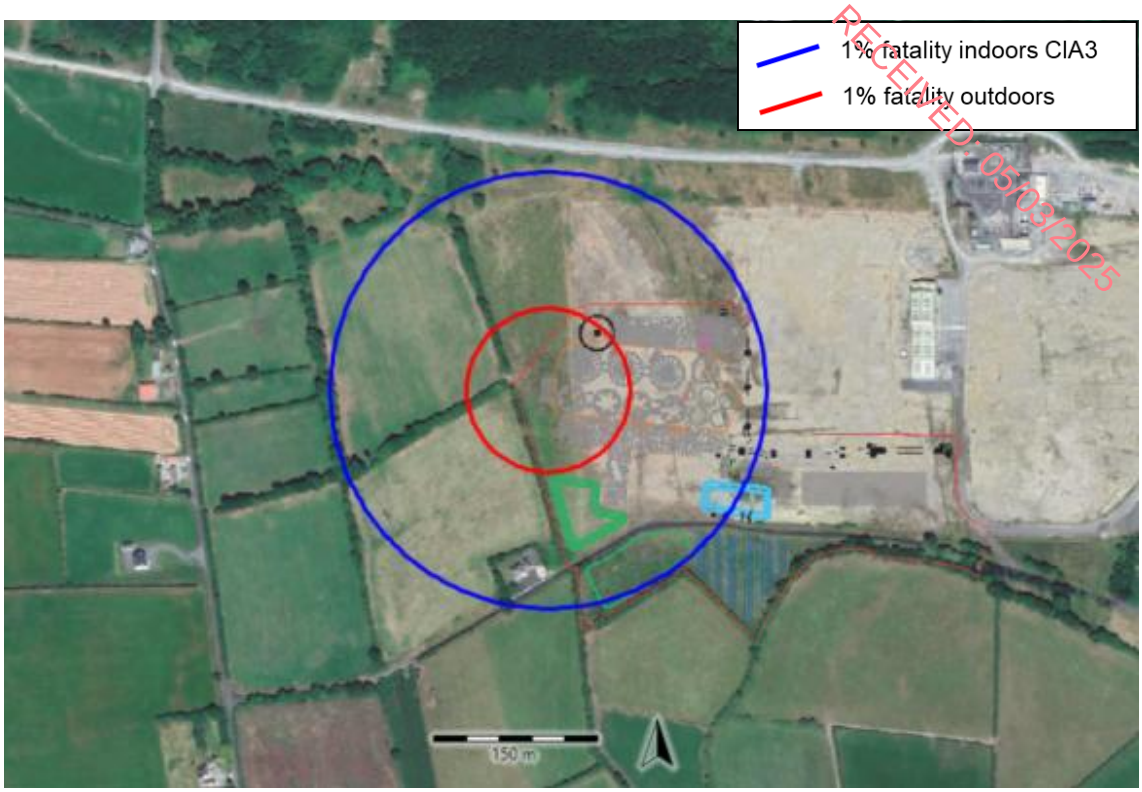


Figure 16 Bay Trailer VCE: Overpressure Contours Corresponding to Indoor and Outdoor Fatality

It is concluded for a VCE at the Bay Trailer Loading Area:

- The overpressure corresponding to 1% fatality outdoors extends outside of the site boundary to the west and north. These areas are not typically occupied; therefore, fatalities are not expected.
- The overpressure corresponding to 1% fatality indoors CIA Cat. 3, extends over the site boundary but does not extend to any occupied building. The contour extends to a derelict building to the south; however, this building is not occupied and fatalities are not expected.

8.0 ASSESSMENT OF MAJOR ACCIDENT HAZARDS AT COMPRESSORS

The model inputs were provided by the project engineers and these will be confirmed during the detailed engineering design phase. Any significant change to these inputs will be assessed appropriately.

8.1 Compressor VCE Model Inputs

Gexcon Effects version 12.4.0 was used to calculate the Multi Energy model overpressures resulting from a VCE in the compressor enclosures.

The current indicative model inputs are provided, these will be confirmed during the detailed engineering design phase. Any significant change to these inputs will be assessed appropriately.

It is assumed that an accidental release of biogas occurs in a compressor building. In order for a vapour cloud explosion to occur, the concentration of natural gas must lie between the lower and upper flammable limits. It is assumed that concentration

within the turbine enclosure is a stoichiometric mixture of air and flammable gas. The complete combustion equation for methane is:

$$CH_4 + 2O_2 = CO_2 + 2H_2O$$

The volume of the compressor enclosure will be 250 m^3.

The mass fraction of methane within this volume was calculated as 0.056 and the total flammable mass was calculated as 16.6 kg (see Appendix A for calculation).

The VCE model inputs are detailed in Table 18.

Parameter	Units	Value	Source
Chemical name		methane	-
Volume of Compressor Building	m^3	250	Project Engineer
Flammable mass	kg	16.6	See Appendix A for calculation
Fraction of flammable cloud confined	-	1	Confined VCE within enclosure
Curve number	-	7	Very Strong Deflagration: Confined conditions and low ignition energy

Table 18 Compressor VCE Model Inputs

8.2 Compressor VCE Model Outputs

The TNO Multi Energy model in Effects Version 12.4.0 consequence modelling software was used to model the overpressure consequences. The model assumes a curve strength of 7 and 100% confinement.

Figure 17 illustrates the overpressure vs distance profile for a VCE in a Compressor Building.

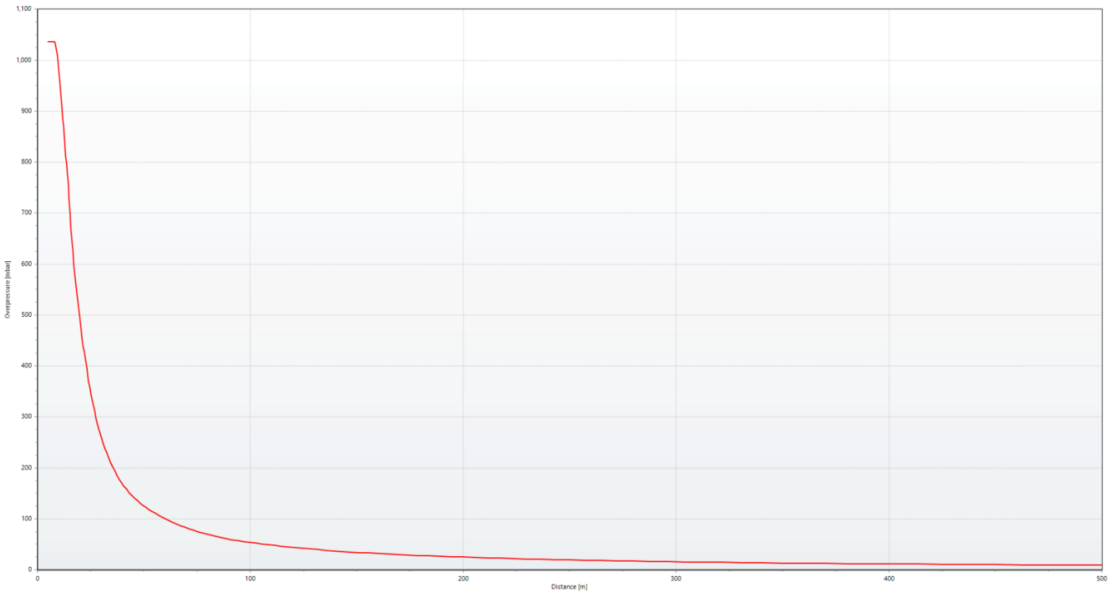


Figure 17 Compressor Natural Gas VCE: Overpressure vs Distance

Table 19 details the distances to specified overpressure endpoints.

Peak overpressure (mbar)	Consequences	Distance (m)
168	1% mortality outdoors	40
50	1% mortality indoors CIA Category 3	107

Table 19 Natural Gas VCE in Compressor Building: Distances to Specified Overpressure Endpoints

Figure 18 illustrates the overpressure contours corresponding to indoor and outdoor fatality.

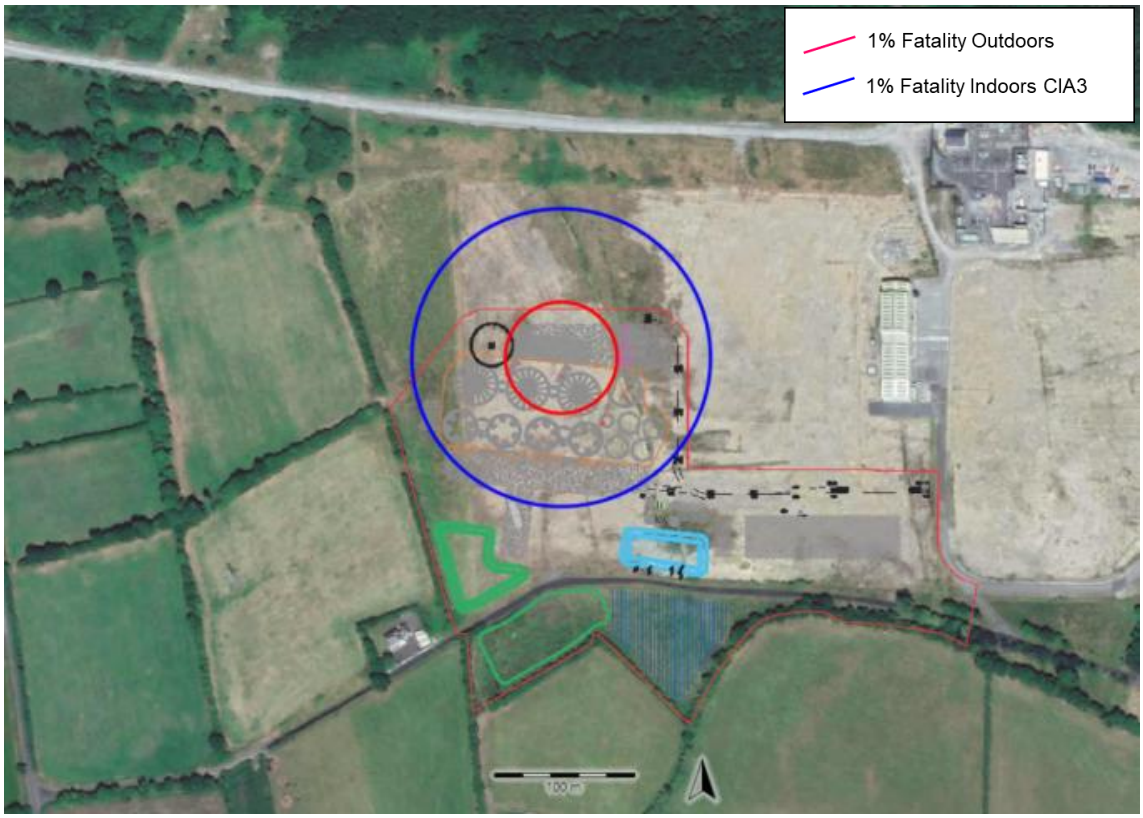


Figure 18 Compressor VCE: Overpressure Contours Corresponding to Fatality Outdoors and Indoors

The following is concluded for a VCE in at the Compressor Buildings:

- The overpressure contour corresponding to 1% mortality outdoors (168 mbar) extends slight over the COMAH site boundary to the north; however, this area is not typically occupied and fatalities are not expected.
- The overpressure contour corresponding to 1% fatality indoors CIA Cat. 3 (representative of residential dwellings) could extend over the COMAH site boundary but does not extend to any residential dwelling and fatalities are not expected.

It is concluded that no off-site fatalities are predicted for a VCE at the Compressor Buildings.

9.0 ASSESSMENT OF MAJOR ACCIDENT HAZARDS AT DIGESTERS

The model inputs were provided by the project engineers and these will be confirmed during the detailed engineering design phase. Any significant change to these inputs will be assessed appropriately.

9.1 Anaerobic Digester Major Accident Scenarios

The secondary digesters will house a gas dome with the capacity of 1,900 m^3 and will contain flammable material at a temperature of 38 ^oC and a pressure of 15 mbarg. Table 34 of the TLUP states the following scenarios for digesters:

- Instantaneous Failure and Fireball, VCE or Flash Fire
- Continuous Leak over 10 Minutes and Jet Fire, VCE, Flash Fire or Pool Fire.

9.1.1 Anaerobic Digester Model Inputs

Digester model inputs are summarised in Table 20. Consequence modelling was completed using DNV Phast Version 9.0 software. The model assumes a curve strength of 7 for 20% of the volume.

Parameter	Units	Value	Description
Substance	-	Methane	Representative of biogas
Tank Capacity	m^3	1,900	Capacity of secondary digester gas dome
Release height	m	2.5	Height of gas dome
Effect height	m	1.5	Standard effect height for receivers
Temperature	^oC	38	Secondary Digester temperature
Weather Conditions	-	F2, D5	HSA Land Use Planning Guidance (2023)
Wind direction	deg	210	Gurteen Wind Data (see Figure 6)

Table 20 Anaerobic Digester Gas Dome Model Inputs

9.1.2 Anaerobic Digester Instantaneous Release: VCE Results

The TNO Multi Energy model was used to model the overpressure consequences in the event a VCE following rupture of a secondary digester tank.

The DNV PHAST Version 9.0 unified dispersion model predicts a maximum flammable mass of 187 kg and 183 kg for a secondary digester rupture for weather categories D5 and F2 respectively.

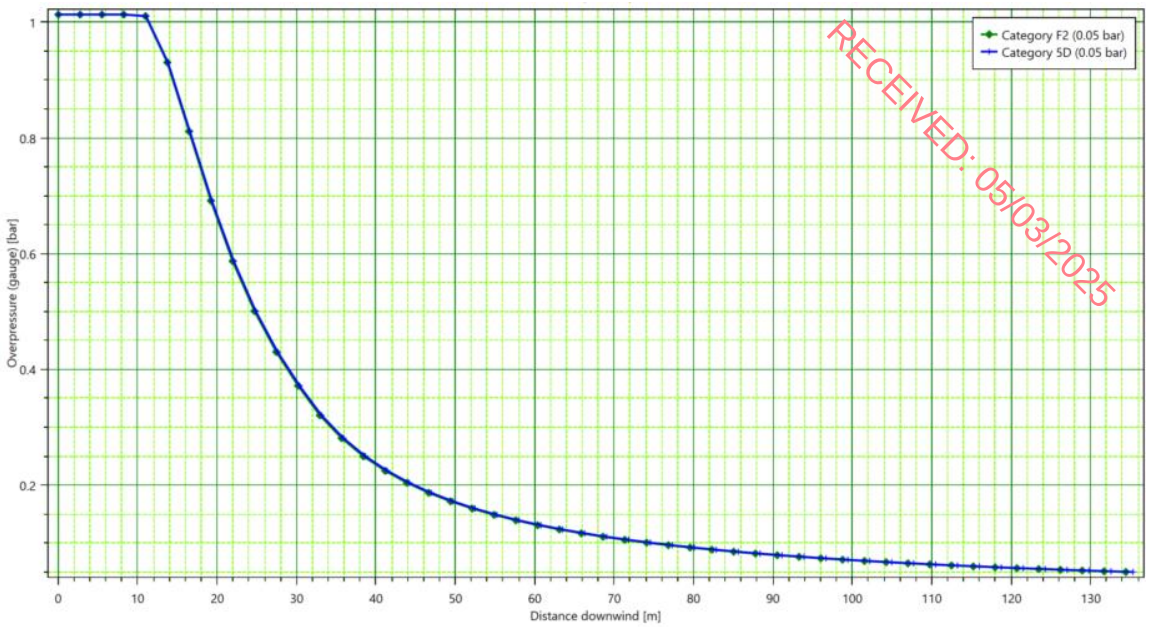


Figure 19 Digester Rupture and VCE: Overpressure vs Distance

Table 21 details the distances to specified overpressure endpoints for a VCE following Digester tank instantaneous release.

Peak overpressure (mbar)	Consequences	Distance (m)	
		F2	D5
168	1% mortality outdoors	51	51
50	1% mortality indoors CIA Category 3	134	134

Table 21 Digester Rupture and VCE: Distance to Specified Endpoints

Figure 20 and Figure 21 illustrates the overpressure contours corresponding to indoor and outdoor fatality following instantaneous rupture of a secondary digester tank and VCE.

