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Shannon Technology and Energy Park

Environmental Impact Assessment Report

VOLUME 1 | Non Technical Summary

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1. Introduction

Shannon LNG Limited ('hereafter referred to as the Applicant') proposes to develop a combined cycle natural gas plant with three combustion turbines, a battery energy storage system, and a liquified natural gas (LNG) Terminal, which will be known collectively as the Shannon Technology and Energy Park (STEP, hereafter referred to as the 'Proposed Development'). It will be located on the Shannon Estuary between Tarbert and Ballylongford in Co. Kerry (hereafter referred to as the 'Proposed Development site'), as shown in Figure 1.

Figure 1 Proposed Development Site

This Environmental Impact Assessment Report (EIAR) has been prepared by AECOM Ireland Limited (AECOM) on behalf of the Applicant, an Irish owned subsisiary of New Fortress Energy Inc.

The EIAR is presented in four volumes as outlined below:

- Volume 1: Non-Technical Summary;
- Volume 2: Main Text;
- Volume 3: Figures; and
- Volume 4: Appendices.

This volume of the EIAR provides an overview of the Proposed Development, the Environmental Impact Assessment (EIA) methodology, the structure of the EIAR and the consultation undertaken.

This EIAR includes a consideration of alternatives and identifies the potential significant environmental effects arising from both the construction and operational phases of the Proposed Development. Where potential significant environmental effects have been identified, mitigation measures have been

proposed to avoid, prevent, reduce or offset the effects. In addition, cumulative environmental impacts of the Proposed Development have been assessed, where appropriate.

The main objectives of the Proposed Development are to:

1. Provide 600 megawatt (MW) of fast acting flexible thermal generation capacity to the Irish electricity market;
2. Provide a 120 MWhr battery energy storage system (BESS) to participate in the electricity ancillary services market; and
3. Provide an LNG Terminal capable of offering up to 180,000 cubic metres (m^3) of LNG storage capacity and regasification capacity of up to 22.6 million standard cubic metres per day (Sm^3/d).

Proposed Development Site

The Proposed Development site is located approximately 4.5 km and 3.5 km from Tarbert and Ballylongford in Co. Kerry, respectively. The area to be developed within the Proposed Development site is 52 ha (including both onshore and offshore elements) and is characterised by predominantly improved grassland in an agricultural setting. Field boundaries predominantly comprise hedgerows with small drainage ditches. A small section of the Ralappane Stream is located in the southernmost part of the Proposed Development site.

The Shannon Estuary comprises 500 square kilometres (km^2) of navigable water extending from Loop Head, in Co. Clare, and Kerry Head, in Co. Kerry, eastwards to the city of Limerick, a distance of approximately 100 km. The naturally occurring deep and sheltered waters of the estuary are connected to the Atlantic Ocean and are accessible to large ocean-going vessels of varying types and sizes.

Overview of Proposed Development

The Proposed Development will be comprised of two main components, as detailed in Chapter 02 – Project Description:

1. A Power Plant; and
2. An LNG Terminal.

The Power Plant will employ combined cycle natural gas technology and its design will comply with all relevant national and international codes. The Power Plant and 120 MWh BESS will be located directly adjacent to the LNG Terminal and will provide additional and flexible power generation capacity to support intermittent renewable generation and resolve a predicted generation capacity shortfall, in line with national policy goals. For example, during periods of high wind (renewable) generation it is expected that the Power Plant would be turned down or off by the system operator (EirGrid) to give priority to renewable power.

The Proposed Development will have an operational capacity to supply up to 22.6 million Sm^3/d of natural gas to the Irish gas transmission network via the already consented 30 inch Shannon Pipeline (PL08.GA0003). Details of previous consents obtained in respect of the site are provided below. The total installed capacity of the flexible modular Power Plant will be up to 600 MW.

The LNG Terminal will include a Floating Storage and Regasification Unit (FSRU) with an LNG storage capacity of up to 180,000 m^3. The ship will be up to 300 m long, up to 50 m wide and the height of the vessel including the top of the exhaust stack will be approximately 50 m above sea level. LNG will be delivered by an LNG Carrier (LNGC) moored seaward of the FSRU, and a jetty and infrastructure to accommodate up to four tugs will also be located offshore. Onshore facilities will include associated administrative/ control buildings, an onsite power generation plant and an Above Ground Installation (AGI). Ireland is expected to become increasingly rely on imports of gas via a single supply point from the UK, predicted to provide 90% of gas by 2030. As Ireland transitions towards 70% renewables by 2030 and phases out of coal and peat-fired electricity generation, natural gas is the only long term reliable back up for intermittent wind generation for the foreseeable future.

Regulatory Framework

Pre-application consultation with An Bord Pleanála has determined that the Proposed Development is strategic infrastructure within the meaning of section 37A of the Planning and Development Act 2000.

An application will therefore be made directly to An Bord Pleanála under section 37E of the Act. This EIAR should be read in conjunction with all the particulars of the planning application.

The Proposed Development will be regulated by the following bodies:

- Environmental Protection Agency (EPA);
- Commission for Regulation of Utilities;
- Health and Safety Authority; and
- Local Planning Authority (Kerry County Council (KCC)).

The Shannon Foynes Port Company has statutory jurisdiction over marine activities.

Impact Assessment Methodology

The EIA process can involve several stages, including: consultation, screening, scoping, baseline surveys, impact assessments, ongoing feedback into a project design, and preparation of the EIAR. For this Proposed Development, the EIAR will be submitted as part of a planning application to ABP, which is the Competent Authority, to enable An Bord Pleanála to assess the impacts and carry out an EIA before consenting or otherwise. This EIAR will also accompany the industrial emissions licence (IEL) application to the Environmental Protection Agency following submission of the planning application.

The first step in the EIA process is 'Screening', which determines if an EIA is required, and usually commences at the project design stage. The EIA Directive lists those projects that require a mandatory EIA and those projects for which an assessment must be undertaken to determine if they are probable to result in likely significant effects. In Ireland, generally the process of ascertaining whether a development requires an EIA is determined by the Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001 (as amended), in particular Schedule 7 thereof.

An EIAR is mandatory for the Proposed Development in line with paragraph 2(a) of Annex I and paragraph 3(a) of Annex II of the EIA Directive, as transposed, respectively, by paragraph 2(a) of Part 1 of Schedule 7 to the 2001 Regulations and paragraph 3(a) of Part 2 of Schedule 7 to the 2001 Regulations. In addition, the Proposed Development falls under the Seventh Schedule of the Planning and Development Act 2000 (as amended).

An EIAR is prepared as part of the EIA process. Typically, the EIAR includes a baseline assessment to determine the status of the existing environment; impact prediction and evaluation to identify impacts and effects and determine the significance of effects (this can include cumulative effects); delineation of mitigation and monitoring measures to reduce the impacts identified; and a residual impact assessment of the significance of effects once any mitigation and monitoring measures have been implemented.

For each technical EIAR chapter, the classification and significance of effects is generally evaluated in accordance with the EIA Directive and the methodology outlined in the EPA's Draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017). Where more relevant and specific standards and methodologies exist, they are adopted and outlined in the respective methodology sections within each technical chapter (for example, specific criteria and assessment terminology used to assess ecology impacts).

The assessment also takes into consideration cumulative impacts with consented, planned and reasonably foreseeable projects. This includes the cumulative impact of the Proposed Development with the 220 kV and medium voltage (10/ 20 kV) grid connections and the masterplan vision for the expansion of the site, which includes a Data Centre Campus.

It is expected that it would be a condition of the industrial emissions licence for the Proposed Development that a closure and residuals management plan, including a detailed decommissioning plan, be submitted to the Environmental Protection Agency for their approval. A detailed assessment of impacts during the decommissioning stage will be undertaken at that time to inform the decommissioning plan.

2. Project Description

The Project Description chapter describes the design, construction, commissioning operation and decommissioning of the Proposed Development, which will comprise of a Liquified Natural Gas (LNG) Terminal, Power Plant AGI and ancillary facilities. The purpose of this chapter is to provide the reader with the details of the scope of works for which planning permission is being sought and the basis upon which this EIAR has been prepared.