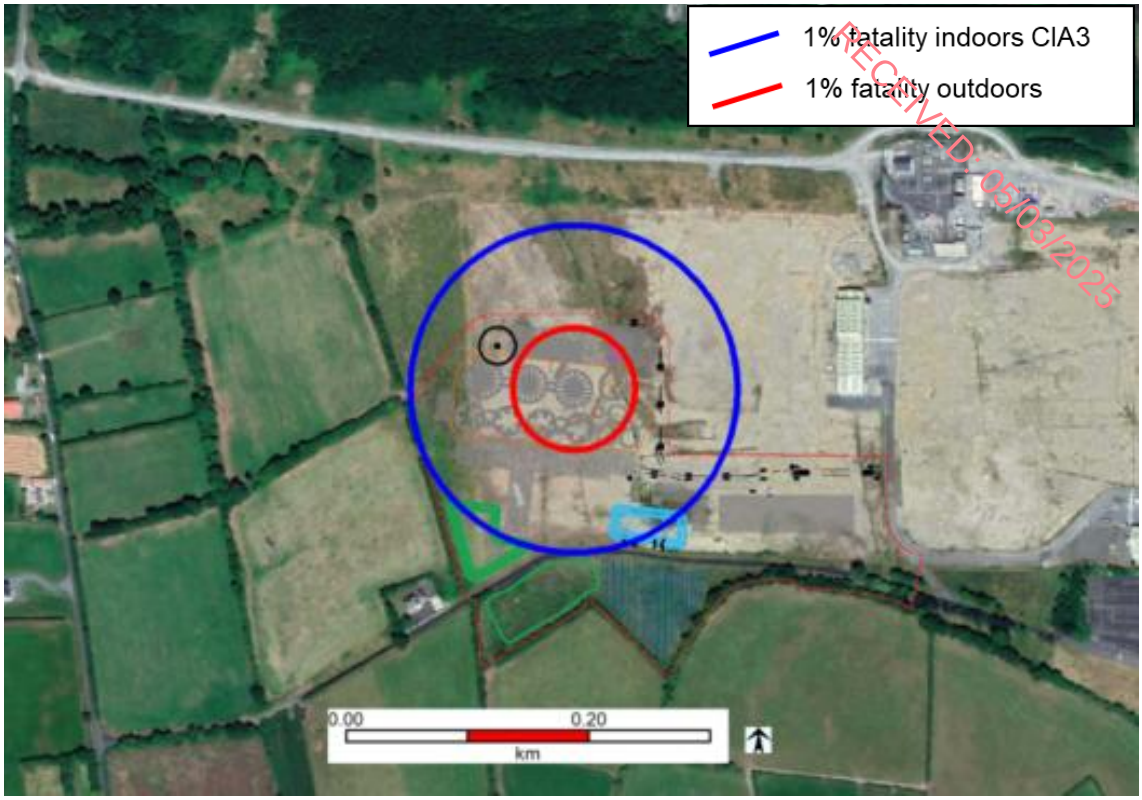


Figure 20 Digester No.2 Rupture and VCE: Overpressure Fatality Contours

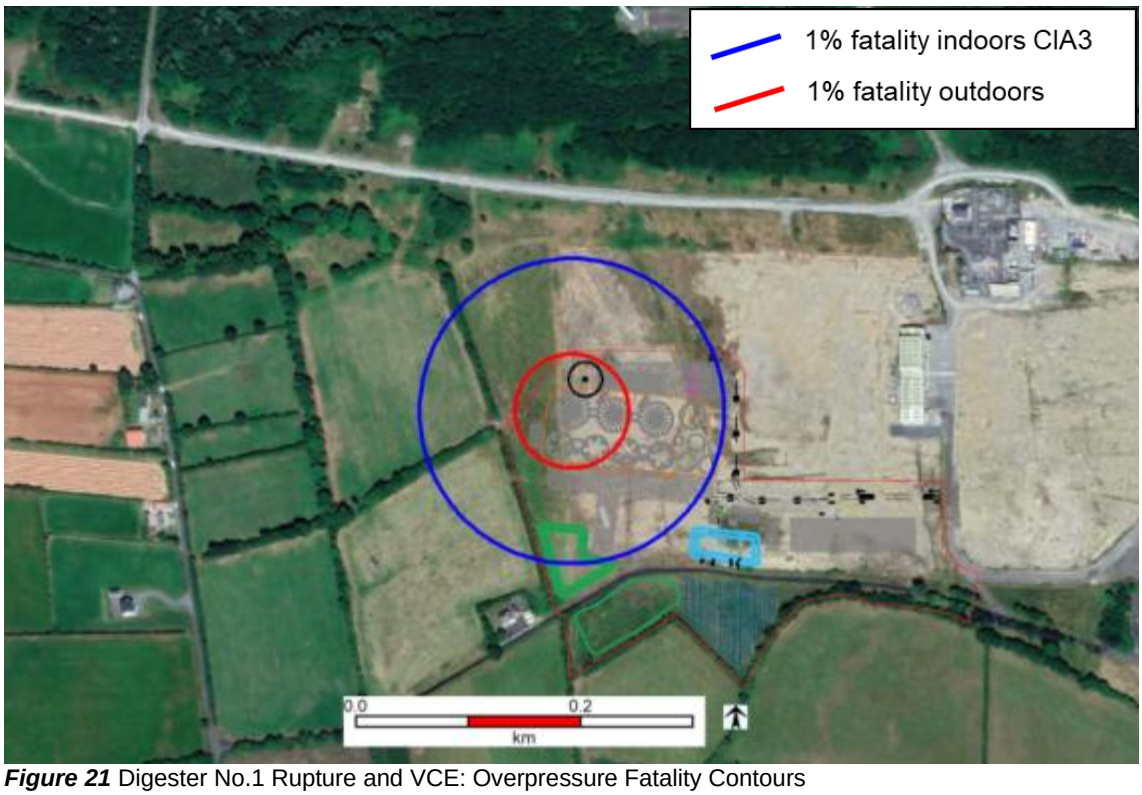


Figure 21 Digester No.1 Rupture and VCE: Overpressure Fatality Contours

It is concluded for a VCE following Instantaneous Rupture of a Secondary Digester:

- The overpressure contour corresponding to 1% fatality outdoors extends over the site COMAH boundary. These areas are unoccupied and fatalities are not expected.

- The overpressure contour corresponding to 1% fatality indoors CIA. Cat. 3 extends over the COMAH site boundary, but does not extend to any off-site occupied building.

9.1.3 Anaerobic Digester Instantaneous Release and Fireball

The HSE fireball model is used in this study. This is a static fireball model and assumes that the fireball is located on the ground with no lift-off.

In the event of an instantaneous release (and direct ignition), the HSE fireball model calculates a fireball radius of 31 m, and a fireball duration is 4.7 s.

Figure 22 illustrates the thermal radiation with distance for a fireball following instantaneous release from a Secondary Digester. Note the same profile for weather categories D5 and F2.

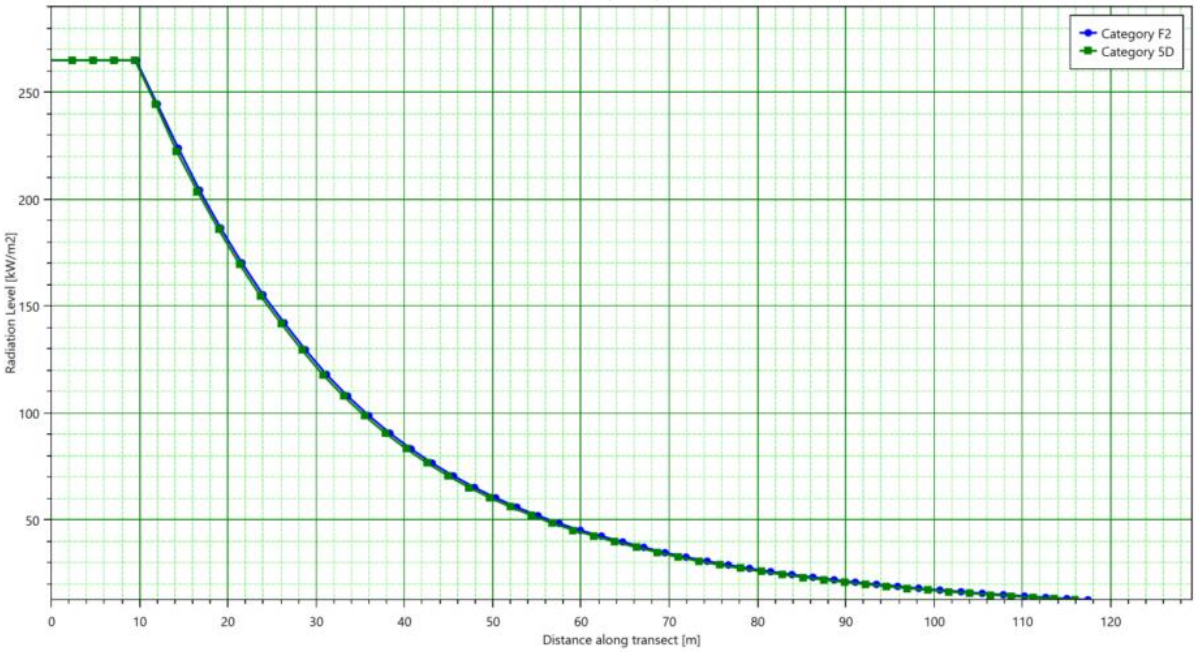


Figure 22 Anaerobic Digester Rupture and Fireball: Thermal Radiation vs. Distance

Figure 23 illustrates thermal dose ($I^{1.33}.t$) based on the exposure duration (t) of the fireball.

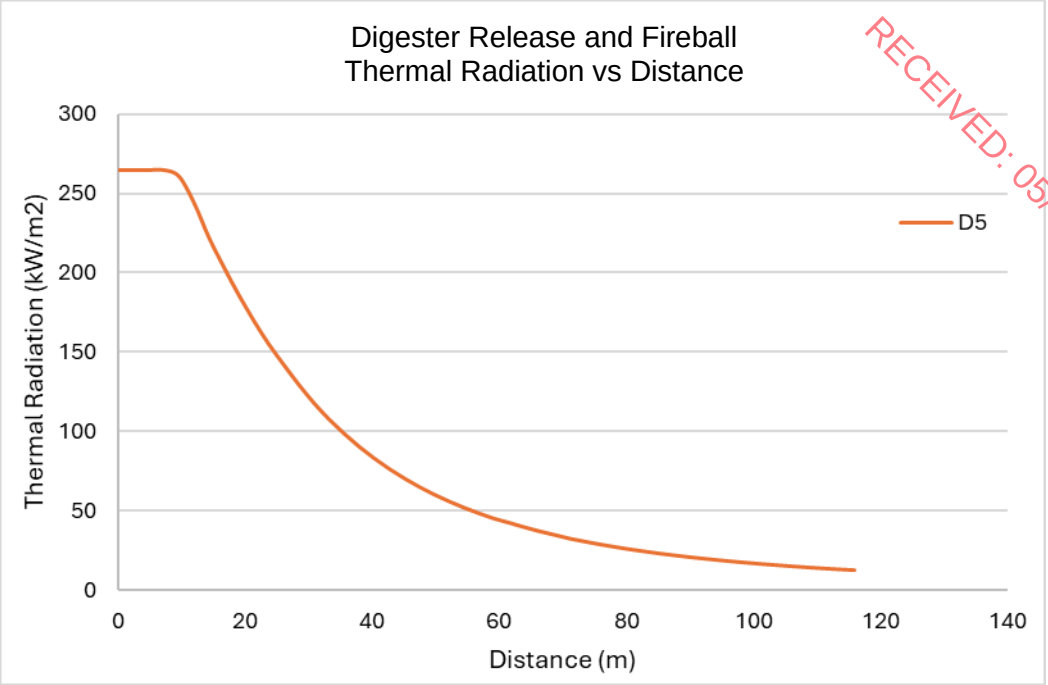


Figure 23 Anaerobic Digester Rupture and Fireball: Thermal Dose vs. Distance

Table 22 details the distances to thermal dose levels associated with specified levels of probability of fatality based on the Eisenberg Probit equation described in Section 4.1.3.

Criterion	Thermal Dose Level	Thermal Radiation	Distance
	TDUs	kW/m^2	(m)
1% fatality (based on a 4.7s fireball)	963	-	53
100% fatality	Fireball radius	-	31
Building protected below this level, 0% fatality probability	-	12.7	117
Building will catch fire quickly, 100% fatality probability	-	25.6	81

Table 22 Anaerobic Digester and Fireball: Distances to Specified Thermal Dose Levels

Figure 24 illustrates the thermal radiation contours corresponding to outdoor lethality levels and Figure 25 illustrates the thermal radiation contours corresponding to indoor lethality levels.

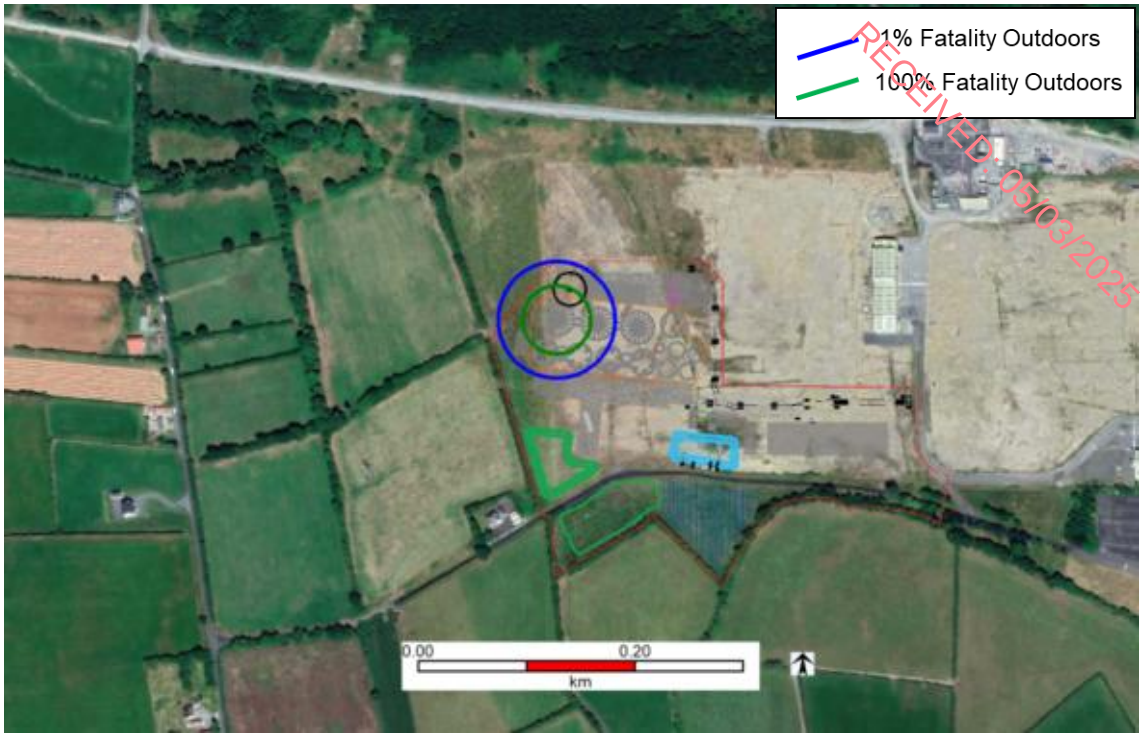


Figure 24 Digester Rupture No.2 and Fireball: Outdoor Lethality Contours

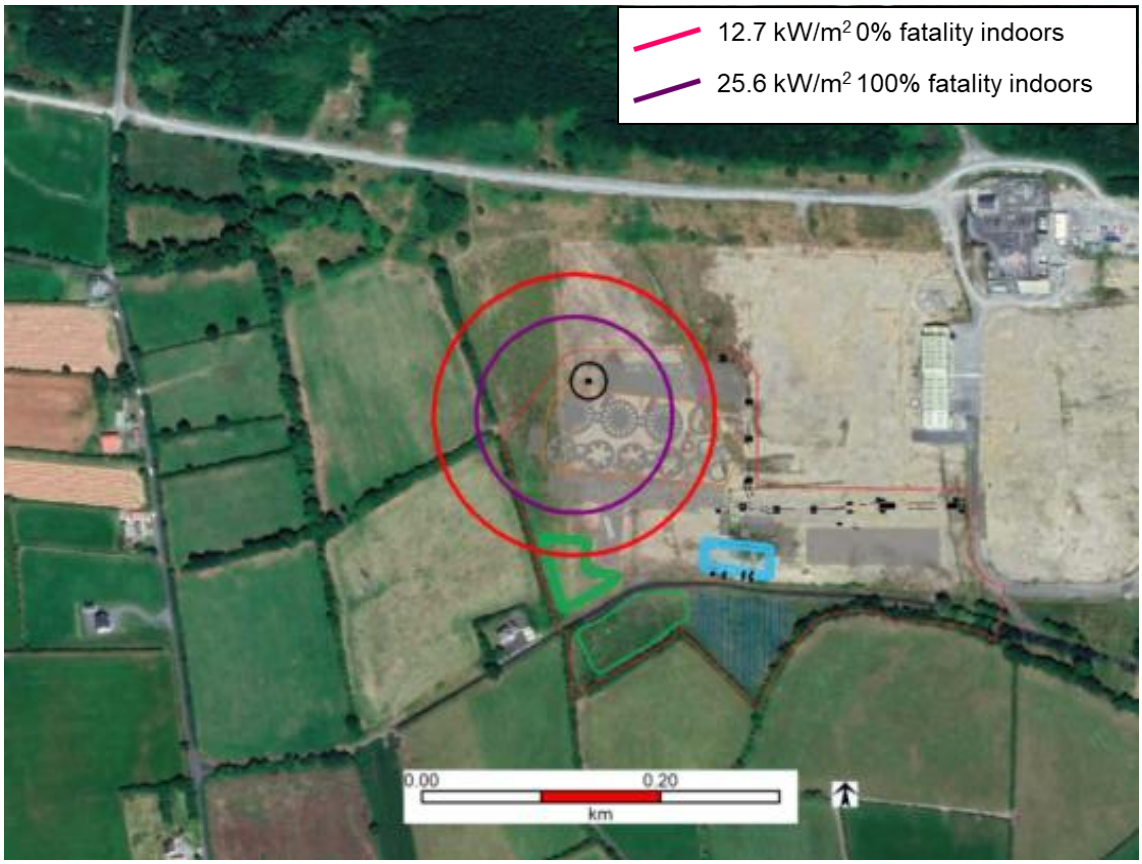


Figure 25 Digester No.2 Rupture and Fireball: Indoor Lethality Contours

It is concluded for a Fireball following Instantaneous Rupture of a Secondary Digester:

- The thermal radiation contour corresponding to 100% fatality outdoors does not extend over the proposed COMAH boundary. The thermal radiation

contours corresponding to 1% fatality outdoors could extend over the COMAH site boundary to the north. This area is unoccupied and fatalities are not expected.

- The thermal radiation contours corresponding to 0% fatality indoors extends over the site COMAH boundary but does not extend to any occupied off-site buildings.

9.1.4 Anaerobic Digester Instantaneous Release: Flash Results

The flash fire envelope was modelled using the unified dispersion model in DNV PHAST Version 9.0 software.

Figure 26 illustrates the flash fire envelope for an Instantaneous Release at a Secondary Digester.

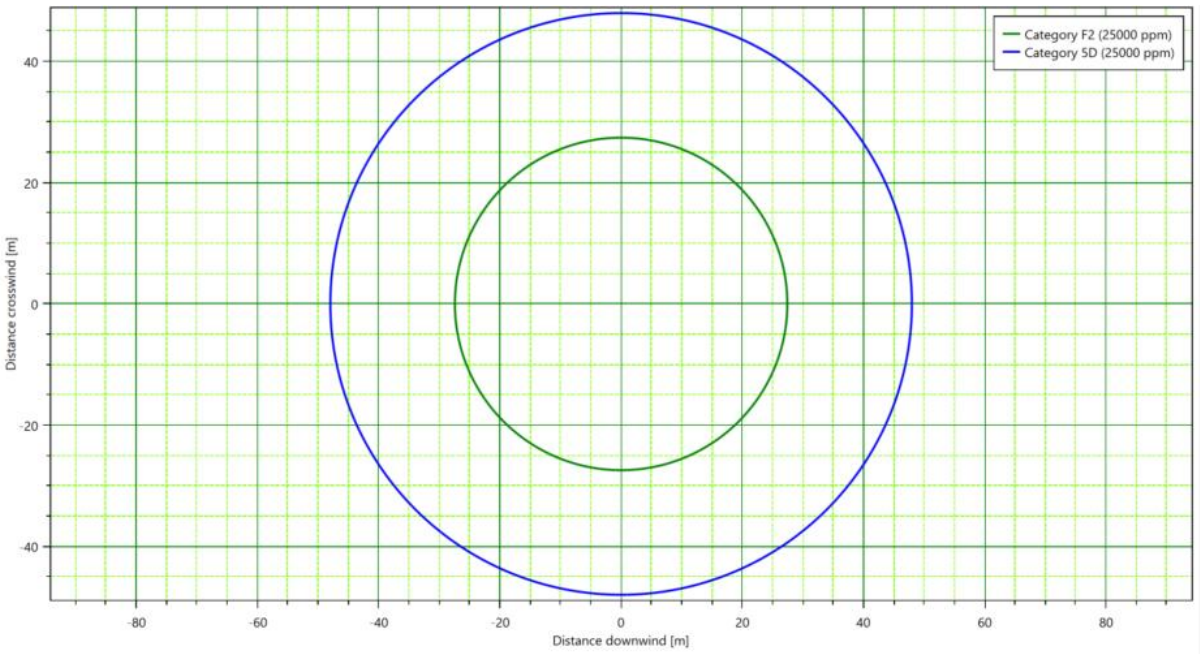


Figure 26 Digester Rupture and Flash Fire: Flash Fire Envelope

The maximum distance of the LFL envelope occurs at a reciever height of 5m where the envelope extends up to 27m for F2 weather conditions and up to 48m for D5 weather conditions.

Figure 26 illustrates the flash fire envelope following an instantaneous release at Secondary Digester No.1.

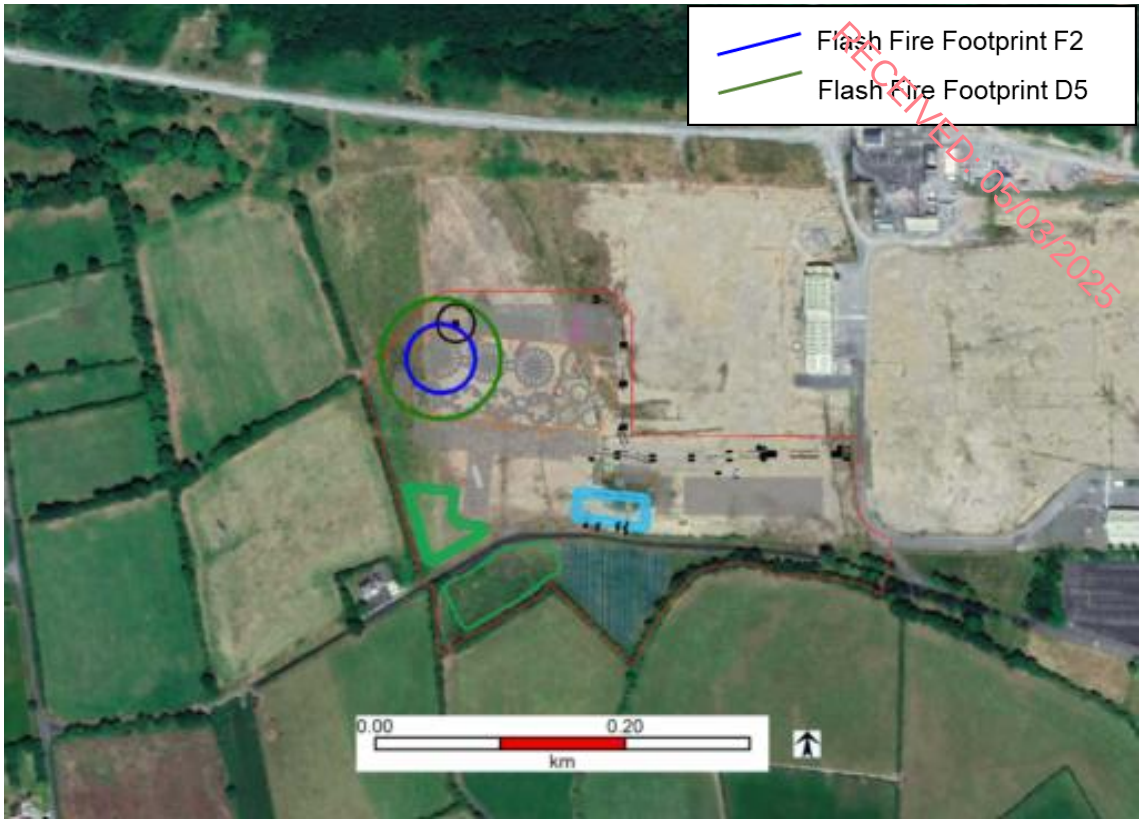


Figure 27 Digester No.1 Rupture and Flash Fire: Flash Fire Envelope

It is concluded for a Flash Fire following Instantaneous Rupture of a Secondary Digester:

- The flash fire envelope, for D5 weather conditions, could extend over the site boundary; however, this area is unoccupied and fatalities are not expected.

9.1.5 Anaerobic Digester Continuous Leak Over 10 Minutes Model Outputs

The Secondary Digesters have a larger capacity and operate at the same pressure and temperature; therefore, the consequences of major accident scenarios at the Secondary Digesters will be reported as a worst-case representative scenario.

9.1.6 Anaerobic Digester Continuous Leak Over 10 Minutes: VCE Results

The TNO Multi Energy model was used to model the overpressure consequences in the event a VCE following release over 10 minutes of a secondary digester tank.

The DNV PHAST Version 9.0 unified dispersion model predicts a maximum flammable mass of 1.0 kg and 1.4 kg for a secondary digester rupture for weather categories D5 and F2 respectively.

Figure 28 illsutrates the overpressure vs distance profile for a VCE following release over 10 minutes at a secondary digester tank.

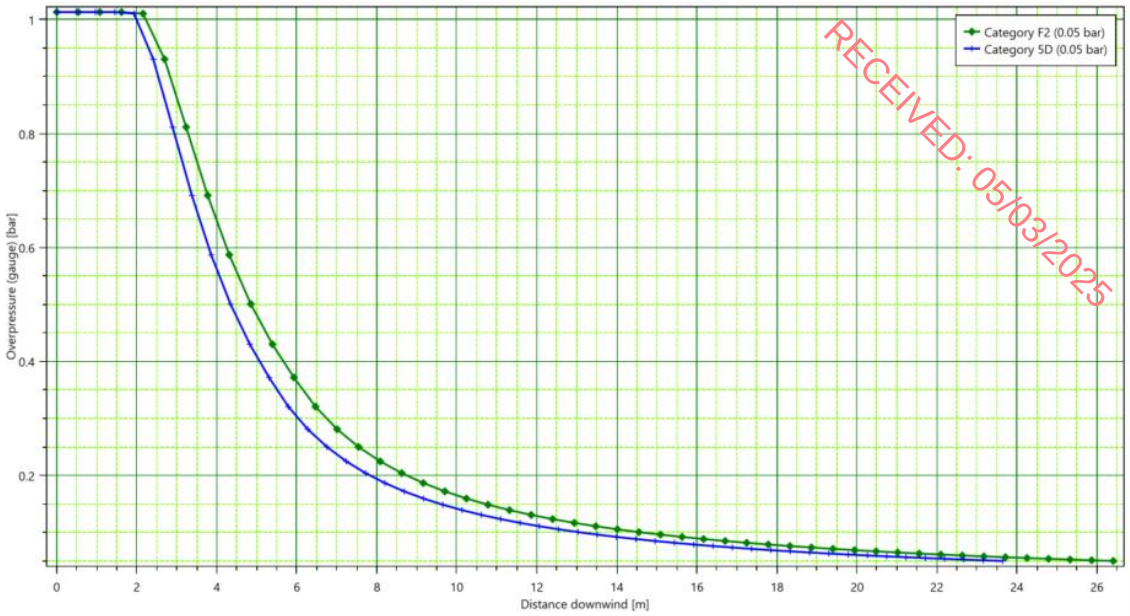


Figure 28 Digester Release over 10 minutes and VCE: Overpressure vs Distance

Table 23 details the distances to specified overpressure endpoints for a VCE following Digester tank release over 10 minutes.

Peak overpressure (mbar)	Consequences	Distance (m)	
		F2	D5
168	1% mortality outdoors	10	9
50	1% mortality indoors CIA Category 3	26	24

Table 23 Digester Release over 10 Minutes and VCE: Distance to Specified Endpoints

Figure 29 illustrates the overpressure contours corresponding to indoor and outdoor fatality following release over 10 minutes of a secondary digester tank and VCE for the worst case weather category (F2).

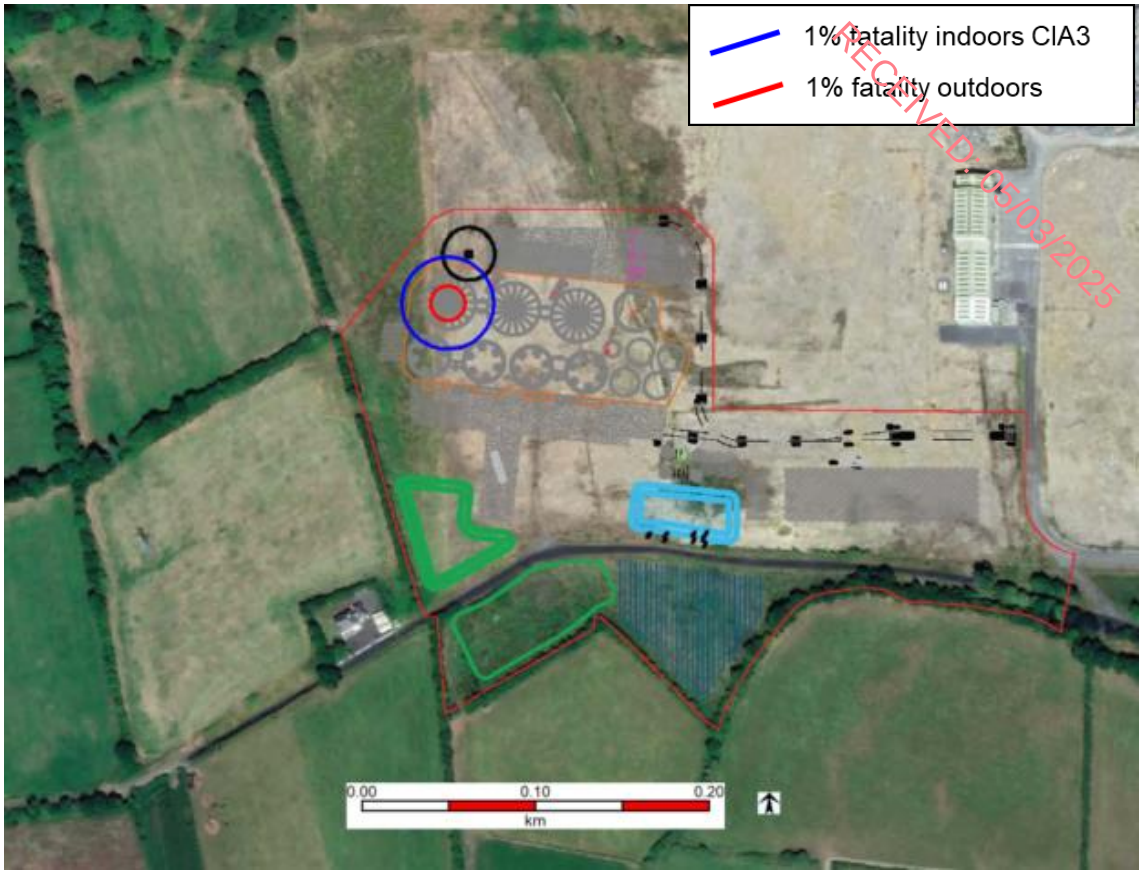


Figure 29 Digester No.1 Rupture and VCE: Distance to Specified Endpoints

It is concluded for a VCE following a release over 10 minutes of a Secondary Digester tank:

- The overpressure contours corresponding to indoor, CIA Cat. 3, and outdoor fatality do not extend over the site boundary.