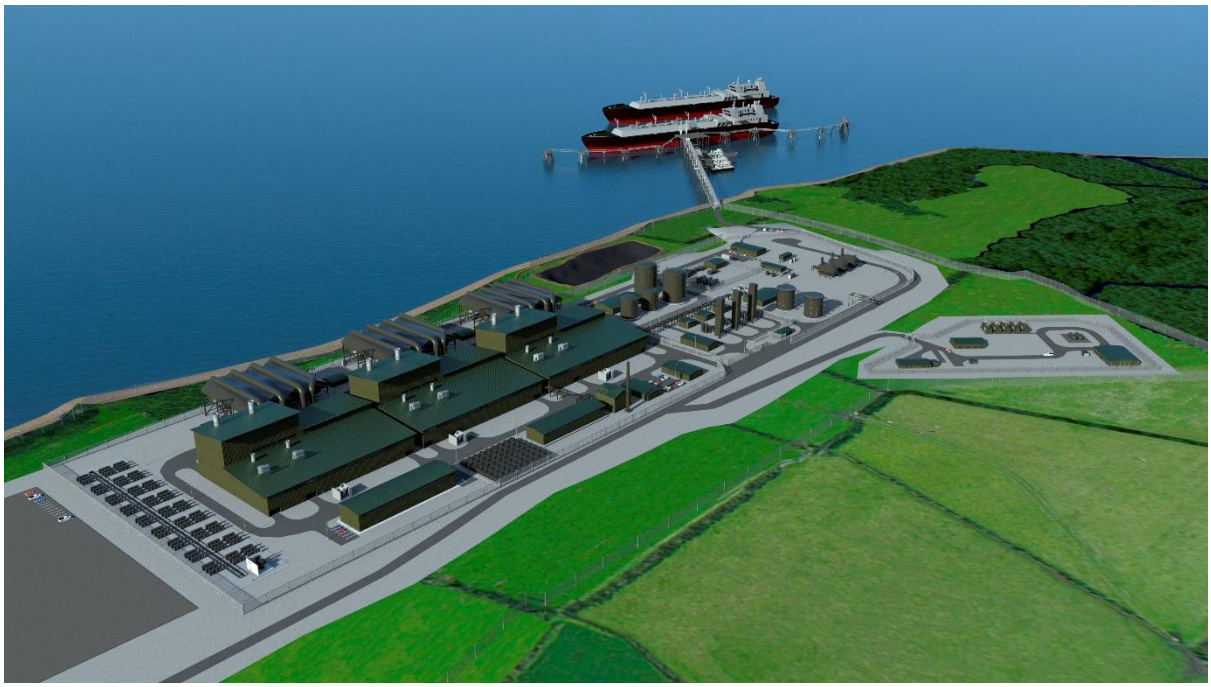

Figure 2 Proposed Development Overview

Power Plant

The Power Plant will comprise:

- A flexible modular Power Plant design with three blocks of Combined Cycle Gas Turbines (CCGT), each block with a capacity of approximately 200 MW for a total installed capacity of up to 600 MW. The multishaft arrangement of the Power Plant provides fast acting response with very low minimum stable generation and is ideally suited to support increased intermittent renewable generation;
- Each of the three blocks will of comprise two gas turbine generators, two heat recovery steam generator and one steam turbine generator and an air-cooled condenser; and
- A 120 MW for 1 hour (120 MWhr) BESS. Due to its very fast response, the BESS supports intermittent renewable generation.

In each 200 MW block two gas turbines burning natural gas will be connected to a generator for electricity production. Exhaust gases from the gas turbines will pass through heat recovery steam generators to generate steam at several different pressures. The steam generated will be routed through a steam turbine, which will also be connected to a generator to produce further electrical power. The spent steam exiting the steam turbine will then be directed into an air-cooled steam condenser. The resulting condensate will then be pumped back into the heat recovery steam generator to repeat the steam cycle.

The Power Plant will be located directly adjacent to the LNG Terminal. The multi-shaft arrangement of the Power Plant provides fast acting response with very low minimum stable generation and is ideally suited to support increased intermittent renewable generation. A 120 MW for 1 hour (120 MWhr) BESS shall also be included in the development. The BESS is comprised of 27 battery containers, approximately 4.5 MWh each, containing lithium ion batteries.

The Power Plant will generate power for its own needs and for the LNG Terminal, and for sale to the market via the national electricity grid, which will be exported via the 220 kV connection (which is subject to a separate planning application). Natural gas will be supplied to the Power Plant from the nearby LNG Terminal. The Power Plant will use up to 2.7 million Sm^3/d[1] (equivalent to approximately 25.5 GWh per day) when operating at full capacity. The LNG Terminal will have sufficient capacity to supply gas requirements of the facility.

An application to connect to the national electrical transmission network via a 220 kV connection was submitted to EirGrid in September 2020. An offer has yet to be received. It is expected that the connection will run 5 km east under the L1010 road to the ESBN/ EirGrid Killpaddogue 220 kV substation. Once the connection offer is made, this 220 kV connection will be subject to a separate planning design and planning application and does not form part of the scope of the Proposed Development.

The Power Plant will not be operational at full load all year round. For example, during periods of high wind (renewable) generation it is expected that the Power Plant could be turned down or off by the system operator (EirGrid) to give priority to renewable power. However, the LNG Terminal will need to be operational all year round. The LNG Terminal could also be operational before the Power Plant and the 220 kV grid connection are completed. Therefore, a medium voltage (10/ 20 kV) connection to supply power to the LNG Terminal in the absence of the 600 MW Power Plant will be required. This connection will be subject to a separate planning application and has been considered in the cumulative impact assessment within each technical chapter. It is likely that the medium voltage connection will be via an underground cable route that will follow the L1010 route in parallel with the 220 kV cables. An onsite back-up power generation, consisting of three 8 MW gas fired electricity generators will supply power to the LNG Terminal until the Power Plant is operational, in the absence of the 220 kV and medium voltage grid connections.

If the 220 kV and medium voltage (10/ 20 kV) grid connections are consented, these back-up power generators will be used as back-up power generation if the grid connections fails, or is unavailable.

A drainage outfall into the Shannon Estuary will also be constructed. Within the Proposed Development site, surface water from paved and impermeable areas will be collected by an underground drainage system and will discharge to either, the existing stream and/ or drainage ditches within the site, or to the Shannon Estuary via the drainage outfall pipe.

LNG Terminal

The LNG Terminal will comprise:

- A FSRU, which will have an LNG storage capacity of up to 180,000 m^3. The FSRU will be up to 300 m long, up to 50 m wide. The LNG vaporisation process equipment to regasify the LNG to natural gas shall be onboard the FSRU. The heat for LNG regasification will be provided via seawater, supplemented by heat from gas fired heaters when the water temperature is inadequate. Loading of LNG onto the FSRU will be via a ship to ship transfer from another LNG carrier (LNGC) berthed alongside;
- A jetty and access trestle, with the jetty comprising an unloading platform, mooring dolphins and breasting dolphins with capacity to accommodate up to four tugs moored on the jetty to support FSRU and LNGC mooring operations; and
- Onshore facilities including a nitrogen generation facility, a control room, a guard house, workshop and maintenance buildings, instrument air generator and fire water system.

The FSRU will store LNG at a temperature of approximately -160 degrees Celsius (˚C) in cryogenic storage tanks. The cold temperature will keep the LNG in its liquid state until it is required to be supplied into the gas network (a process known as regasification).

Visiting LNGCs will be berthed alongside the FSRU to transfer LNG from the LNGC to the FSRU. Up to 60 LNGC visits per year are anticipated with unloading from the LNGC to the FSRU via ship-to-ship transfer estimated to take an average of 35 hours.

[1] Million Sm^3/d = Million Standard cubic metres per day of natural gas: cubic metre natural gas at 101,325 Pa and 15°C, dry

Regasification will use an 'open loop mode', meaning that only the heat from the seawater will be used to regasify the LNG into a gaseous state. When the water temperatures are insufficient, the FSRU will operate in 'combined loop' regasification mode, whereby supplementary heat is provided by onboard gas fired seawater water heaters.

Following regasification, the natural gas will be transferred through gas piping along the jetty from the FSRU to the onshore receiving facility. The onshore receiving facility may inject nitrogen into the gas to adjust its calorific value to ensure it complies with Irish gas specifications. Following calorific adjustment, the gas shall then route to the Above Ground Installation (AGI) where metering, odorant injection and pressure adjustment shall occur before the gas enters the gas transmission network via the consented 26 km Shannon 30" Pipeline that will be built between the Terminal and Foynes.

AGI

The AGI will include an odourisation facility, gas heater building, gas metering and pressure control equipment. The AGI facilitates the connection of the LNG Terminal to the consented 26 km Shannon 30" Pipeline, which was subject to a separate EIAR.

The AGI will be capable of providing reverse flow fuel gas for both the 600 MW Power Plant and LNG Terminal back up power generators from the grid in the event that supply from the FSRU is interrupted.

Construction Phase

Subject to planning consent and other approvals an arbitrary start date of Jan 2023 is taken as a construction start date (however this is subject to change). It is envisaged that the initial construction phase will last approximately 32 months, with an additional 6 months commissioning prior to operation. During the initial phase, approximately 975 people will be employed onsite at peak.

The construction phase will comprise:

- Enabling, earthworks and site preparation;
- Construction of the LNG Terminal, Power Plant and AGI;
- Construction of the drainage outfall;

During the construction phase, electricity will be supplied via a series of portable site units prior to the medium voltage electricity connection becoming available and water will be obtained from a water main along the L1010 (up to 98 m^3/day). Sewerage effluent will be collected in tanks for removal by tanker and temporary surface water drainage and silt ponds will be constructed to control runoff. Construction materials will be sourced locally from authorised quarries, where possible to minimise the environmental impact of transportation.

Commissioning Phase

Following completion of construction and installation of equipment, and before the LNG Terminal commences operations, there will be a testing and commissioning phase. This phase will comprise:

- Installation compliance checks;
- Commissioning tests; and
- Performance demonstration tests.