9.1.7 Anaerobic Digester Release Over 10 Minutes: Jet Fire Results

The (DNV Recommended) jet fire cone model was used to calculate the thermal radiation consequences from a release over 10 minutes from a digester tank.

Figure 30 illustrates the thermal radiation vs distance profile for a jet fire following release over 10 minutes from a secondary digester at a receiver height of 1.5m.

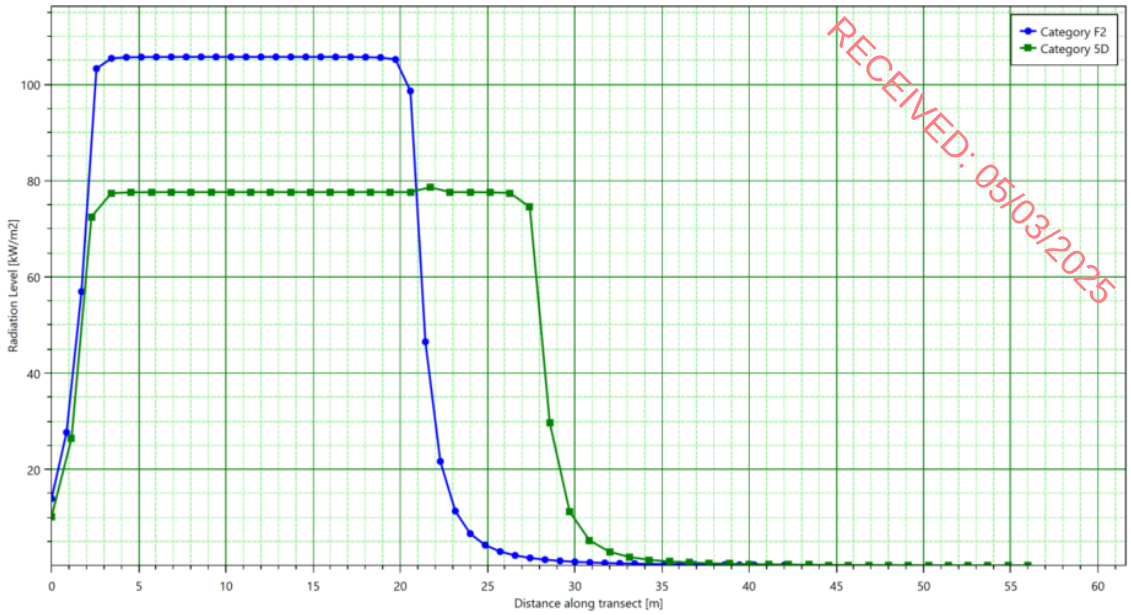


Figure 30 Digester Release over 10 Minutes and Jet Fire: Thermal Radiation vs Distance

Table 24 details the distances to specified thermal radiation endpoints.

Consequence	Thermal Radiation (kW/m^2)	Distance (m)	
		D5	F2
1% fatality outdoors	8.02	30	24
0% fatality indoors	12.7	30	23
100% fatality indoors	25.6	28	22

Table 24 Digester Release over 10 Minutes and Jet Fire: Distances to Specified Thermal Radiation Endpoints

Figure 31 illustrates the thermal radiation contour corresponding to 1% fatality outdoors for the worst-case weather category (D5). The jet fire contour is dependent on the release direction from the tank. The effect area contour illustrates the thermal radiation footprint for all release directions.

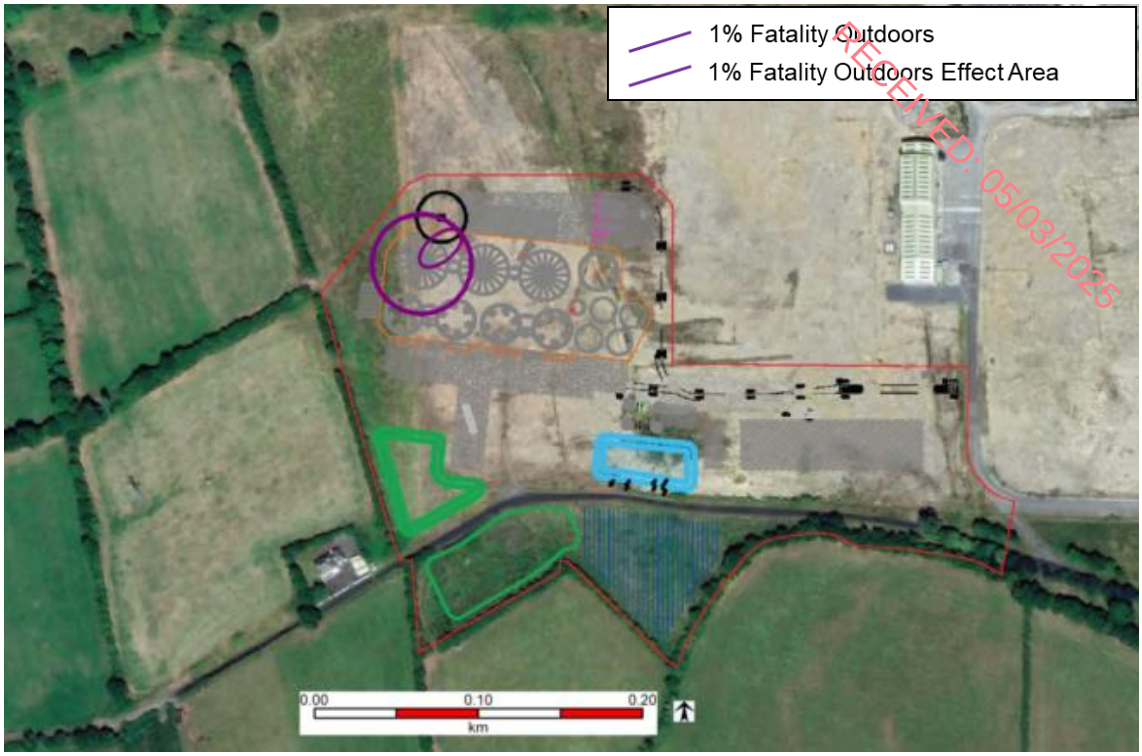


Figure 31 Digester Release over 10 Minutes and Jet Fire: Thermal Radiation Contour Corresponding to 1% Fatality Outdoors

It is concluded for a Jet Fire following release over 10 minutes from a Secondary Digester tank:

- The thermal radiation corresponding to 1% fatality outdoors does not extend over the site boundary and no off-site fatalities are expected.

9.1.8 Anaerobic Digester Release Over 10 Minutes: Flash Fire Results

The flash fire envelope was modelled using the unified dispersion model in DNV PHAST Version 9.0 software.

The maximum distance of the LFL envelope occurs at a reciever height of 4.5m, for weather category F2, where the envelope extends up to 22m. The maximum distance of the LFL envelope, for weather category D5, occurs at a reciever height of 3.5m where the envelope extends up to 19m.

Figure 32 illustrates the flash fire envelope for a Release over 10 minutes at a Secondary Digester for the worst-case weather category (F2).

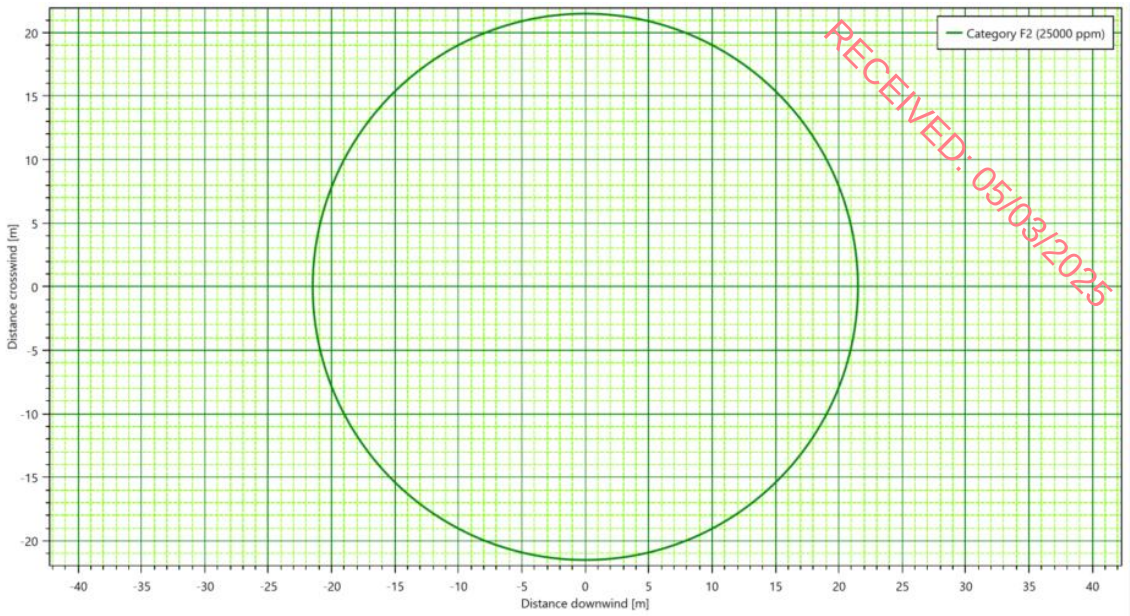


Figure 32 Digester Release over 10 Minutes and Flash Fire: Flash Fire Envelope

It is concluded that there are no off-site consequences following a release over 10 minutes from a secondary digester.

9.1.9 Anaerobic Digester Release Over 10 Minutes: Pool Fire Results

There DNV Phast Discharge and Dispersion model calculates that a pool fire does not occur following a release over 10 minutes from a secondary digester tank.

10.0 ASSESSMENT OF MAJOR ACCIDENT HAZARDS AT BIOGAS PIPELINE

The model inputs were provided by the project engineers, and these will be confirmed during the detailed engineering design phase. Any significant change to these inputs will be assessed appropriately.

10.1 Biogas Pipeline Model Inputs

There are 2 No. biogas pipelines on-site. The pipeline from the AD tanks to the Energy Building is *ca.* 100 m long and has a diameter of 250mm. The pipeline from the AD tanks to the biogas upgrading is *ca.* 88 m long and has a diameter of 250 mm. The consequences of a release from the 100m pipeline will be shown as a worst-case representative of a pipeline release.

Phast Version 9.0 short pipeline model was used to model a release of Biogas following pipeline release.

The pipeline model inputs are detailed in Table 25.

Parameter	Pipeline rupture	Source/Assumption
Scenario	Pipeline rupture	-
Material	Methane	Representative of Biogas
Pipeline diameter	250 mm	Project Engineer
Hole Size	250 mm 25 mm	Pipeline rupture Pipeline Leak (0.1D)
Length of pipeline	100 m	Project Engineer
Pressure	10 mbar (gauge)	Project engineer
Averaging time	Flammable – 18.75 s	DNV PHAST
Short Duration Effects	30 second cut off time for flammable effects	Assumed
Exposure duration	60 s	HSA recommended (HSA, 2023)
Release height	7 m	Above ground pipeline – 7m high pipe rack
Release direction	Vertical and Horizontal	HSA TLUP and HSA requested
Effect height	1.5 m	Average height of person
Wind speed	5 m/s 2 m/s	Recommended by HSA as representative modelling conditions
Pasquill Stability Factor	D (daytime conditions) F (nighttime conditions)	
Temperature	10 degC (F2) 15 degC (D5)	HSA TLUP (HSA 2023)

Table 25 Biogas Pipeline Release: Model Inputs

10.2 Biogas Pipeline Rupture Predicted Phenomena

The unified dispersion model in DNV PHAST Version 9.0 predicts the following phenomena for each release scenario:

- Pipeline Rupture (vertical and horizontal): Jet fire and VCE

The unified dispersion model in DNV PHAST Version 9.0 does not predict that there will be a buildup of flammable material sufficient to result in any flash fire or fireball consequences.

The unified dispersion model in DNV PHAST Version 9.0 does not predict that there will be any consequences associated with a leak (0.1 *x* D) from the biogas pipeline.

10.3 Biogas Pipeline Rupture: Jet Fire Model Outputs

The jet fire cone model in DNV PHAST Version 9.0 consequence modelling software was used to model the consequences of a jet fire.

Figure 33 and Figure 34 illustrate the thermal radiation vs distance profile for a horizontal and vertical rupture (respectively), for a receiver height of 1.5m.

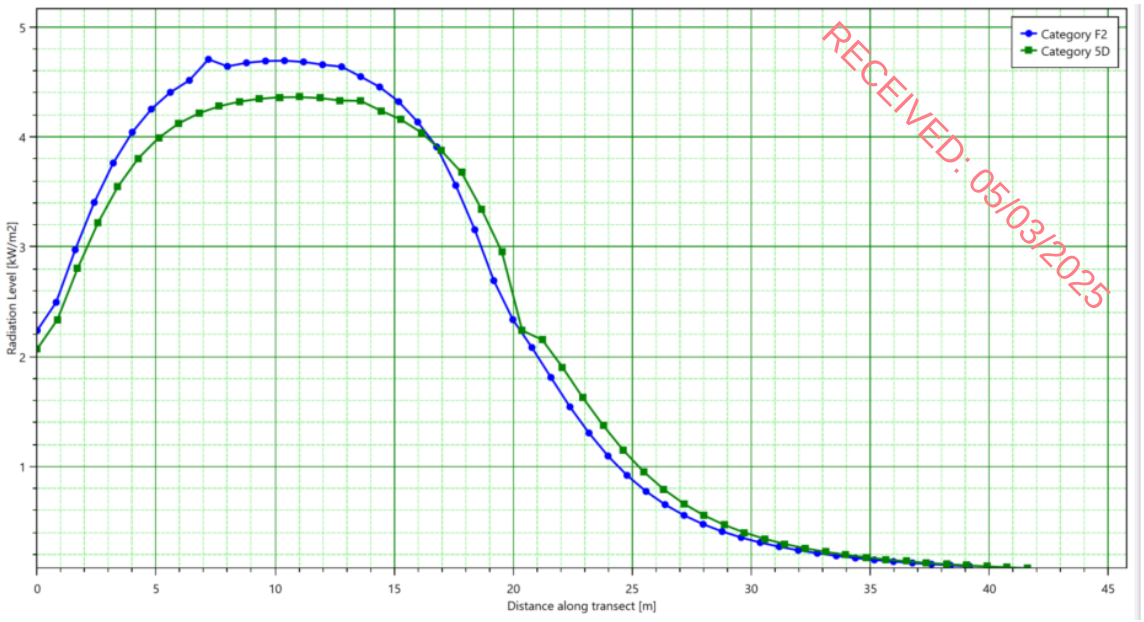


Figure 33 Biogas Pipeline Horizontal Release and Jet Fire: Thermal Radiation vs Distance

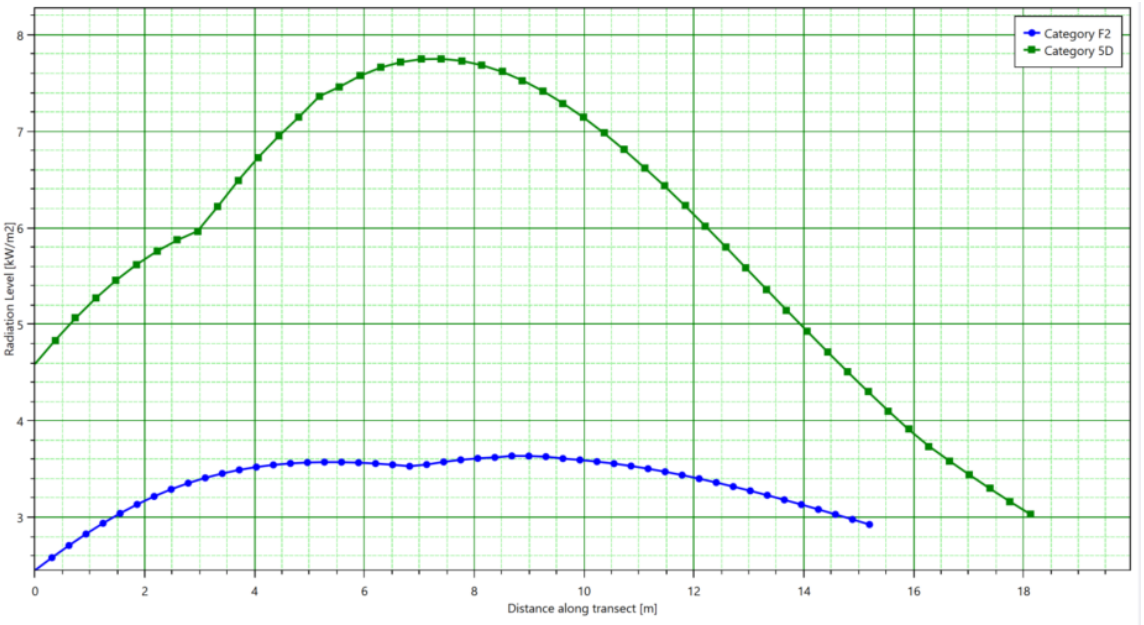


Figure 34 Biogas Pipeline Vertical Release and Jet Fire: Thermal Radiation vs Distance

It is concluded that in the event of a jet fire following a release from a Biogas Pipeline:

- The thermal radiation level corresponding to 1% mortality outdoors, is not reached at a receiver height of 1.5m. There are no expected off-site consequences.

10.4 Biogas Pipeline Rupture: VCE Model Outputs

The TNO Multi Energy model was used to model the overpressure consequences in the event a VCE following a rupture in the Biogas pipeline.

The DNV PHAST Version 9.0 unified dispersion model predicts a maximum flammable mass of 0.45 kg / 0.65 kg for a horizontal release, D5 / F2 weather

conditions respectively, and a maximum flammable mass of 0.32 kg / 0.49 kg, D5 / F2 weather conditions respectively, for a vertical release.

Figure 35 illustrates the overpressure vs distance profile for a VCE following a horizontal pipeline release, at a receiver height of 1.5m.

Figure 36 illustrates the overpressure vs distance profile for a VCE following a vertical pipeline release, at a receiver height of 1.5m.

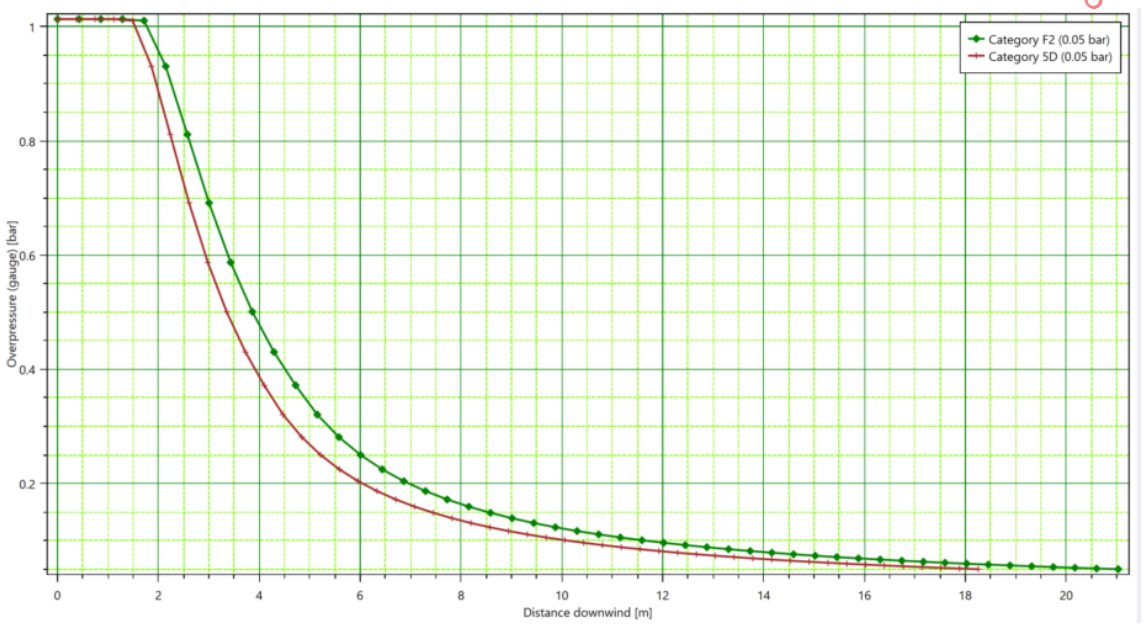


Figure 35 Biogas Pipeline Horizontal Release and VCE: Overpressure vs Distance

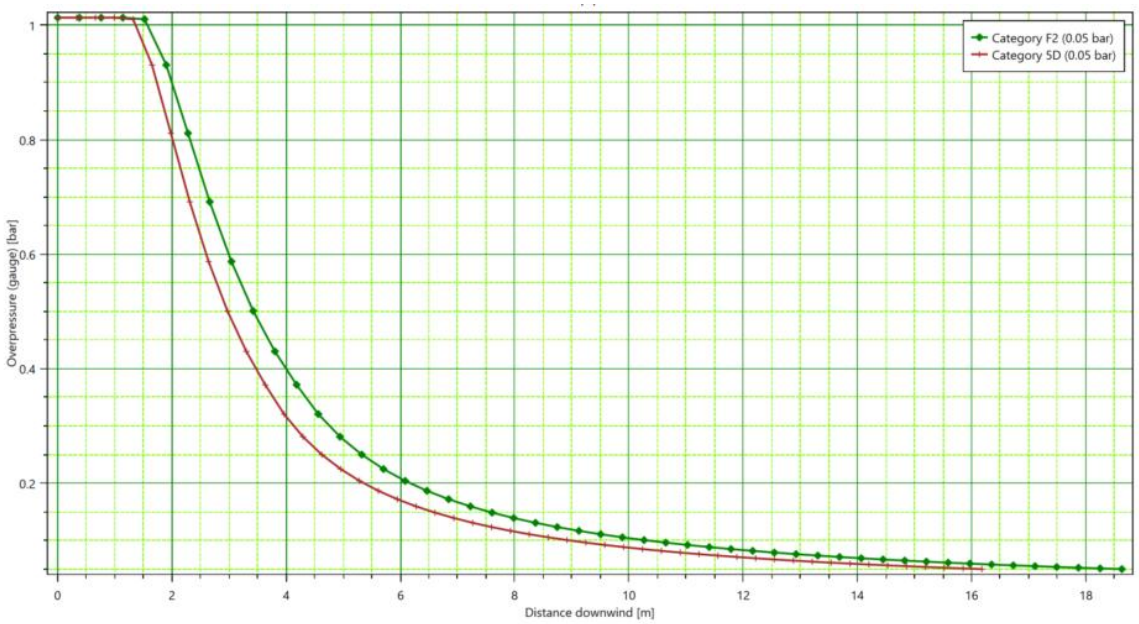


Figure 36 Biogas Pipeline Vertical Release and VCE: Overpressure vs Distance

Table 26 and Table 27 detail the distances to specified overpressure endpoints for a VCE following horizontal and vertical release at the biogas pipeline (respectively).

Peak overpressure (mbar)	Consequences	Distance (m)	
		F2	D5
168	1% mortality outdoors	8	7
50	1% mortality indoors CIA Category 3	20	18

Table 26 Biogas Pipeline Horizontal Release and VCE: Distances to Specified Overpressures

Peak overpressure (mbar)	Consequences	Distance (m)	
		F2	D5
168	1% mortality outdoors	7	6
50	1% mortality indoors CIA Category 3	19	16

Table 27 Biogas Pipeline Vertical Release and VCE: Distances to Specified Overpressures

Figure 37 illustrates the overpressure contours corresponding to indoor and outdoor fatality following biogas pipeline rupture and VCE for the worst-case weather category (F2).

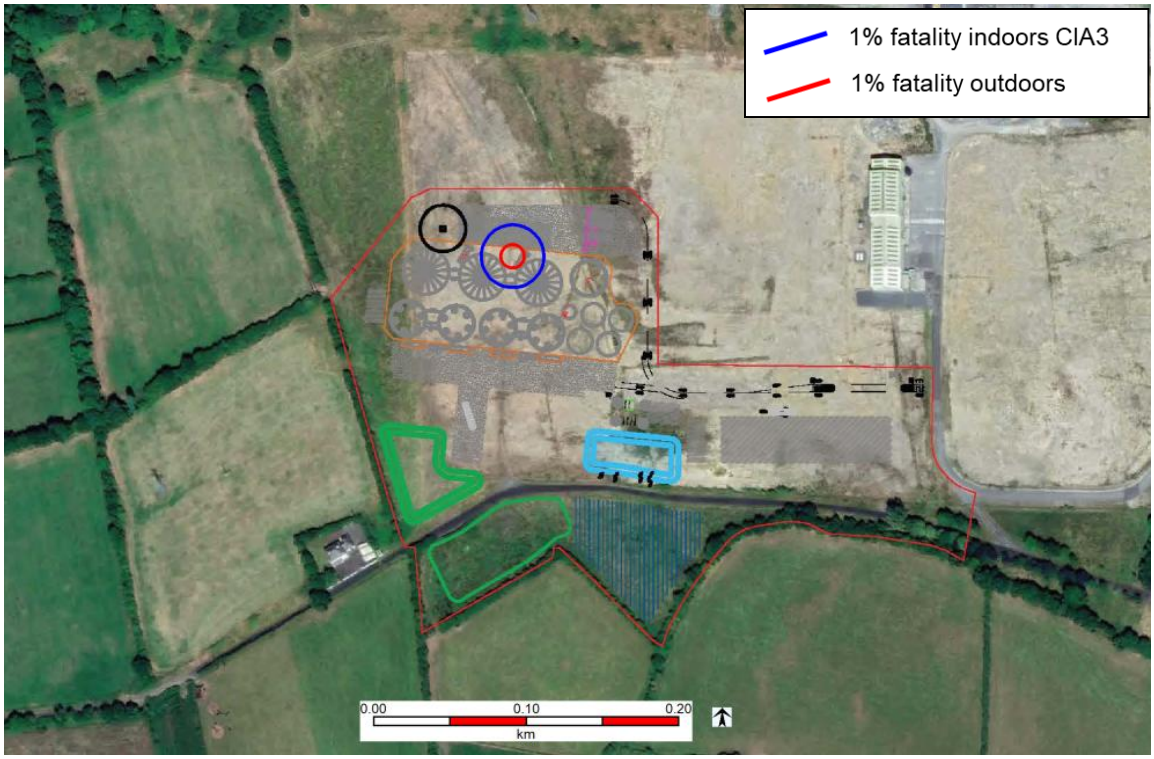


Figure 37 Biogas Pipeline Rupture and VCE: Distance to Specified Endpoints

It is concluded that in the event of a VCE following a release from a Biogas Pipeline, the contours corresponding to 1% fatality outdoors and 1% fatality indoors CIA Cat. 3 do not extend over the site boundary.

11.0 EVENT FREQUENCIES

11.1 Bay Gate Trailer VCE

Event frequencies for cylinder releases are as specified in HSA guidance (HSA, 2023) Table 65.

There are 114 No. cylinders in each trailer. Therefore, the frequency of release within a trailer is as follows:

- Instantaneous release: 114 *x* 5.0E-07/year = 5.7E-05/year
- Release through 3.3mm hole: 114 *x* 5.0E-07/year = 5.7E-05/year

The ignition probability is taken as 100%. Therefore, the likelihood of a VCE at a Bay Gate Trailer is 1.14E-04 per year per trailer. There are up to 2 No. trailer on-site, therefore, the total frequency of a VCE at a Bay Gate Trailer is 2.28E-04 per year.

11.2 Bay Trailer Filling Station

Table 25 of the HSA's TLUP guidance document (HSA, 2023) states a frequency of 4.0E-06 per hour for a rupture of a loading hose and a frequency of 4E-05 per hour for a leak of a loading hose. It is anticipated that 2 No. bay trailers will be filled per day, 365 days per year, and it could take up to 11.4 hours per fill.

Table 28 details the filling station event frequencies for 1 no. filling stations.

Installation	LOC scenario	Modifier (no. hours)	Consequence	Value	Frequency (per year)
Filling Station	Rupture of Loading Hose (4E-06 per hour)	2920	Jet fire	0.1	1.66E-03
			VCE	0.54	8.99E-03
			Flash fire	0.36	5.99E-03
	Leak of Loading Hose (4E-05 per hour)	2920	Jet fire	0.1	1.66E-02
			VCE	0.54	8.99E-02
			Flash fire	0.36	5.99E-02

Table 28 Filling Station Release Event Frequencies

It is anticipated that 2 No. bay trailers will be filled per day, 365 days per year, and it could take up to 11.4 hours per fill. Therefore, the frequencies listed in Table 28 will be applied twice in the risk calculation of the site.

11.3 Energy Centre VCE

The HSA specifies a likelihood of 5E-06 per year when assessing an instantaneous release from a process vessel; for modelling purposes, the gas generator is 1 No. of process equipment. A 100% ignition probability indoors is to be assumed.

In order for there to be a build-up of natural gas in the Energy Centre, the leak detection and blocking system has to fail. The purple book (2005) states that the failure on demand of a blocking system, such as the one proposed, is 0.01 per demand. This will be applied to the 'release through a 10mm pipe' scenario as a mitigation measure.

Table 29 details the events and corresponding frequencies that could lead to a VCE within the Energy Centre building.

Installation	LOC scenario	LOC frequency		Consequence	Conditional Prob.	Event freq. (per turbine)
Indoor equipment	Equipment rupture/leak	5E-06	/yr	VCE	-	5E-06
Indoor equipment	Release over 10 minutes	1E-05	/yr	VCE	-	1E-05
Indoor equipment	Release through 10mm pipe	5E-04	/yr	VCE	0.01	5E-06

Table 29 Energy Centre Enclosure VCE Event Frequency

Therefore, the total frequency for a VCE within the Energy Centre is **2.0E-05 per year.**

11.4 Compressor VCE

The HSA specifies a likelihood of 5E-06 per year when assessing an instantaneous release from a process vessel; for modelling purposes, each compressor is 1 No. of process equipment. A 100% ignition probability indoors is to be assumed.

In order for there to be a build-up of natural gas in the enclosure, the leak detection and blocking system has to fail. The purple book (2005) states that the failure on demand of a blocking system, such as the one proposed, is 0.01 per demand. This will be applied to the 'release through a 10mm pipe' scenario as a mitigation measure.

Table 30 details the events and corresponding frequencies that could lead to a VCE within the compressor enclosure.

Installation	LOC scenario	LOC frequency		Consequence	Conditional Prob.	Event freq. (per turbine)
Indoor equipment	Equipment rupture/leak	5E-06	/yr	VCE	-	5E-06
Indoor equipment	Release over 10 minutes	1E-05	/yr	VCE	-	1E-05
Indoor equipment	Release through 10mm pipe	5E-04	/yr	VCE	0.01	5E-06

Table 30 Compressor Enclosure VCE Event Frequency

The total frequency for a VCE within a compressor is **2.0E-05 per year per compressor.** There are 2 No. compressors at the proposed development. Therefore, the total frequency for a VCE at a Compressor at the proposed development is 4.0E-05 per year.

11.5 Anaerobic Digester

Table 34 of the HSA's TLUP guidelines (HSA, 2023) gives the following frequencies for each digester.

Installation	LOC scenario	Consequence	Frequency (per year)
Anaerobic Digester Tank	Instantaneous failure (per tank)	Fireball	4.50E-07
		VCE	1.64E-06
		Flash fire	2.46E-06
	Continuous leak over 10 minutes (per tank)	Jet fire	4.50E-07
		VCE	1.64E-06
		Flash fire	2.46E-06
		Pool fire	4.55E-07

Table 31 Anaerobic Digester Event Frequencies

There are 3 No. digester tanks that store biogas at the proposed development. The frequencies listed in Table 31 will be applied at each tank.

11.6 Biogas Pipeline

Table 40 of the HSA's TLUP guidelines (HSA, 2023) gives the following pipeline loss of containment frequencies for overground pipelines within an establishment of diameter <75 mm:

- Pipeline rupture frequency: 1E-06 per m per year

Table 32 details the event frequencies for the Biogas pipelines at the proposed development.