Operational Phase

Described above for the Power Plant, LNG Terminal and AGI.

Decommissioning Phase

Decommissioning activities will include, as a minimum:

- All wastes will be collected and recycled or disposed of by an authorised waste contractor;
- Utilities will be drained of all potential pollutants or sealed to prevent leakage if being reused elsewhere;
- All raw materials, oils, fuels, etc. onsite will be returned to the supplier, or collected and recycled or disposed of by an authorised waste contractor, as appropriate;

- All buildings and equipment will be decontaminated, decommissioned and demolished in accordance with a phased demolition plan, and either sold for reuse or recycled, or disposed of by an authorised waste contractor, as appropriate;
- Roadways to be broken up and removed and security fences dismantled;
- All hazardous and non-hazardous process substances to be removed;
- All roads and hardstanding areas to be removed and recycled or disposed of by an authorised waste contractor, as appropriate;
- Landscape will be reinstated in accordance with a landscape reinstatement plan; and
- On completion of safe decommissioning of equipment, the potable water, fire water and electrical power supplies could be disconnected, and removed or abandoned in place.

When operations have ceased, and assuming confirmation from the monitoring programme that all emissions have ceased, it is expected that there would be no requirement for long-term aftercare management at the Proposed Development site.

3. Alternatives

This chapter outlines the need for the Power Plant, the BESS, and the LNG Terminal that encompass the Proposed Development. It also discusses the siting of the Proposed Development, the main layout options as well as the main alternatives considered in respect of the technologies and processes.

Need for the Proposed Development

The Proposed Development will address Ireland's security of energy supply risks, supports intermittent renewable generation, and resolves a predicted generation capacity shortfall. As electricity from renewable sources increases, a simultaneous increase in electricity demand, and closure of coal, oil and peat-fired electricity generation, means that natural gas is predicted to play an increasingly important role as a backup fuel. The National Energy and Climate Change Plan 2021-2030 forecasts that natural gas demand will increase from current demand levels of 4.69 to 6.38 million tonnes of oil equivalent by 2040. Renewable generation is weather dependent, and its output fluctuates considerably. For this reason, conventional power plants are required to fill the fluctuating gap between electricity demand and renewable generation. Natural gas is the only viable major energy source currently available to back-up renewable generation and thereby maintain a resilient electricity supply to the country while supporting the transition to 70% renewable generation by 2030.

EirGrid has forecast a shortfall in generation capacity of up to 570 MW by 2026 and advised that new additional gas fired conventional power plants are urgently required. If realised, this shortfall will mean that that electricity demand exceeds supply, and the system operator(s) will be required to reduce demand on the system. The Proposed Development can counteract this issue and provide sufficient system capacity to prevent a shortfall from occurring. As the year-on-year production from the Corrib gas field declines, Ireland will increasingly rely on imports of gas via a single supply point from the UK, predicted to provide 90% of gas by 2030. Due to the decline in North Sea production, the UK itself is expected to import up to 75% of its gas supply by 2030 (from Norway, Russia, Qatar and various countries outside Europe) (Irish Academy of Engineering, 2018). Therefore, the gas supply route to Ireland will be longer than at present with a greater risk of supply disruption. The impact of losing this single gas supply point from the UK has been assessed by the Commission for Regulation of Utilities as being a '*major*' risk for electricity production in Ireland. An interconnector to France would not provide sufficient capacity for the loss of the UK gas interconnector.

The Proposed Development will provide gas supply diversity and will allow Ireland to comply with the EU Regulation on security of supply. In the absence of the Proposed Development, Ireland will remain non-compliant to 2040 and beyond. Alternative natural gas supplies are either insufficient to satisfy demand (pipeline from France and biomethane), technically not mature (hydrogen), or contrary to Irish legislation (offshore exploration). The Proposed Development gives Ireland direct access to global gas markets and therefore greater control over the source of Ireland's gas supplies.

Alternatives to the Proposed Development

A site selection process has been carried out, based on access to a large landbank with access to deep water, navigation channel widths, turning circle and control zone requirements, and significant wave heights and peak wave periods. The site selection assessment concluded that the Ballylongford/ Tarbert location is the most suitable location to accommodate the Proposed Development. The location of the Proposed Development was selected to minimise overall land take and to minimise environmental impact, including reduced impacts on biodiversity and cultural heritage, a reduced visual impact and a reduction in carbon sequestration.

Alternative designs, layouts and technologies were also considered for the LNG Terminal and Power Plant.

Based on the potential environmental effects, construction time and future hydrogen transition, the FSRU-based terminal approach was selected from the following LNG Terminal concepts:

1. Onshore terminals, where LNG is transferred to onshore storage tanks and regasified as required;
2. Floating terminals, where LNG storage and regasification is completed on a ship or barge, referred to as a FSRU; and
3. Hybrid terminals**,** where LNG is stored on a vessel, a floating storage unit (FSU), but the regasification occurs onshore.

Specialised studies and extensive consultation were carried out to identify the key functional requirements of power generation capability to be developed. A range of Power Plant technologies were considered, including combined heat and power, open cycle gas turbines, single-shaft and multi-shaft. The studies concluded that the proposed Power Plant is the most efficient, flexible and reliable option with the lowest CO_2 emissions profile of the alternatives considered.

4. Planning and Development

Taking account of recent developments in Ireland's response to climate change, including an objective for 70% of Ireland's electricity to come from renewable sources by 2030, the Proposed Development supports the resilient transition of Ireland's electricity system to renewables.

The Proposed Development can support to protect Ireland in the event of a major gas supply disruption from the UK. The Power Plant addresses Ireland's forecast shortage of conventional power generation. Natural gas will play an increasingly important role in Ireland's climate change plans as coal and peat-fired electricity generation is phased out and the amount of electricity from renewable sources increases.

The Proposed Development is aligned with European, national, regional and local energy and climate policy and will enhance Ireland's energy security, address power capacity shortfalls and support the national target to achieve 70% renewables by 2030.

5. Land and Soils

Existing Environment

The Proposed Development site covers an onshore area of approximately 41 ha (or 52 ha including the offshore elements) and comprises grassland on the southern shore of the Shannon Estuary with offshore elements of the scheme consisting of the jetty, the site wastewater outfall pipe and seawater intake and discharge at the FRSU. Onshore and offshore geological/ geotechnical site investigations were undertaken at the Proposed Development site in 2006 and 2007.

Soil deposits comprise predominantly 'till derived from Namurian era sandstones and shales' with small amounts of alluvium in localised areas, up to 4.2 m thick in total. Groundwater was encountered in place within the till, with low rates of inflow. Permeabilities of 3 to 4 x 10^{-6} m/s were calculated for the upper till. Geotechnical testing showed the upper till loses strength rapidly with increasing moisture content

and behaves like a clay/ silt and clay, despite its high granular content. The lower till layer overlying bedrock is stiff, of low permeability and no water strikes were recorded in this material.

Soils and stream sediments in the vicinity of the site have not been mapped under the GSI TELLUS soil geochemical sampling programme and soils are assessed by the GSI as having low to no aggregate potential.

The bedrock underlying the Proposed Development site is described as mudstone, siltstone and sandstone of the Shannon Group, of Namurian age. The bedrock outcrops along the majority of the Proposed Development site's northern coastline. Groundwater in the bedrock is classified as a 'Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones'. Groundwater was encountered in the upper fractures/ weathered zone of the bedrock and artesian conditions were noted in a number of isolated locations across the Proposed Development site.

Depth to rock varies from 0.75 m in the east of the Proposed Development site to up to 9.8 m. A number of inactive faults orientated from northwest to southeast were inferred in the area. The bedrock is described a moderately strong, has High to Very High crushed rock aggregate potential and is therefore suitable for use as aggregate on site. Radon potential risk is considered 'Low'. There are no GSI geotechnical sites, recorded landslide/ geohazard events, mineral localities or active quarries mapped within the Proposed Development site, however there is potential for very limited erosion along short sections of the coastline, therefore the proposed onshore works are set back 10m from the cliff edge.

The offshore sediments consist of soft alluvial deposits thickening northward from the coastline (from 0 to 26+m thick) over the stiffer Upper and Lower Till, in turn overlying the Shannon Group bedrock. Based on geotechnical testing conducted deep piled foundations, with some drilled and socketed into bedrock, are proposed to support marine structures.

The land use is agricultural and no significant contamination of soils is anticipated based on previous uses.

Soils and bedrock geology encountered at the Proposed Development site are considered favourable for the construction of the proposed Power Plant, with most plant to be founded on bedrock at the cut platform level of 18 m above Ordnance Datum (m OD). All excavated soil and rock material (of the order of 480,000 m^3) are expected to be suitable for re-use on the Proposed Development site as general or structural fill, giving the Proposed Development a net zero cut/ fill balance. The Environmental Sensitivity Mapping (ESM) Strategic Environmental Assessment (SEA) mapping tool indicates the Proposed Development site to have a low to very low sensitivity with respect to existing soils and geology.

Overview of Potential Significant Impacts Assessed

Accidental construction stage spill and leaks, including from the use of concrete and lime products and fuels, may give rise a small adverse effect on a low sensitivity environment and, if managed in accordance with the Construction Environmental Management Plan (CEMP), the significance of any impact arising from this is slight. An Outline Construction Environmental Management Plan (OCEMP) has been produced as part of this planning submission. A detailed CEMP will be produced by the successful Contractor prior to the main construction works and will take account of the measures included in the OCEMP and any commitments included within the statutory approvals.

Other construction phase risks arise from excavation, rock breaking and material stockpiles on the Proposed Development site in terms of rock slope stability and silt runoff to watercourses or the marine environment. The removal of land from agricultural or other potential beneficial uses is considered a permanent direct impact. Temporary storage of soil and crushed rock will be stored in low sensitivity areas distant from key sensitive receptors (the shoreline, drainage systems, retained drainage channels or areas subject to flooding) and will be carefully managed in accordance with the CEMP to prevent potential adverse effect on the receiving environment. Offshore piling and construction for the jetty and outfall pipe is designed maximise the use of precast concrete members and minimise the use of wet concrete and grout.

Operational Phase risks to soils and geology will arise principally from diesel fuel tanks for the fire water pumps and generators, maintenance, chemical odorant and cleaning chemicals, which will be managed by siting this equipment within designated bunded areas, resulting in a small risk of adverse effect to a low sensitivity environment and the significance of any effect is slight.

Effects Identified and Key Mitigation/ Monitoring

Mitigation measures associated with both the construction and operational phases of the Proposed Development have been embedded within the design and proposed based on the assessment. These mitigation measures may also interact with waste management and water aspects of the development.

CEMP will be prepared by the appointed Contractor for the Proposed Development which will incorporate relevant environmental avoidance or mitigation measures to reduce potential environmental impact.

Construction Phase mitigations include:

- Foundation solutions will be designed based on the properties of the underlying soils and bedrock;
- Offshore piling and jetty and outfall construction will be managed to minimise sediment mobilisation and avoid use of wet concrete and other alkaline materials in the offshore environment;
- Temporary storage of soil and crushed rock will be managed to prevent potential negative impact on the receiving environment;
- Soils and crushed rock will be tested for their chemical and geotechnical suitability prior to reuse as fill;
- Fill placement and compaction will be undertaken in line with defined procedures and will be inspected by a geotechnical engineer;
- Where possible, earthworks will be undertaken during dry weather in view of the sensitivity of the overburden soils to moisture content;
- Fuels, oils and other potentially hazardous chemicals will be stored in bunds in designated areas;
- Use of precast concrete elements in the foreshore and offshore environments where possible;
- Concrete use and wash-out areas will be in designated areas, with measures to prevent alkaline wastewaters or contaminated storm water runoff to the underlying subsoil or to the surface water or marine environment; and
- Fill material from external sources, if required, will be vetted in order to ensure that it is of a reputable origin and that it is ‘clean’ (i.e. will not introduce contamination to the environment.

Operational Phase mitigations include:

- Handling all hazardous or water-polluting materials in a manner to prevent/ minimise potential impact on soil;
- Routing of road runoff from the approach road north to the power plant and terminal, rather than to natural drainage leading to the Ralappane Stream;
- Fuels, oils, odorants and other potentially hazardous chemicals will be stored in bunds in designated areas;
- Secondary containment and spill kits will be provided for other hazardous materials to be stored on the Proposed Development site, such as maintenance oils and cleaning chemicals; and
- An environmental management plan will be prepared for the operational phase

Cumulative impacts arising from the related LNG Pipeline, Data Centre and medium voltage (10/ 20 kV)/ 220 kV power supply developments envisaged under the Masterplan were considered and no significant residual effects were identified to geology and soils. These development as per the masterplan will be subject to separate EIARs. The cumulative operational impact of the Proposed Development and cumulative schemes are considered to be slight.

Summary of Impact

The Residual Impact of the Proposed Development on the surrounding land and geological environment is considered to be slight or imperceptible at both the Construction and Operational phases.

6. Groundwater and Surface Water

Existing Environment

The Proposed Development site is not a designated site but is bordered to the west, north and east by designated sites (Lower River Shannon candidate Special Area of Conservation (cSAC), Ballylongford Bay proposed Natural Heritage Area (pNHA) and River Shannon and River Fergus Estuaries Special Protection Area (SPA)).

Onshore and offshore geological/ geotechnical and environmental site investigations were undertaken in 2006 and 2007. The Proposed Development site and its surroundings have shown no change in use or significant development since an extensive surface water assessment was undertaken in 2007.

Soil deposits are 'till derived from Namurian sandstones and shales', from 0.5 to 8.0 m depth, with small amounts of alluvium in localised areas. Groundwater was encountered in place in the till, with low rates of inflow. The upper till is moderately permeable (hydraulic conductivity of 3 to 4 x 10^{-6} m/s (metres per second)). The lower till layer overlying bedrock is stiff and is of low permeability and no water strikes were recorded in this material. The till thickens offshore and is overlain by soft alluvium, also thickening offshore.

The bedrock underlying the Proposed Development is mudstone, siltstone and sandstone of the Shannon Group and outcrops at the coast along the majority of the site's northern boundary. Groundwater in the bedrock is classified as a 'Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones'. The Proposed Development site is not located within a groundwater drinking water source protection area and public records indicate no springs and a relatively small number of low-yielding groundwater abstraction wells between 1 and 2 km from the Proposed Development site.

Depth to rock varies from 0.75 m (in the east of the Proposed Development site where the LNG Terminal and Power Plant will be situated) to up to 9.8 m near the western boundary. Groundwater vulnerability is classified as 'High to Extreme' due to the limited subsoil thicknesses. Monitoring wells in bedrock within the Proposed Development site generally have moderate permeability and a poor yield. Groundwater yield from a trial well indicated insufficient groundwater yield (<1 L/s) to meet the needs of a previous proposal for a comparable facility.

The Proposed Development site is drained by several short streams or drainage channels which either discharge to the main Ralappane Stream (also termed the D1 Stream) or directly north to the Shannon Estuary. The Ralappane Stream drains directly to the Shannon Estuary via a tidal wetland area to the west of the Proposed Development site; is not sampled by the EPA and its Water Framework Directive status is Unassigned for WFD purposes.

West of the confluence of the River Shannon with the River Fergus, water depths in the Shannon Estuary are in excess of 20 m and increase in depth in a westerly direction. Tidal flow velocities are high (approximately 2 m/s), giving rise to high levels of turbulence throughout the estuary. The maximum tidal range in the Shannon is ca 5.5m.

Groundwater wells and surface water courses on the Proposed Development site were sampled in February 2020 and were found to be relatively unpolluted, other than pressures associated with the coastal, agricultural setting, including anaerobic conditions, slightly elevated salinity and some localised hydrocarbon detections.

Overview of Potential Significant Impacts Assessed

Accidental construction phase spill and leaks, including concrete and lime products and fuels, may give rise to a small adverse effect on an extremely high sensitivity environment (Lower River Shannon cSAC) with the significance of the effect being significant, but such activities will be set back from the coast, other than the jetty and waste water outfall. Construction will be managed in accordance with the CEMP resulting in a negligible impact from spills and leaks after mitigation to a receptor of extremely high sensitivity. This will result in an imperceptible effect.

Other construction phase risks arise from offshore piping and jetty construction, onshore excavation, localised dewatering near rock cuttings and silt runoff to surface waters from material stockpiles on the Proposed Development site. Suspended sediment may be generated by piling operations offshore,

however modelling indicates that sediment deposition during the assumed 90 day piling period are likely to be low, due to the high tidal velocity leading to significant dispersion and dilution of the sediment load. Dewatering of bedrock will be a permanent, localised, direct impact but will not lead to a net volume change in groundwater discharge to the estuary, resulting in an imperceptible effect. Excavated materials storage areas and stormwater runoff will be carefully managed in accordance with the CEMP to prevent negative effects on the receiving environment. Stormwater discharge from the Proposed Development will be carried out under a discharge permit.

With the exception of crossings of the existing watercourses for the access road, there is no development proposed within potentially flood-susceptible areas of the proposed development, therefore the Proposed Development will have negligible impact on the existing flood regime. These proposed crossings of watercourses within the Proposed Development will be adequately-sized to have a minimal impact on the current hydraulic regime in the area. The negligible impact to a receptor of extremely high sensitivity will result in an imperceptible effect.

Operational phase risks to groundwater, surface water and marine waters will arise principally from discharges of seawater used for regasification from the FRSU and of stormwater, process effluent and sanitary water via a discharge outfall pipe to the estuary.

As the seawater used for regasification in the FRSU will be treated with sodium hypochlorite to manage bacterial growth in onboard pipework, the regasification seawater discharge has been modelled in terms of both temperature and residual chlorine concentration and this indicates negligible impact to the marine environment of extremely high sensitivity, resulting in an imperceptible effect.

The onshore effluent streams will be collected via separate constructed drainage networks and will be treated and monitored prior to discharge as required by the site's IE licence from the EPA, has been modelled in terms of E.coli bacteria dispersion in the estuary and will result in negligible adverse effect on an extremely high sensitivity environment and the significance of any residual effect is imperceptible.