Installation	LOC scenario	LOC frequency		Modifier	LOC frequency /year	Consequence	Conditional probability	Event frequency (per year)
AD to Energy Centre	Pipeline rupture	1.00E-06	/m/yr	100	1.00E-04	Jet fire	0.1	1.00E-05
						VCE	0.54	5.40E-05
						Flash fire	0.36	3.60E-05
	Pipeline Leak	5.00E-06	/m/yr	100	5.00E-04	Jet fire	0.1	5.00E-05
						VCE	0.54	2.70E-04
						Flash fire	0.36	1.80E-04
AD to Biogas Upgrading	Pipeline rupture	1.00E-06	/m/yr	88	8.80E-05	Jet fire	0.1	8.80E-06
						VCE	0.54	7.75E-05
						Flash fire	0.36	3.17E-05
	Pipeline Leak	5.00E-06	/m/yr	88	4.40E-04	Jet fire	0.1	4.40E-05
						VCE	0.54	2.38E-04
						Flash fire	0.36	1.58E-04

Table 32 Biogas Pipeline Event Frequencies

12.0 LAND USE PLANNING RISK CONTOURS

Gexcon RiskCurves Version 12.4.0 modelling software was used to model the cumulative risk contours for the proposed development.

The site risk model inputs are as follows:

- The consequences arising from major accident scenarios.
- Event frequencies,
- Gurteen Met Station wind speed and frequency data (see Section 4.5)
- Consequence results from major accident hazards

The HSA specify that D5 conditions are assumed to occur 80% of the time, with F2 occurring for the remaining 20%. The TLUP states that persons are assumed to be indoors 90% of the time and outdoors 10% of the time.

Table 33 details the matrix that is used by the HSA to advise on suitable development for technical LUP purposes:

Level of Sensitivity	Inner Zone (Zone 1)	Middle Zone (Zone 2)	Outer Zone (Zone 3)
Level 1	✓	✓	✓
Level 2	✗	✓	✓
Level 3	✗	✗	✓
Level 4	✗	✗	✗

Table 33 LUP Matrix

The HSA has defined the boundaries of the Inner, Middle and Outer Land Use Planning (LUP) zones as:

1E-05/year	Risk of fatality for Inner Zone (Zone 1) boundary
1E-06/year	Risk of fatality for Middle Zone (Zone 2) boundary
1E-07/year	Risk of fatality for Outer Zone (Zone 3) boundary

The TLUP guidelines (HSA, 2023) state the maximum tolerable risk to a member of the public is 1E-06 per year and the maximum tolerable risk to a person at an off-site work location is 5E-06 per year.

Figure 38 illustrates individual risk of fatality contours based on a hypothetical residential population, outdoors for 10% of the time and indoors in buildings of CIA Category 3 overpressure vulnerability (typical residential dwelling) for 90% of the time.

Figure 38 Land Use Planning Risk-based Contours

The following is concluded for the individual risk arising from the proposed development:

- The individual risk contours corresponding to the inner, middle and outer zone extends over the proposed development boundary. There are no occupied buildings in these areas.
- The land use planning contours do not extend to the nearest residential development and do not extend to the Irish Bioeconomy and Acorn Recycling Building.
- The individual risk contour corresponding to the outer zone extends to the Substation Access road. Personnel are only present at the Substation for routine maintenance; therefore, this road is not commonly used. Therefore, the level of individual risk at this location is acceptable.

Figure 39 illustrates location based individual risk contours for new COMAH establishments based on a hypothetical residential population, outdoors for 10% of

the time and indoors in buildings of CIA Category 3 overpressure vulnerability (typical residential dwelling) for 90% of the time.

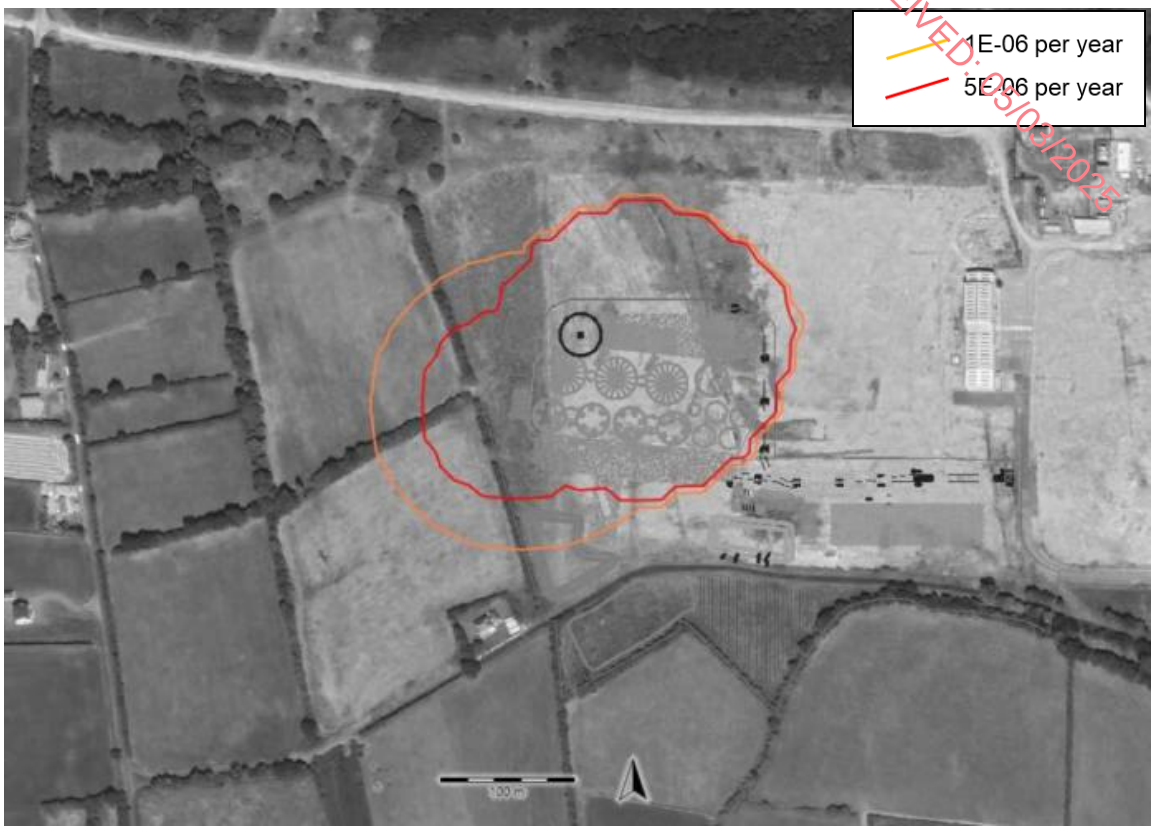


Figure 39 Individual Location-Based Risk Contours for New Establishments

It is concluded that the individual location-based risk contours do not extend to an off-site work location or to an area where the public are present. It is also concluded that the Land Use Planning zones do not extend to sensitive receptors. Therefore, it is concluded that the criteria in Table 1 of the *Guidance on Technical Land Use Planning advice (HSA, 2023)* is met and level of off-site risk at the proposed development is acceptable.

13.0 CONCLUSION

AWN Consulting Ltd. were requested by Purser, on behalf of Nua Bioenergy Limited, to complete a land use planning assessment for a proposed Anaerobic Digester facility located at Lisheen Mine, Co. Tipperary.

The proposed development will be classified as a “lower tier” COMAH establishment and as such will be subject to the provisions of the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, S.I. No. 209 of 2015.

The Land Use Planning assessment was completed in accordance with guidance published by the HSA (HSA, 2023). The following major accident scenarios were assessed:

Installation	LOC scenario	Consequence/Event
Indoor equipment (Energy Centre)	Instantaneous failure	VCE
	Continuous leak over 10 minutes	VCE
	10 mm pipe leak over 10 minutes	VCE
Indoor equipment (Compressor)	Instantaneous failure	VCE
	Continuous leak over 10 minutes	VCE
	10 mm pipe leak over 10 minutes	VCE
Indoor equipment (Bay Trailer)	Instantaneous failure	VCE
	Loss of entire contents	VCE
Biogas Pipeline	Rupture of Pipeline	Fireball/Jet fire
		VCE
		Flash fire
	Pipeline Leak of 0.1D	Fireball/Jet fire
		VCE
		Flash fire
Anaerobic Digester Tanks	Instantaneous Failure	Fireball
		VCE
		Flash fire
	Continuous Leak over 10 minutes	Jet fire
		VCE
		Flash fire
		Pool fire
Bay Trailer Refilling	Rupture of unloading hose	Jet fire
		VCE
		Flash fire
	Leak of unloading hose of 10% of diameter	Jet fire
		VCE
		Flash fire

Major Accidents to the Environment

There are no substances stored on site that have environmental hazard phrases. Therefore, a major accident to the environment is not considered in the study.

Land Use Planning Contours

Figure 40 illustrates individual risk of fatality contours based on a hypothetical residential population, outdoors for 10% of the time and indoors in buildings of CIA Category 3 overpressure vulnerability (typical residential dwelling) for 90% of the time.

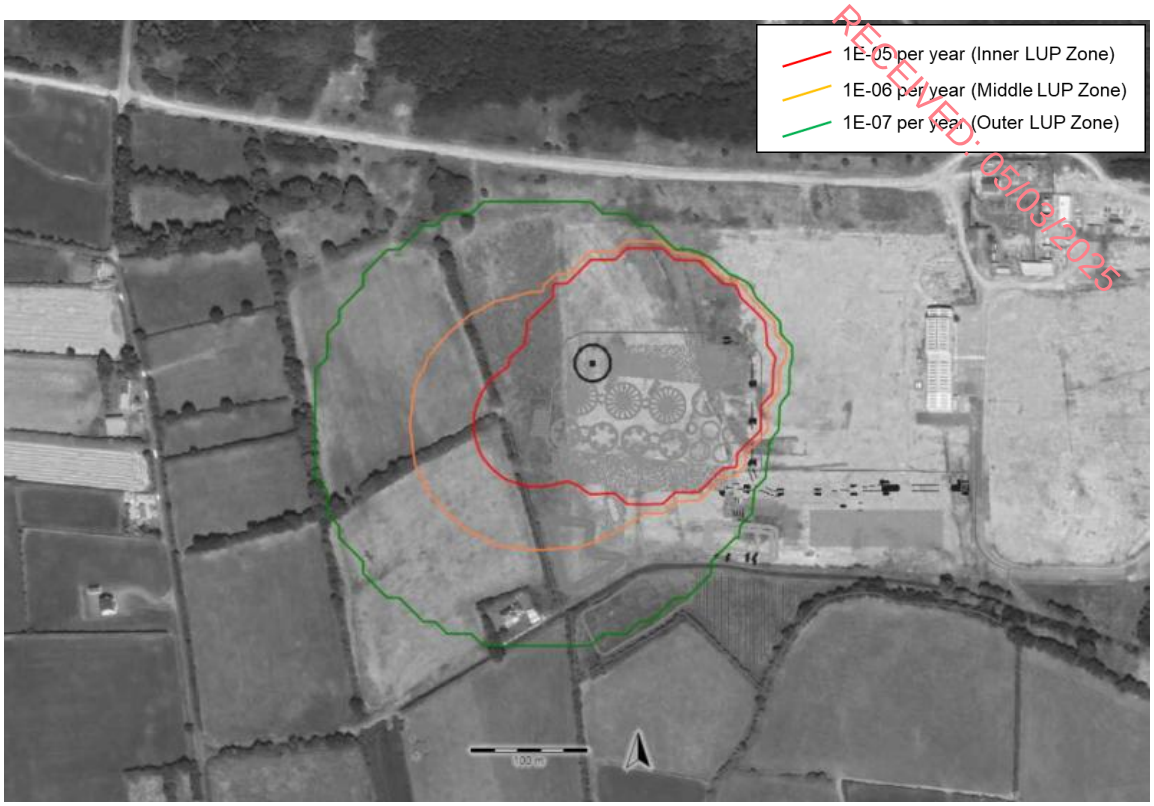


Figure 40 Land Use Planning Risk-based Contours

The following is concluded for the individual risk arising from the proposed development:

- The individual risk contours corresponding to the inner, middle and outer zone extends over the proposed development boundary. There are no occupied buildings in these areas.
- The land use planning contours do not extend to the nearest residential development and do not extend to the Irish Bioeconomy and Acorn Recycling Building.
- The individual risk contour corresponding to the outer zone extends to the Substation Access road. Personnel are only present at the Substation for routine maintenance; therefore, this road is not commonly used. Therefore, the level of individual risk at this location is acceptable.

Figure 41 illustrates location based individual risk contours for new COMAH establishments based on a hypothetical residential population, outdoors for 10% of the time and indoors in buildings of CIA Category 3 overpressure vulnerability (typical residential dwelling) for 90% of the time.

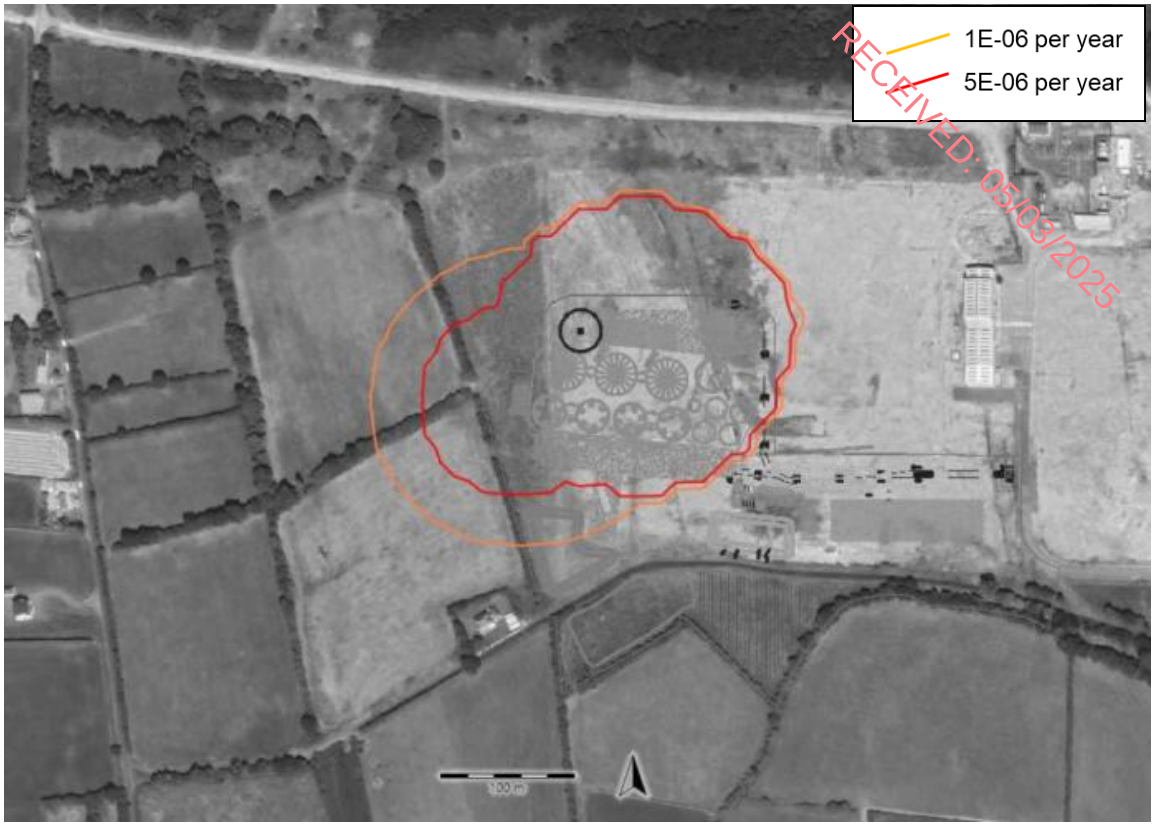


Figure 41 Individual Location-Based Risk Contours for New Establishments

It is concluded that the individual location-based risk contours do not extend to an off-site work location or to an area where the public are present. It is also concluded that the Land Use Planning zones do not extend to sensitive receptors. Therefore, it is concluded that the criteria in Table 1 of the *Guidance on Technical Land Use Planning advice (HSA, 2023)* is met and level of off-site risk at the proposed development is acceptable.

Figure 42 illustrates the individual risk contour corresponding to 1E-09 per year (1 in-a-billion). This is the level of individual risk the HSA have requested for new establishments as a proposed consultation distance.