Other operational phase risks to groundwater and surface water may arise from accidental losses of diesel fuel, transformer oils, odorant chemical and other chemicals used onsite. These risks will be managed by siting sensitive chemical storage and equipment within bunded areas, resulting in a low adverse effect to an extremely high sensitivity environment and the residual significance will be imperceptible.

Effects Identified and Key Mitigation/ Monitoring

Cumulative impacts arising from the related LNG Pipeline, Data Centre and medium voltage (10/ 20 kV)/ 220kV power supply developments envisaged under the Masterplan were considered and no significant residual effects were identified to the water environment. These development as per the masterplan will be subject to separate EIARs. The cumulative operational impact of the Proposed Development and cumulative schemes are considered to be imperceptible.

Mitigation measures have been embedded with the design and have been proposed based on the assessment. These mitigation measures will be implemented for the construction and operational phases of the Proposed Development, which may also interact with waste management and land and soils aspects of the development.

A CEMP will be prepared for the Construction Phase of the Proposed Development which will incorporate relevant environmental avoidance or mitigation measures to minimise generation of suspended sediments offshore, reduce potential environmental impact of onshore temporary storage of soil or rock fill, road runoff, runoff of contaminated waters from constructions areas, storage and use of oils, chemicals, fuels and waste material on site, control of concreting operations and vehicles on site. Site waste management, including control of solid waste, sewage and other waste stream inventories will be managed under the CEMP.

Operational phase mitigations include:

- Handling all hazardous or water-polluting materials in a manner to prevent/ minimise potential impact on groundwater and surface water;
- Secondary containment (bunding) and spill kits will be provided for other hazardous materials to be stored onsite, such as fuels, maintenance/ lubricating oils, odorant and cleaning chemicals;

- An Environmental Management Plan will be prepared for the operational phase;
- Operation of the Proposed Development in compliance with the requirements of the IE licence, to be issued and enforced by the EPA;
- Cumulative impacts arising from the related LNG pipeline (previously consented), Power Transmission and Data Centre developments envisaged under the Master Plan were considered. No significant residual impacts were identified to groundwater and surface water and the cumulative operational impact is considered to be imperceptible. The Power Transmission and Data Centre developments will be subject to separate EIAR; and

Summary of Impact and Effect

The residual effect of the Proposed Development on the surrounding groundwater and surface water environments is considered to be imperceptible during both the Construction and Operational phases.

7. Biodiversity

7.1 Marine Biodiversity

Existing Environment

The River Shannon Estuary is of significant ecological importance and comprises protected sites that support a diverse range of habitats and species. The sites, which are protected under national and international law, are the Lower River Shannon cSAC and the River Shannon and River Fergus Estuaries SPA. The cSAC and SPA site overlap with the Proposed Development site. The cSAC has been established for the protection of a range of marine and terrestrial habitats and species. Marine habitats of the cSAC include intertidal and subtidal habitats, and coastal lagoons and marsh areas while marine species include marine mammals and fish. The SPA which has been established for the protection of populations birds and the coastal wetland and marine habitats used by the species.

A range of surveys were conducted to identify the presence of protected habitats and species within the Proposed Development site. Protected marine habitats within the Proposed Development site include intertidal and subtidal areas, while protected species includes the Bottlenose Dolphin, a resident species of the Estuary. The estuary is also host to a wide range of fish species, many of which are protected species. The species include the migratory species salmon (*Salmo salar*), lamprey (*Petromyzon marinus* and *Lampetra fluviatilis*), eel (*Anguilla Anguilla*), twait shad (*Allosa fallax fallax*) and sea trout (*Salmo trutta*) while other fish species commonly found in the estuary include juvenile flatfish (*Pleuronectiformes* spp.), gobies (*Gobiiformes* spp.) and sticklebacks (*Gasterosteidae* spp.), and adult and juvenile bass (*Dicentrarchus labrax*), plaice (*Pleuronectes platessa*) and flounder (*Platichthys flesus*).

To inform the assessment of the potential impact of the Proposed Development a series of specialist studies were conducted. These included assessments of the of impact of project discharges, underwater noise emissions, and habitats loss on aspects of the marine environment.

Impact Assessment

The studies showed that discharges from the Proposed Development, which includes wastewater effluents, biocide treated discharge waters and heated water discharge, would not result in significant environmental impacts.

Similarly, releases of sediment spoil to the water to the estuary during construction would not result in a significant risk of impact to the environment.

In contrast, there is potential that the accidental release of sediment and chemical pollutants during the construction of the infrastructure for the Proposed Development may impact habitats and species immediately adjacent to, and upstream and downstream of the Proposed Development site. To avoid negative environmental impacts a range of pollution prevention measures will be implemented.

The generation of underwater noise during the construction period has potential to result in negative impacts to marine mammals. To avoid potential impacts a range of mitigation and monitoring measures will be set in place.

The Proposed Development includes the installation of jetty piles and the installation of a trenched water outfall. While these works will result in the loss of habitat, the area lost is negligible and will not result in significant effects.

7.2 Terrestrial Biodiversity

Existing Environment

To assess the ecological impacts of the Proposed Development, a range of assessments and surveys were undertaken. Surveys were conducted to identify the presence or likely presence of protected species and habitats within the study area. The value of these ecological receptors was determined and the possible impacts that the Proposed Development may have upon them was assessed. The National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI) were consulted and their findings integrated into the assessment.

The Lower River Shannon cSAC and the River Shannon and River Fergus Estuaries SPA overlap with the Proposed Development site. The impacts on these sites are discussed in the Natura Impact Statement (NIS) which accompanies this application. There will be no direct impacts on pNHAs or Natural Heritage Areas (NHAs).

Habitat surveys determined that the terrestrial habitats within the planning boundary were of local value. A small section of cliff habitat within the Site boundary has been classified as international value as this overlaps with the Lower River Shannon cSAC. However, this is not a qualifying habitat for the cSAC and does not correspond to Annex I habitats. No rare plant species were recorded within the Proposed Development site boundary during the survey.

General mammal surveys as well as Badger (*Meles meles*) bait marking surveys and trail camera surveys were conducted within and around the boundary of the Proposed Development site. Two outlier Badger setts were recorded within the Site boundary, as well as two main setts outside the Site boundary. No signs of Otter (*Lutra lutra*) were recorded within the Site, however signs of Otter were found in the vicinity. Small numbers of common bat species were recorded within the Site i.e. Common Pipistrelle (*Pipistrellus pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*) and Leisler's Bat (*Nyctalus leisleri*). These were recorded foraging and commuting mainly along hedgerow/ treelines with the Site boundary. However, no mature trees or buildings, with the potential to be used as significant bat roosting sites, were recorded within the Proposed Development site boundary Irish Hare (*Lepus timidus*) and Common Frog (*Rana temporaria*) were also recorded at the Site. No reptile species were recorded.

Breeding bird surveys concentrated on habitats within the Proposed Development site boundary. Overall, the study area is of a local value for a range of terrestrial bird species that are relatively common in the Irish countryside and the Proposed Development site is not of significant value for birds.

Estuarine bird surveys were carried out along the coastal waters near to the north of the Site as well as further east and west along the estuary coastline, mainly during the winter months. While moderate numbers of birds were recorded approximately 1 km west of the Proposed Development site, very small numbers of birds use the intertidal and subtidal habitats within the Proposed Development site, largely due to the lack of intertidal mudflat habitat here. No nationally or internationally important numbers of birds were recorded during the estuarine bird surveys.

A fish stock assessment confirmed that fish are present within the Ralappane Stream in small numbers i.e. Stone Loach (*Nemacheilus barbatus*), Stickleback (*Gasterosteus aculeatus*) and European Eel.

Impact Assessment

Overall, the majority of ecological impacts will arise during the construction phase as a result of disturbance to Badger, bats, Otter, birds, fish and common frog, damage to and loss of small areas of habitats (including 2 outlier Badger setts), hedgerows/ treelines and wet grassland, and potential water pollution incidents and sediment mobilisation. In the absence of mitigation these impacts range from not significant to moderate.

A range of mitigation and monitoring measures have been proposed in the EIAR to offset potential negative impacts noise mitigation, lighting mitigation, replacement planting and pollution prevention measures. All construction works and mitigation measures relating to ecology will be monitored by a suitably qualified ecologist.

Following the implementation of mitigation and monitoring measures a slight County impact on Annex I diving birds i.e. Red-throated Diver and Great Northern Diver is predicted to occur. However, all other impacts will not be significant above Local geographic scale of significance.

8. Air Quality

An assessment of the potential impact on air quality of the Proposed Development has been undertaken. This has focused on impacts associated with dust and particulates, during the construction and decommissioning phases, and emissions associated with combustion sources (energy plant stacks and road vehicle exhausts) during the operational phase.

Existing Environment

Baseline air quality has been characterised through the review of publicly available data sources, including monitoring data reported by the Environmental Protection Agency. In general, baseline air quality was found to be of a good standard and well below the health-based Air Quality Standards set by the Government for the protection of human health and the Environmental Assessment Levels used as the threshold for pollutants not covered by the Government standards.