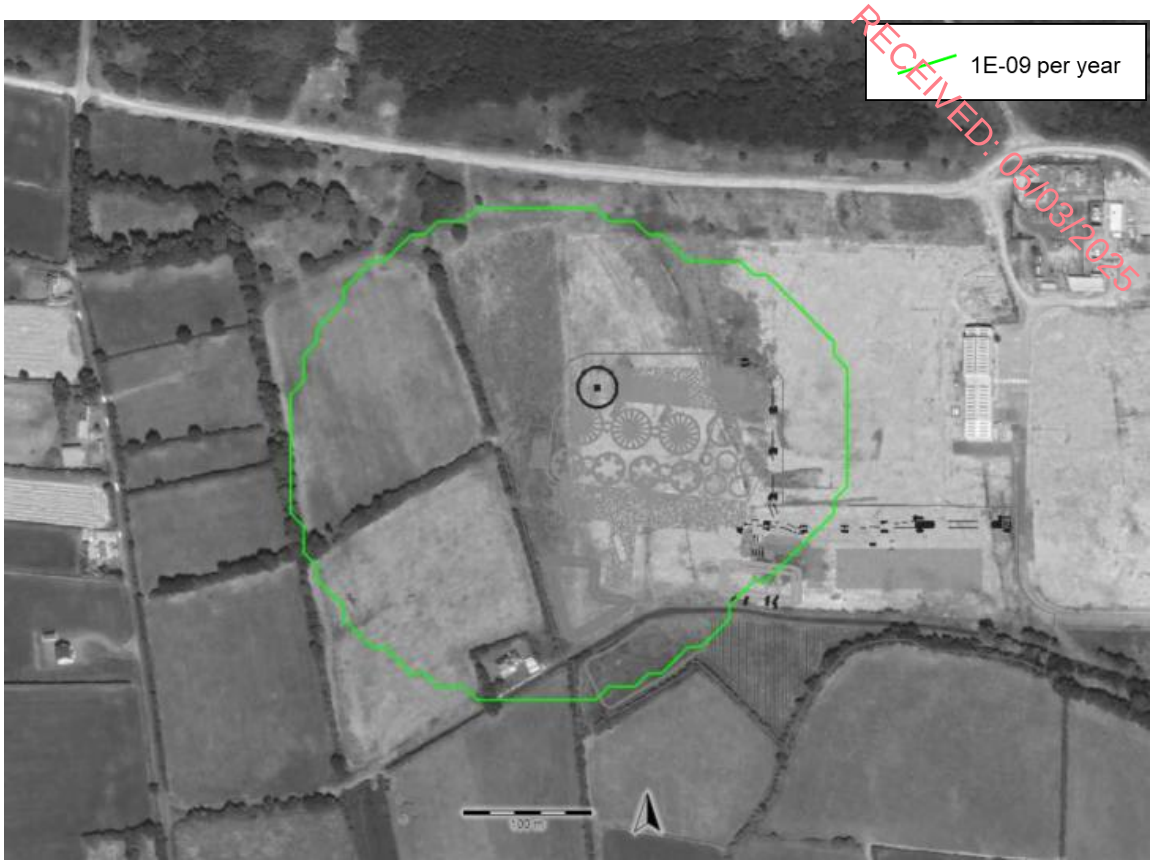


Figure 42 Proposed Consultation Distance

14.0 REFERENCES

Centre for Chemical Process Safety (CCPS) (2000), Guidelines for Chemical Process Quantitative Risk Analysis, 2nd Edition, AIChemE

Chemical Industries Association (CIA) (2020), Guidance for the location and design of occupied buildings on chemical manufacturing and similar major accident sites, 4th Edition

Committee for Prevention of Disasters (2005), Guidelines for Quantitative Risk Assessment, CPR 18E, Second Edition, The Hague ("Purple Book")

Committee for Prevention of Disasters (2005), Methods for calculation of physical effects, CPR 14E, third Edition, The Hague ("Yellow Book")

DNV, PHAST Supporting Documentation, DNV Phast Version 9.0 Technical Documentation, 2024

Environmental Protection Agency (EPA), (2019), EPA Guidance on Retention Requirements for Firewater Run-off, EPA.

Guidelines for Initiating Events and Independent Protection Layers in Layer of Protection Analysis, Center for Chemical Process Safety, 2015

Health and Safety Authority (HSA) (2023) Guidance on Technical Land-Use Planning Advice, for planning authorities and COMAH establishment operators

Health and Safety Authority (HSA) (2017) Guidance to Inspectors on the Assessment of Safety Reports under the COMAH Regulations 2015

Kletz T. (1999), HAZOP and HAZAN, Identifying and assessing process industry hazards, Institute of Chemical Engineers, 4th Edition

Small Diesel Spills, National Oceanic and Atmospheric Administration 2023

UK Health and Safety Executive (HSE) (2017), Planning Case Assessment Guide, Chapter 6K, Failure Rate and Event Data for use within Land Use Planning Risk Assessments

APPENDIX A

Natural Gas VCE Calculation

Complete combustion equation for Methane:

$CH_4 + 2O_2 = CO_2 + H_2O$

Stoichiometric Mass Fraction Calculation:

Compound	Mol	Mol fraction	Molecular weight (kg/kmol)	Mass (kg)	Mass fraction
CH_4	**1**	**0.096**	**16.040**	**1.54**	**0.056**
O_2	2	0.192	31.999	6.13	0.222
N_2	7.44	0.713	28.014	19.96	0.723
Total	10.44	1		27.63	1.000

Bay Trailer

Volume of Bay Trailer Available Space = 37.1 m^3

Density of Natural Gas Mixture at 10°C (calculated from DNV PHAST 9.0): 1.193 kg/m^3

Mass of Flammable Mixture: 44.26 kg (37.1 m^3 x 1.193 kg/m^3)

Compound	Mass (kg)
CH_4	2.46
O_2	9.82
N_2	31.98

Flammable Mass of Methane in Bay Trailer: **2.46 kg**

Energy Centre

Volume of Energy Centre: 1626 m^3 – 152 m^3 occupied by equipment.

Available Space = 1474 m^3

Density of Natural Gas Mixture at 10°C (calculated from DNV PHAST 9.0): 1.193 kg/m^3

Mass of Flammable Mixture: 1758.48 kg (1474 m^3 x 1.193 kg/m^3)

Compound	Mass (kg)
CH_4	97.78
O_2	390.14
N_2	1207.56

Flammable Mass of Methane in Energy Centre: **97.8 kg**

Compressors

Volume of Compressor Building: 250 m^3

Density of Natural Gas Mixture at 10°C (calculated from DNV PHAST 9.0): 1.193 kg/m^3

Mass of Flammable Mixture in Compressor: 298.5 kg (250 m^3 x 1.193 kg/m^3)

Compound	Mass (kg)
CH_4	16.58
O_2	66.17
N_2	215.50

Flammable Mass of Methane in Compressor Building: **16.58 kg**

END OF REPORT

PURSER

Volume 3:

Appendix 17.6

Geophysical Survey Report (Ref: 25003) dated 09 February 2025

EIAR Addendum: Nua Bioenergy, Lisheen
P-2024-35-59

GEOPHYSICAL SURVEY

REPORT

Killoran Townland,
Moyne,
County Tipperary

Licence Number: **25R0042**

Date:
09/02/2025

J. M. Leigh Surveys Ltd.
124 Oaklawn West
Leixlip
County Kildare
www.jmlsurveys.com
01 615 4647

J. M. Leigh Surveys Ltd.
124 Oaklawn West,
Leixlip, Co. Kildare
Tel: 01 615 4647
Mobile: 0879062729
www.jmlsurveys.com

SURVEY SUMMARY SHEET
KILLORAN TOWNLAND, MOYNE,
COUNTY TIPPERARY

Site Name	Killoran, Moyne, County Tipperary	**JML Ref No.**	25003
Townland	Killoran	**Licence No.**	25R0042
County	County Tipperary	**Licence Holder**	Joanna Leigh
ITM (centre)	E621080, N666540	**Purpose**	RFI
Client	IAC Ltd.	**Reference No.**	2460936 Tipperary County Council

Ground Conditions	The application area is contained within a small irregular field. Ground conditions were rough underfoot, with bramble vegetation along the eastern boundary. A post and wire fence in the centre of the application area resulted in some magnetic disturbance.
Survey Type	Detailed gradiometer survey totalling c.1 hectare

Summary

The data is dominated by linear responses and parallel trends. These are indicative of former field divisions and ploughing activity.

A broad sub-linear response is recorded along the western extent of survey. Although it is possible that this is agricultural in origin, an archaeological interpretation must be considered. The response has a magnetic signature indicative of an archaeological ditched feature. This response is of possible archaeological interest.

Isolated responses within the data also have a magnetic signature indicative of archaeology. Although it is possible that they represent more deeply buried ferrous debris, it is equally possible that isolated pit-type features are represented here. This interpretation is tentative as there is no clear archaeological pattern.

Fieldwork Date	28th January 2025

Report Date	09/02/2025	**Report Author**	Joanna Leigh

Contents

Geophysical Survey Report
Killoran, Moyne,
County Tipperary

1 Introduction

1.1 A geophysical survey has been conducted by J. M. Leigh Surveys Ltd. at a site in the townland of Killoran, County Tipperary. The survey application area is located within the south of a small rectangular field, to the immediate west of the former Lisheen Mine Site, Killoran, Moyne, Thurles, County Tipperary. Figure 1 at a scale of 1:5,000 presents the survey location.

1.2 The survey was requested by IAC as part of a wider archaeological study for a proposed anaerobic digestion plant (planning reference 2460936 Tipperary County Council).

1.3 Much of the proposed development is contained within the footprint of the former Lisheen Mine Site. The field under investigation lies to the immediate west of the former Lisheen Mine. The proposed development area and geophysical survey area are presented in Figure 1.

1.4 The survey has been requested by IAC Ltd. to provide information regarding this specific area, within a proposed development site. The results of this survey shall be used to inform archaeological test trenching and an Environmental Impact assessment report for the proposed development.

1.5 There are no recorded monuments within the geophysical survey application area. However, the survey area sits within an archaeologically rich landscape. The closest monuments are a recorded house (TN036-050018), a burnt pit (TN036-050017) a fulacht fia (TN036-050004) and several pit burials (TN036-050006, TN036-050003 and TN036-050005). The recorded monuments within the immediate vicinity of the geophysical survey area are presented in Figure 1.

1.6 The main aim of the survey was to identify any geophysical responses that may represent the remains of unknown archaeological features within the application area. A detailed gradiometer survey was conducted under licence 25R0042, issued by the Department of Housing, Local Government and Heritage.

2 Survey Ground Conditions and Further Information

2.1 The survey area was contained within the lower half or a triangular field, to the immediate west of the former Lisheen Mine. The field comprised of rough pasture at the time of survey.

2.2 A post and wire fence, providing access to an adjacent field, runs through the centre of the survey area. This resulted in some magnetic disturbance. Haybales were also located here and restricted some survey.

2.3 Along the southern extent of the survey area was a tall metal fence and hay bales. The modern metal fencing resulted in some localized magnetic disturbance.

2.4 The eastern extent of the survey area was restricted by rough ground and bramble vegetation.

3 Survey Methodology

3.1 A detailed gradiometer survey detects subtle variations in the local magnetic field and measurements are recorded in nano-Tesla (nT). Some archaeological features such as ditches, large pits and fired features have an enhanced magnetic signal and can be detected through recorded survey.

3.2 Data was collected with a Bartington Grad 601-2 instrument. This is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey fast and effective.

3.3 The instrument is calibrated in the field to ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.01nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

3.4 All data was collected in ‘zigzag’ traverses. Grid orientation was positioned to facilitate data collection and remained constant throughout the survey area. Data was collected with a sample interval of 0.25m and a traverse interval of 1m. The survey grid was set out using a Trimble GPS VRS unit. Survey tie-in information is available upon request.

4 Data Display

4.1 A summary greyscale image of the survey results is presented in Figure 2, at a scale of 1:1,000.

4.2 Figure 3 presents the interpretation of the results, also at a scale of 1:1,000.

4.3 Numbers in parentheses in the text refer to specific responses highlighted in the interpretation diagrams (Figure 3).

4.4 Isolated ferrous responses in the gradiometer data highlighted in the interpretation diagram most likely represent modern ferrous litter and debris and are not of archaeological interest. These are not discussed in the text unless considered relevant.

4.5 The raw gradiometer data is presented in archive format in Appendix A1.01. The raw data is displayed as a greyscale image and xy-trace plot, both at a scale of 1:500. The archive plots are used to aid interpretation of the results and are for reference only. These are available as PDF images upon request.

4.6 The display formats referred to above and the interpretation categories are discussed in the summary technical information section at the end of this report.

5 Survey Results & Conclusion

5.1 The data is dominated by a series of linear responses (1) and parallel trends (2). These are indicative of former field divisions and ploughing activity.

5.2 Further faint linear trends (3) also run through the data. These are also most likely agricultural in origin, but do not appear to be associated with the probable former boundaries (1) and ploughing (2). The trends (3) may represent a former farm trackway.

5.3 A broad response (4) is evident along the western extent of the survey. This has no clear pattern, but the response has a magnetic signature indicative of a ditched feature. It is possible that a short archaeological ditch is located here. This is speculative but must be considered.

5.4 Further isolated responses (5) have been recorded in the data. These appear isolated and have no clear archaeological pattern. Although it is possible that they represent more deeply buried ferrous debris, an archaeological interpretation must be considered. It is possible that isolated pit-type features are represented here. This interpretation is cautious.

5.5 Modern magnetic disturbances (6) result from a temporary fence. Further magnetic disturbance in the centre of the application area is from a post and wire fence, and along the southern extent of survey there is a tall fence. No interpretation within the areas of magnetic disturbance can be provided.

5.6 Consultation with a licensed archaeologist and with the Department of Housing, Local Government and Heritage is recommended to establish if any additional archaeological works are required.

6 Technical Information Section

Instrumentation & Methodology

Detailed Gradiometer Survey

Detailed gradiometer survey can either be targeted across a specific area of interest or conducted as a blanket survey across an entire application area, often as a standalone methodology.

Sampling methodologies can vary but a typical survey is conducted with a sample interval of 0.25m and a traverse interval of 1m. This allows detection of potential archaeological responses. Data is collected in grids measuring 40m x 40m, with the data displayed accordingly. A more detailed survey methodology may be applied where archaeological remains are thought likely. This can sometimes produce results with a more detailed resolution. A survey with a grid size of 20m x 20m and a traverse interval of 0.5m will provide a data set with high resolution.

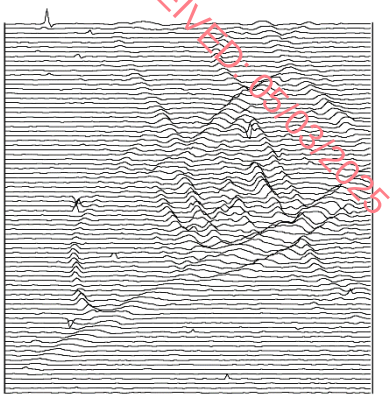
Bartington GRAD 601-2

The Bartington Grad 601-2 instrument is a specifically designed gradiometer for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey fast and effective. The sensors have a separation of 1m allowing greater sensitivity.

Frequent realignment of the instruments and zero drift correction ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.1nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

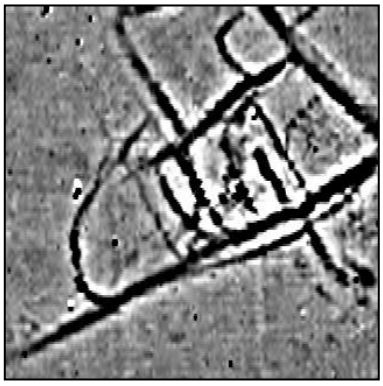
Gradiometer Data Display & Presentation

XY Trace



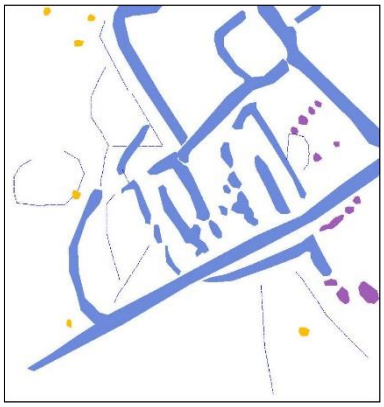
The data are presented as a series of linear traces, enabling a semi-profile display of the respective anomalies along the X and Y-axes. This display option is essential for distinguishing between modern ferrous materials (buried metal debris) and potential archaeological responses. The XY trace plot provides a linear display of the magnitude of the response within a given data set.