Local air quality sensitive receptors include residential properties located closest to the Proposed Development in each direction, and properties located adjacent to the local road network on the approach to and from the Proposed Development. Receptors considered in the assessment also include air quality sensitive habitats within the Lower River Shannon cSAC and River Shannon and River Fergus Estuaries SPA.

Impact Assessment

The construction dust assessment considered the risk of dust impacts occurring based on the scale of construction works and the number and sensitivity of locations that are sensitive to dust impacts, such as the nearest residential dwellings, including those located within 25 m of the site access. This then informed the level of recommended dust control measures required to ensure that any effect will not be significant. The dust control measures taken forward by the Applicant and their construction contractor will be set out with the project CEMP.

The operational phase assessment considered the impact emissions from the Proposed Development activities site at sensitive receptors i.e. residential. The air quality assessment also considered the combined impact of these emissions, plus emissions from Proposed Development-related road vehicle emissions at residential dwellings located close to the roads used. A normal operational scenario forms the focus of the assessment, based on the Proposed Development operating continuously at its maximum capacity[2] and assuming both the LNG Terminal and the Power Plant are in operating simultaneously. A series of sensitivity/ alternative scenarios have also been considered, including consideration of the LNG Terminal is in operation without the Power Plant and various iterations of operating conditions that are considered conservative and highly unlikely to occur.

The assessment identified that the operation of the Proposed Development will have the largest impact (i.e. increase in pollutant concentrations) on the limited number of residential dwellings close to the site, but that impact will reduce with increasing distance from the Proposed Development site. For the normal operational scenario, impacts at the closest sensitive residential dwellings to the site are such that pollutant concentrations remain well below the Air Quality Standards and Environmental Assessment Levels, nor will the Proposed Development increase pollutant concentrations to the extent that pollutant emissions from further development of the area will put standards and levels at risk The overall impact

[2] This assumes the Power Plant operates at 100% load all year round and the LNG Terminal receiving 60 LNG carriers per year. This is conservative because it is expected that the Power Plant will be turned off during periods of high wind to give priority to renewable generation. 60 Ships per year is the design capacity of the LNG Terminal.

significance of the operation of the Proposed Development is considered to be slight, continuous, likely to occur and long-term, for the duration of the Proposed Development's operation.

As such and in summary, the construction, operation and decommissioning of the Proposed Development does not contravene local or national planning policy. Pollutant concentrations will not increase to the extent that the Air Quality Standards or Environmental Assessment Levels are reached or at risk of exceedance. Therefore, the effect of the Proposed Development is not considered significant overall and is compliant with local and national planning policy.

9. Noise and Vibration

Existing Environment

The existing acoustic environment in and around the site was quantified via baseline surveys. It was identified that existing sound levels are variable, but at times very low due to the absence of sound generated by human activity. Sound sources identified included birdsong, farm animals and weather induced sound (e.g. the wind 'rustling' vegetation). Some intermittent road traffic sound was present, mainly from the L1010.

There are various residential and ecological receptors in the vicinity of the Proposed Development. Noise and vibration impacts affecting residential receptors are covered in the noise and vibration chapter. Noise and vibration impacts affecting ecological receptors is covered in Chapter/Section 7.

Impact Assessment

The potential for the Proposed Development to give rise to airborne noise and groundborne vibration impacts has been considered as follows:

- Noise and vibration impacts arising during the construction phase, including:
  - Potential noise impacts arising from construction site activities located within the construction site, covering all construction activities proposed (e.g. piling, earthworks);
  - Potential vibration impacts arising from construction site activities located within the construction site, covering all construction activities proposed (e.g. piling, earthworks) ; and
  - Potential noise impacts arising from changes in traffic flows on existing roads.
- Noise and vibration impacts arising during the operational phase, including:
  - Operation of plant and equipment; and
  - Increase in traffic flows associated with employees, deliveries etc.

Underwater sound and vibration impacts are covered in Section 7.1of this document.

To determine the impact of the Proposed Development on existing receptors in the area, a 3D sound model was constructed using CadnaA 2020 acoustic modelling software. This model was used to determine potential exceedances of the nominated criteria and investigate the mitigation measures required to reduce emissions to compliant levels.

Mitigation requirements for potential impacts and identified as follows:

- Careful programming of site works;
- The impact of blasting induced noise, vibration and overpressure will be mitigated via process management, community liaison and though the limiting of blasting charge quantities. To determine the maximum permissible blast charge, a number of trial blasts will be carried out such that a site-specific scaled distance graph can be developed. Using this graph, limits required to achieve the relevant criteria can be determined;
- Operational phase noise impacts can be mitigated via the inclusion of mitigation measures such as attenuators, silencers, careful plant item selection and, acoustic barriers and enclosures. A 2 dB exceedance of the nominated criteria is predicted at one receptor location (R1), however it is

concluded this is not significant due to the contextual factors discussed in the noise and vibration chapter.

- A commitment has been made to ensure the final design of the development complies with the relevant operational phase noise limits. This will be confirmed via an appropriate noise monitoring regime.

Residual impacts are those arising from changes in traffic flows on existing roads during the construction phase. However, as discussed in this chapter, the spatial extent of this impact is small, being restricted to one road link; the L1010 between the site entrance and Tarbert. No impacts are predicted during the operational phase

Furthermore, although the change in noise from this road is sufficient to constitute an impact, absolute levels are not high therefore the impact may be less than indicated by the numerical assessment presented below.

10. Landscape and Visual

Existing Environment

Site surveys assessed the character of the landscape, the most sensitive features and the visual amenity. The location of the site on the edge of the southern shore of the Shannon Estuary results in it being particularly visible in scenic views from the northern shore of the estuary; from the waters of the estuary and Scattery Island and Hog Island; and from sections of the south shore extending west to beyond Ballylongford Bay and Carrig Island. The Proposed Development site is currently in pasture with some tillage, comprising primarily improved grassland with some wet grassland adjacent to the Shannon Estuary shore. Its boundary to the shore is formed by low sandy cliffs. A small stream runs in a north-westerly direction through the site and discharges into the Shannon Estuary. Field boundaries consist mostly of hedgerows and some small drainage ditches.

The topography of the land within the Proposed Development site is generally rolling and rising up from the Shannon Estuary shoreline. Some of the fields are waterlogged in wet weather and there are pockets of marshy ground. There are currently several old disused farm buildings and structures on the Proposed Development site. The Shannon Estuary within the study area is also the location for several large and visually prominent industrial developments such as Moneypoint Power Station at the shore in Co. Clare and Tarbert Power Station at the shore in north Co. Kerry.

Impact Assessment

Potential effects are separated into landscape and visual effects. Landscape effects are the result of physical changes to the character of the landscape resulting from new development. Visual effects relate closely to landscape effects but concern changes in views. Fifteen photomontages have been produced as a tool to support the landscape and visual impact assessment.

Effects at Construction

Effects arising during construction will result from machinery, personnel, excavations, traffic and material movements. Landscape and visual effects and their significance during construction works will be temporary. They will be highest within the immediate vicinity of the site, primarily along the adjacent roads. Principal views of construction works will likely be experienced within a radius of approximately up to 500 m from the site boundary as well as from dwellings facing the development site located within approximately 1 km from the site boundary. Existing intervening vegetation will partially screen site clearance, earthworks, construction compounds, construction works and associated machines moving on the construction site. The removal of vegetation during site clearance and earthworks will be a permanent effect.

Construction effects will be temporary, short term effects which occur during the construction phase only. Views of this area and any associated earthworks will also be partly restricted due to the undulating nature of the topography within the Co. Kerry part of the study area. Open views of the majority of

construction works will be possible from the Shannon Estuary itself and the shores of Co. Clare including elevated location in the hinterland.

Landscape Effects

The landscape character at the location of the Proposed Development will change from rural agricultural to a site with large industrial buildings and uses, which is considered adverse and significant. However, the Proposed Development aims to retain a number of existing hedgerows and tree lines on site. A detailed landscape masterplan includes the retention of existing vegetation and proposes new planting to supplement the site with additional woodland, hedges and trees. This will help the integration of the Proposed Development into its surrounds.

In the context of the wider area, the Proposed Development will industrialise the landscape character and further intensify the industrial components of the landscape character in the wider study area when seen in conjunction with the existing industrial landscape character around Moneypoint Power Station. The Proposed Development will be perceived in conjunction with other existing large-scale industrial developments along the Shannon Estuary, which define already the overall character of estuary and its shorelines within the study area. The Proposed Development will therefore not be seen as totally uncharacteristic and can integrate into the wider landscape character.

Visual Effects

The main visual effects will relate to the introduction of a new large industrial facility onshore and the LNG terminal and ships within the River Shannon. The main visual receptor groups are residents, vehicle travellers including ferry passengers, workers and visitors/ tourists. Residents will have the highest sensitivity to change than road users or ferry passengers. Vehicle travellers and workers will focus mainly on traffic or their commercial tasks and not primarily on available views. Ship passengers will see the Proposed Development in conjunction with the prominent existing Tarbert Power Station and Moneypoint Power Station structures.

Cumulative Landscape and Visual Effects

The medium voltage (10/ 20 kV) and 220 kV connections have the potential to cause additional landscape and visual effects during construction if the constructions stage overlaps with the one from the Proposed Development. Effects will arise from the removal of vegetation along the cable corridors, earthworks and moving machinery. Cumulative landscape and visual effects are considered to be medium to high locally and their significance is considered to range from moderate to significant adverse but temporary in views where the construction sites of both developments can be discernible at the same time. The main receptors of these effects will be local residents and vehicles drivers. Considering the use of the existing L1010, landscape effects will be minimal if roadside vegetation will be retained or reinstated. The significance of landscape and visual effects will therefore reduce to slight and imperceptible neutral.

The Proposed Development and the Data Centre Campus will not be constructed simultaneously and there will be no landscape and visual cumulative effects arising during the construction phase. However, during operation and depending on the layout of the Data Centre Campus and its visual presence, the landscape character will change further from a rural coastal setting to industrial. This change will be discernible along the southern shore of the River Shannon estuary in available views from the local road network and residential receptors in Co. Kerry as well as from the shores and from elevated areas further north in Co. Clare including designated scenic roads and the Wild Atlantic Way. Cumulative landscape and visual effects will likely be significant adverse.

Mitigation and Monitoring Measures

The principal mitigation for the Proposed Development is embedded in the design of its architecture, public realm, green infrastructure and open space, which has evolved through an iterative process of assessment and consultation. Mitigation and monitoring measures taken into account to minimise landscape and visual effects included:

- Minimise the visual impact of the built structures with the use of a colour scheme to allow the buildings to be as unobtrusive as feasible against their backdrop. The proposed colour scheme was drawn from colours found the surrounding local landscape;

- Avoidance of most elevated portion of land as a location for tallest elements of the Proposed Development;
- Lighting will be kept to essential locations only, with the position and direction of lighting being designed to minimise intrusion and disturbance to adjacent areas;
- Disturbance of existing vegetation will be minimised where possible. Proposed planting will help integrating the Proposed Development into the surrounding landscape, provide screening where needed, reflect vegetation patterns of local habitats, and minimise the effect on the landscape character of the area;
- Enhancement of site tree cover by introduction of additional tree and woodland planting; and
- Appropriate new native plant species to be used throughout the scheme.

11. Traffic and Transport

An assessment of the potential impact on the road network due to the Proposed Development has been undertaken. This assessment has focused on the impacts associated with the construction and operational phases of the Proposed Development at key junctions along the road network to/ from the Proposed Development site.

Existing Environment

The L1010 is a local road, single lane carriageway, which access to the Proposed Development is proposed from. The L1010 connects with the R551/ N67 in Tarbert Town and the R551/ R552 in Ballylongford Village. The L1010 is subject to a 50 km/hr speed limit on the approaches to Tarbert and Ballylongford, but this increases to 80 km/hr outside of these areas. A section of the L1010 is currently subject to an improvement scheme by KCC which extends from Tarbert Town to the Proposed Development access, it is anticipated that these improvements (road widening) would be complete prior to the commencement of the Proposed Development main construction elements. To form the baseline for this assessment, the key junctions which would be subject to construction and operational traffic were identified and traffic surveys were undertaken at these key junctions.

Impact Assessment

An Outline Construction Traffic Management Plan (OCTMP) has been prepared and included as part of this planning submission which has been used to inform the traffic associated with the construction phase of the Proposed Development. A detailed Traffic Management Plan (CTMP) will be produced by the successful Contractor prior to the main construction works. For the operational phase the anticipated staffing schedule has been provided for by the Applicant.

The traffic associated with the respective phases was assigned to the road network. Analysis was then undertaken using industry standard junction modelling software which demonstrated the impact at the key junctions during both the construction and operational phases on the road network.

From the analysis for the construction phase, it was found that the Proposed Development will result in a slight effect on junction capacity, but this would be a temporary effect. Similarly, the increased construction traffic would lead to an increase in queuing at the junctions but the effect would be not significant and temporary in nature.

From the analysis for the operational phase, it was found that the Proposed Development would result in a not significant effect on junction capacity, but this would be a long term effect. Similarly, the increased operational traffic would lead to an increase in queuing at the junctions but the effect would be imperceptible and long term in nature.

For the construction phase a package of measures has been presented that could be adopted by the appointed contractor subject to agreement with Kerry County Council. For the operational phase no mitigation or monitoring measures are necessary to accommodate the Proposed Development but a framework for a Mobility Management Plan has been included as an appendix to the traffic and transport chapter.

12. Cultural Heritage

The Cultural Heritage Chapter provides a statement of the potential impacts and residual effects upon the identified Cultural Heritage resource resulting from the Proposed Development.

Existing Environment

Detailed archaeological surveys were undertaken to inform the Environmental Impact Statement (EIS), relating to a previous planning application for a larger development, including a walkover survey, intertidal survey, marine geophysical survey, terrestrial geophysical and aerial photography. Measures to mitigate impact to Cultural Heritage assets noted on these surveys recommended in the EIS were subsequently placed as Condition 32 of Planning Permission (08.PA0002 which has since expired) and followed up with archaeological testing and recording in 2008. On the basis of this previous work, the following Cultural Heritage is noted within the Proposed Development.

There is one recorded archaeological site partially located within the boundaries of the Proposed Development. This is a ringfort (KE003-004) which is located on the east boundary which was noted as CHS10 in the previous EIS. The Cultural Heritage sites identified during the EIS within the Proposed Development comprise six assets – CHS4 Farm Complex, CHS5 Possible Archaeological Feature, CHS6 well, CHS7 gun emplacement, CHS14 Mass Rock and CHS15 a two-bay ruined structure.

The archaeological testing in 2008 revealed 31 Areas of Archaeological Potential within the footprint of the current Proposed Development. These represent a wide range of archaeological site types from the prehistoric period onwards including burnt mounds, enclosures, hearths and post-medieval settlement activity.

Impact Assessment

The Cultural Heritage assets and 31 Areas of Archaeological Potential are located within the footprint of the Proposed Development and will be impacted by groundworks associated with the construction of the Proposed Development.

A site of archaeological potential was recorded during the marine geophysical survey in 2007. This was interpreted as potential debris from shipping in the Shannon Estuary. The submerged anomaly lies some 200 m to the east of the Proposed Development and is unlikely to be directly impacted by works during construction.

There will be residual impacts on 26 assets of moderate effect and residual impacts on two assets of no effect.

The ringfort (KE003-004)/ CHS10 will remain *in situ* within the boundaries of the Proposed Development with a buffer zone created around it. This recommendation was included as Condition 32 (f) of Planning Permission (08.PA0002) and a fence-line was proposed to demarcate the appropriate buffer zone. This fence-line will also be included in the current scheme as embedded mitigation.

A seabed impact exclusion zone of 50 m was to be maintained around the seabed anomaly to ensure that it is not impacted under Condition 32 (d) of Planning Permission (08.PA0002). This mitigation will be included at the construction phase of the current Proposed Development.

A photographic survey and written description of CHS6 Well should be carried out in advance of groundworks within the vicinity of this asset. It is also recommended that the dismantling of the well be carried out in an orderly fashion under the supervision of a suitably qualified archaeologist.

CHS4 Farm Complex, CHS7 Gun Emplacement and CHS15 two-bay ruined structure were recorded as part of the upstanding building survey in 2008 to fulfil a condition on planning approval (Condition 32 (d) of Planning Permission 08.PA0002). No further mitigation is required in relation to these assets which will demolished during the construction phase.

CHS14 Mass Rock was made known to the 2007 EIS by local knowledge. This asset was not observed during fieldwork associated with the EIS including the intertidal survey nor was it observed during a survey of the foreshore area associated with this EIAR in March 2021. This asset no longer exists and there will be no impact to it.

It is proposed that full resolution of all 31 Areas of Archaeological Potential (including CHS5 Possible Archaeological Feature) and areas identified during archaeological testing within the Proposed Development boundary will be carried out prior to commencing the-Construction Phase. It is proposed that all works for the outfall and jetty will be conducted under archaeological monitoring under licence by a suitably qualified and experienced marine archaeologist. All archaeological works (which will be agreed by the Archaeological Consultant and the National Monument Service (NMS)) will be carried out in compliance with the National Monuments Acts 1930 – 2004 (and Policy and Guidelines on Archaeological Excavation (Department of Arts, Heritage Gaeltacht and the Islands, 1999).

13. Population and Human Health

Impacts on population and human health have potential to arise from various aspects of the Proposed Development. An assessment of impacts on the following was undertaken:

- Land use;
- Severance;
- Employment; and
- Human health.

Study Area

The study area for the population and human health assessment has considered the area of land that encompasses the likely effects of the Proposed Development. The area used for the baseline analysis comprises the electoral divisions of Carrig, Lislaughtin, Tarmon and Tarbert, as this is where the majority of population and human health effects are likely to occur. However, there is potential for effects to occur on receptors outside of this area. For example, it is not always possible to determine the catchment area for community facilities as residents of an area may utilise facilities located within different districts, counties, or regions without regard for statutory boundaries. In addition, this assessment refers to the findings of other EIAR chapters which have different study areas. For example, the Climate chapter (Chapter 15) considers effects of the Proposed Development on the global climate.