*Greyscale**



As with dot density plots, the greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at fine increments, allowing the full range of values to be displayed within the given data set. This display method also enables the identification of discrete responses that may be at the limits of instrument detection. In the summary diagrams processed, interpolated data is presented. Raw un-interpolated data is presented in the archive drawings along with the xy-trace plots.

Interpretation



An interpretation of the data is made using the plots presented in the final report, in addition to examination of the raw and processed data. The project managers' knowledge and experience allow a detailed interpretation of the survey results with respect to archaeological potential.

**XY Trace and raw greyscale plots are presented in archive form for display of the raw survey data. Summary greyscale images of the interpolated data are included for presentation purposes and to assist interpretation. The archive plots are provided as PDF images upon request.*

Glossary of Interpretation Terms

Categories of responses may vary for different data sets. The list below are the most used categories for describing geophysical responses, as presented in the summary interpretation diagrams.

Archaeology

This category refers to responses which are interpreted as of clear archaeological potential and are supported by further archaeological evidence such as aerial photography or excavation. The term is generally associated with significant concentrations of former settlement, such as ditched enclosures, pits, and associated features.

? Archaeology

This term corresponds to anomalies that display typical archaeological patterns where no record of comparative archaeological evidence is available. In some cases, it may prove difficult to distinguish between these and evidence of more recent activity also visible in the data.

Area of Increased Magnetic Response

These responses often lack any distinctive archaeological form, and it is therefore difficult to assign any specific interpretation. The resulting responses are site specific, possibly associated with concentrations of archaeological debris or more recent disturbance to underlying archaeological features.

Trend

This category refers to low-level magnetic responses barely visible above the magnetic background of the soil. Interpretation is tentative, as these anomalies are often at the limits of instrument detection.

Ploughing/Ridge & Furrow

Visible as a series of linear responses, these anomalies equate with recent or archaeological cultivation activity.

? Natural

A broad response resulting from localised natural variations in the magnetic background of the subsoil; presenting as broad amorphous responses most likely resulting from geological features.

Ferrous Response

These anomalies exhibit a typically strong magnetic response, often referred to as ‘iron spikes,’ and are the result of modern metal debris located within the topsoil.

Area of Magnetic Disturbance

This term refers to large-scale magnetic interference from existing services or structures. The extent of this interference may in some cases obscure anomalies of potential archaeological interest.

Bibliography

European Archaeological Council (EAC) (2016) '*Guidelines for the use of Geophysics in Archaeology*' by Armin Schmidt, Paul Linford, Neil Linford, Andrew David, Chris Gaffney, Apostolos Sarris, and Jörg Fassbinder.

English Heritage (2008) '*Geophysical guidelines: Geophysical Survey in Archaeological Field Evaluation*.' Second Edition.

Gaffney, C. Gater, J. & Ovenden, S. (2006) '*The use of Geophysical Techniques in Archaeological Evaluations.*' IFA Paper No. 6.

Gaffney, C & Gater, J (2003). '*Revealing the buried past: Geophysics for Archaeologists*.' Tempus Publishing Limited.

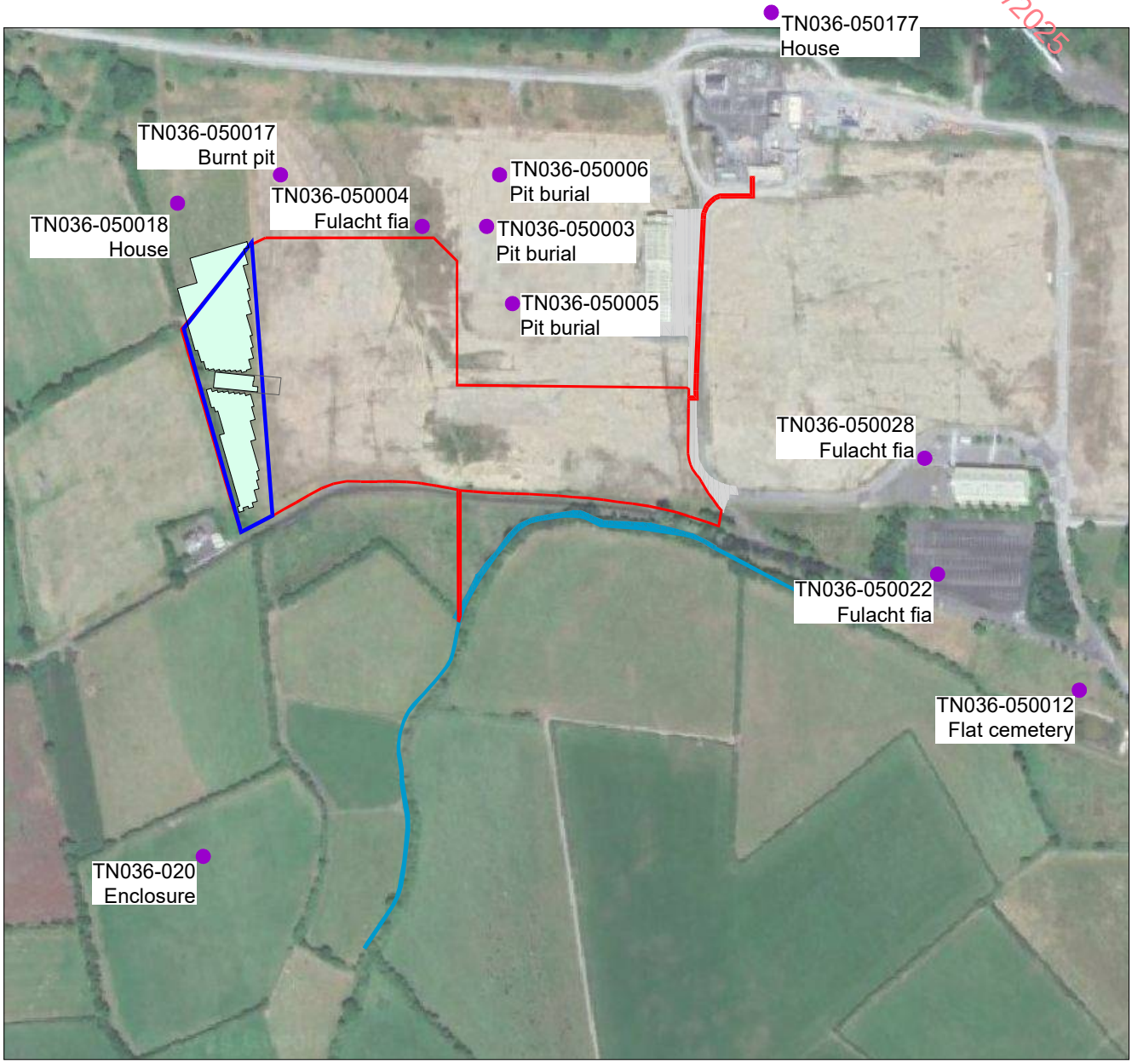
National Soil Survey of Ireland (1980) *General soil map second edition (1:575,000)*. An Foras Taluntais.

List of Figures

Figure	Description	Scale
Figure 1	Site & Survey Location Diagram	1:5,000
Figure 2	Summary Greyscale Image	1:1,000
Figure 3	Summary Interpretation	1:1,000

Archive Data Supplied as a PDF Upon Request

A1.01	Raw data XY-Trace plot & greyscale image	1:500



Development application area

Geophysics application area

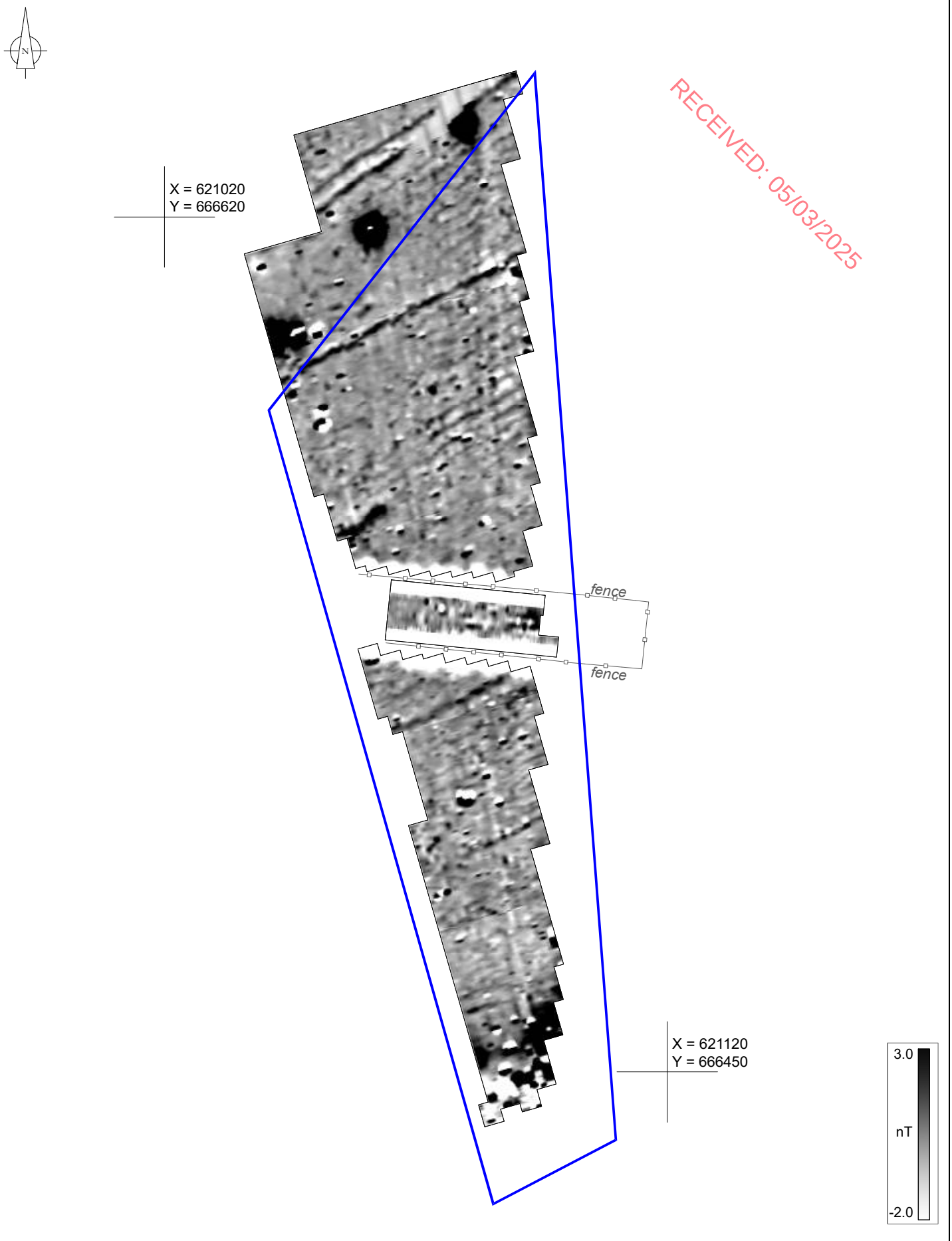
Detailed Gradiometer Survey

0 metres 200

Client:	Project:	Title:
IAC Ltd.	Geophysical Survey Killoran, County Tipperary	Site & Survey Location

J.M. Leigh Surveys Ltd.
www.jmlsurveys.com

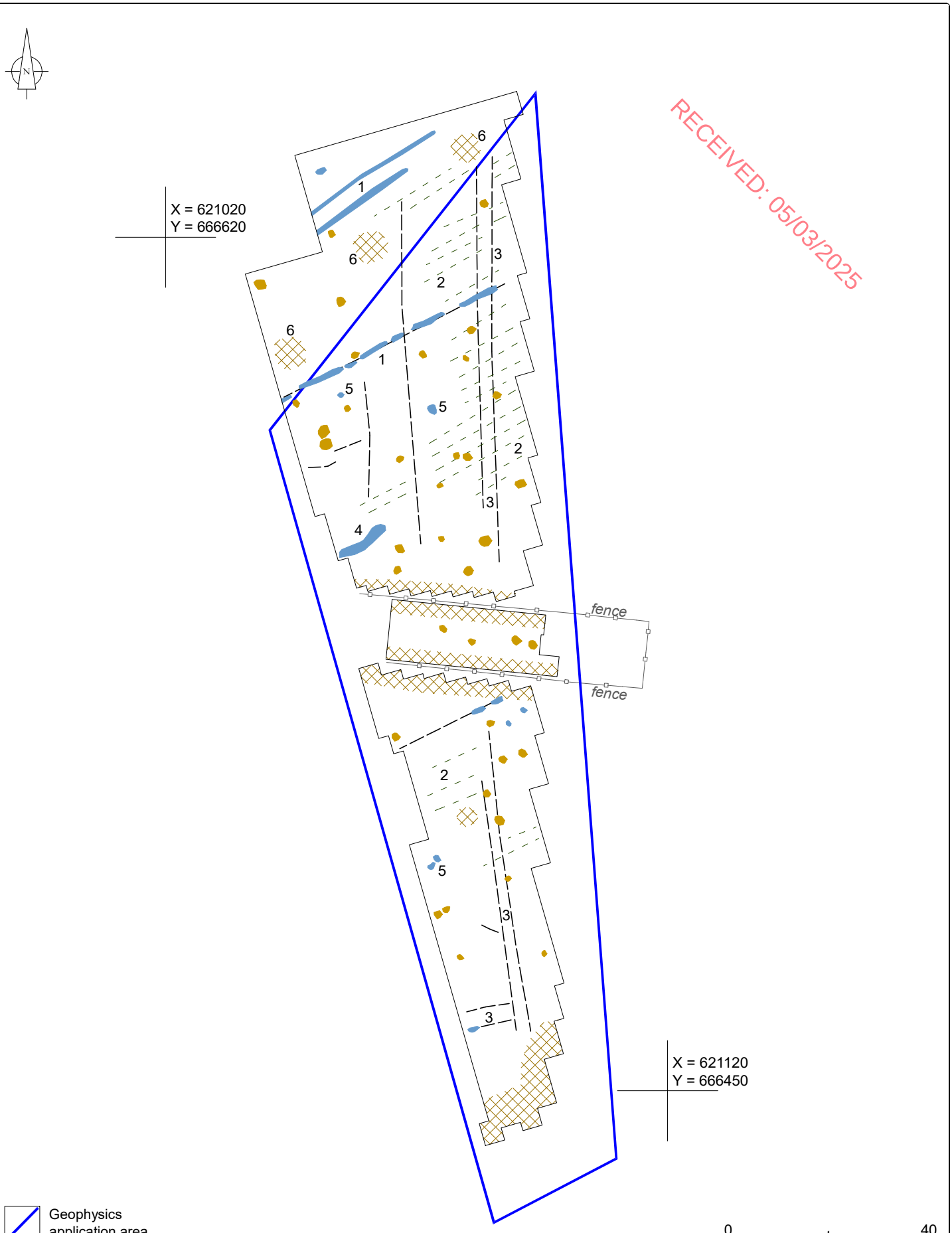
Scale @ A4: 1:5,000
Figure: 1
Licence No.: 25R0042
Issue Date: 09.02.2025



Geophysics application area

0 metres 40

Client:	Project:	Title:		
IAC Ltd.	Geophysical Survey Killoran, County Tipperary	Summary Greyscale Image	J.M. Leigh Surveys Ltd. www.jmlsurveys.com	Scale @ A4: 1:1,000 Figure: 2 Licence No.: 25R0042 Issue Date: 09.02.2025



Client:	Project:	Title:		
IAC Ltd.	Geophysical Survey Killoran, County Tipperary	Summary Interpretation	J.M. Leigh Surveys Ltd. www.jmlsurveys.com	Scale @ A4: 1:1,000 Figure: 3 Licence No.: 25R0042 Issue Date: 09.02.2025

PURSER

Contact
+353 (0) 87 142 4070
info@purser.ie
www.purser.ie

Head Office
20 Harcourt Street
Dublin 2
D02 H364
Ireland