Key Limitations and Assumptions

This population and human health assessment is based on professional judgement and considers both the negative and positive impacts that the Proposed Development can have upon existing and surrounding receptors. It provides a broad, high level indication of effects, reporting on the potential effects to people and the local community.

The assessment draws upon other specialist topic inputs to aid the assessment of the impact of the Proposed Development on population and human health receptors.

Baseline Environment

The Proposed Development will be located along the Shannon Estuary in County Kerry. The nearest residential properties to the Proposed Development are located within 500 m to the south of the Proposed Development along the L1010 road in the townlands of Kilcolgan Lower and Rallapane. The area is predominantly rural and the primary land use in the study area is agricultural. There are two locations offering community resources near to the site: the town of Tarbert and the village of Ballylongford.

The town of Tarbert is located approximately 4.5 km east of the Proposed Development on County Kerry's border with County Limerick. The town is small and has a population of approximately 500. Tarbert comprises a high street with a number of facilities for the local community, including a post office, a church (St Mary's Roman Catholic Church), a healthcare facility (a general practitioner), a community centre and three schools: a pre-school (Wishing Tree Pre-School), a primary school (Tarbert National School) and a secondary school (Tarbert Comprehensive School).

The village of Ballylongford is located approximately 3.5 km to the south-west of the Proposed Development. The village is situated at the top of a creek of Ballylongford Bay on the tidal estuary of the River Shannon. The village is small and is home to approximately 400 people, though it does offer some services and sees a large influx of tourists which visit the range of historical sites in the local area.

The population of the study area has recently declined and is relatively elderly. During the public consultation undertaken by the Applicant, 97% (35) of the public comments were supportive of the development. 16 of the 36 comments received were supportive due to the local employment opportunities that the Proposed Development will create.

Assessment of Impacts

During Construction

Construction of the Proposed Development will lead to a slight negative effect on land use due to the loss of agricultural land currently used for grazing and impacts on views experienced by users of the Wild Atlantic Way. It will also lead to a slight positive effect on the local employment workforce due to the number of construction workers required. It will also lead to an imperceptible negative effect on severance between the local population and the services which they frequently use due to construction traffic travelling to and from the Proposed Development site.

The Proposed Development will also lead to the following impacts on human health during the construction phase:

- A negative human health impact due to the presence of construction traffic leading to nuisance and noise level increases at residential properties on the L1010 and Church Street in Tarbert.
- A positive human health impact due to the workforce required to construct the Proposed Development leading to increased accessibility to employment opportunities and training for the employment workforce in the local and wider community. Employment and income are among the most significant determinants of long-term health and so this project could improve the socio-economic circumstance and therefore the health and wellbeing of the workforce.

During Operation

Operation of the Proposed Development will lead to a slight negative effect on land use due to the loss of agricultural land currently used for grazing and impacts on views experienced by users of the Wild Atlantic Way. It will also lead to a slight positive effect on the local employment workforce due to the number of operational workers required.

The Proposed Development will also lead to the following impacts on human health during the operation phase:

- A positive human health impact due to the workforce required to operate the Proposed Development leading to increased accessibility to employment opportunities and training for the employment workforce in the local and wider community.
- A negative human health impact due to the impact of the Proposed Development on GHG emissions and climate change.

Cumulative Effects

A number of the cumulative schemes have potential to lead to loss of agricultural land and to negatively impact on views from the Wild Atlantic Way. This could lead to a negative cumulative impact on land use, though overall this impact is not considered likely to be significant.

14. Major Accidents and Disasters

It is a requirement of EIARs to incorporate a section which identifies and describes the potential major accidents and disasters that could be relevant to the site. A study has therefore been carried out for the Proposed Development.

The LNG, power generation and natural gas industries worldwide have an excellent safety record. Operators of these facilities incorporate the highest standards of safety and environmental protection measures throughout the design, construction and operation of their facilities. This industry is subject to stringent regulatory controls and there are a number of worldwide LNG, natural gas and maritime industry organisations which share guidance and best practise to drive continuous improvement in safety and environmental performance.

Safety and environmental protection measures are incorporated at all stages in the lifecycle of the Proposed Development. From the extensive number of engineering codes and standards which are used in the design of facilities, from the construction of vessels and infrastructure to the specification of pipework and instruments to monitor and control the process. Detailed safety and environmental risk assessments will be carried out during design and on a regular basis during the operating phase of the Proposed Development to identify and analyse hazards. Potential hazards that are identified will be eliminated wherever possible or reduced by incorporating appropriate measures such as automated control and emergency systems, fire detection, protection, and alarm systems. Prior to operation, detailed operating and emergency procedures will be developed and reviewed by the Regulatory Authorities, alongside the comprehensive safety documentation which is required for compliance with national regulations including the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations, 2015 (the COMAH Regulations).

The Proposed Development will be regulated by the following bodies:

- Environmental Protection Agency (EPA).
- Commission for Regulation of Utilities (CRU).
- Health and Safety Authority (HSA); and
- Planning Authority.

The Shannon Foynes Port Company has statutory jurisdiction over marine activities.

The installed protective measures will reduce the potential risks to people and the environment from the Proposed Development to a level ‘As Low as Reasonably Practicable’ (ALARP). Demonstration of ALARP is a requirement for COMAH Installations.

The assessment of major accidents and disasters carried out for the EIAR has concluded that the risk of a fire from a release of LNG or natural gas as the most significant potential major accident hazard at the Proposed Development. Consequently, minimising the quantity of LNG and gas present and providing secure containment is of the utmost importance. Therefore LNG will be stored within the LNGCs and FSRU only, and there will be no gas storage onshore other than natural gas within pipework only. Gas pipework systems will be designed and installed to international engineering standards and will incorporate safety measures such as using welded connections and where practical, routing pipework below ground.

The Power Plant will contain process equipment such as natural gas compressors, turbine generators and electrical transformers, containing flammable and combustible substances. Consequently, a fire has also been identified in this assessment as the most significant potential major accident in this area of the Proposed Development.

A number of fire prevention and protection measures are included in the design of the Proposed Development, which are as follows:

Layout of the Proposed Development to minimise the potential for an incident in one area affecting other areas;

Passive fire protection systems will be installed in appropriate areas, which allows certain systems to withstand a fire for a defined period of time to enable the emergency response plan to be initiated;

- A network of fire and gas detectors, audible and visual fire alarms will be installed throughout the Proposed Development to alert operations personnel who will initiate the emergency response; and
- Active fire protection systems will be installed onsite, supplied by large firewater storage tanks and activated on demand from the fire and gas system or manually initiated from the central control room.

The design of fire protection systems and the development of emergency procedures has taken into consideration an ongoing process of consultation with the local Fire Officer.

The location of the Proposed Development is within the protected area of the Shannon Estuary (the Lower River Shannon cSAC, the River Shannon and River Fergus Estuaries SPA and the Ballylongford Bay pNHA). Therefore, the highest standards of environmental protection will be incorporated into the design of the Proposed Development. International maritime law applies to the ships which will be moored at the jetty, and the use of fuels and disposal of waste from toilets and washing facilities are strictly controlled. These wastes are collected and transferred onshore for treatment and safe disposal by a licensed contractor. The risk of an accident occurring, such as a release of fuel oil from a ship is very low, however a detailed pollution response plan, emergency equipment and procedures will be in place prior to construction and throughout the lifetime of the Proposed Development.

The Proposed Development site location has been carefully chosen and there is a very low risk of natural disasters occurring such as flooding and earthquakes. Potential impacts of climate change have also been taken into consideration, for example, the height of the jetty has been set to accommodate predicted future water levels.

There is a very low risk of a major accident or disaster occurring at the Proposed Development. The LNG facility will be regulated as an Upper Tier COMAH Installation and the highest levels of safety and environmental protection will be in place for the lifecycle of the facility, from prior to construction and throughout the operational lifetime. Detailed risk analyses for the Proposed Development such as Quantitative Risk Assessment (QRA) and Environmental Risk Assessment (ERA) will be carried to analyse the potential for further risk reduction.

The facilities associated with the Proposed Development will be designed, constructed and operated by specialist, experienced organisations who will adhere to all applicable national regulations and internationally recognised best practice in the design and operation of the facility, controlling the risks and delivering essential gas supplies to the national network.

15. Climate

Chapter 15 – Climate Change of the EIAR presents the findings of an assessment of the likely significant effects of the Proposed Development on the Climate and of Climate Change effects on the site and surrounding area. The scope of the assessment considers the construction and operation of the Proposed Development.

The chapter includes three assessments:

- A lifecycle greenhouse gas (GHG) assessment which considers the impact of GHGs from the Proposed Development on the climate;
- A Climate Change Resilience (CCR) assessment which considers the impact of climate change on the Proposed Development; and

- An In-combination climate change impact (ICCI) assessment which considers the combined impacts of the Proposed Development and climate change on the surrounding environment.

The Climate Action and Low Carbon Development (Amendment) Bill 2021, read in the Oireachtas in April 2021, will commit Ireland to becoming a carbon-neutral economy by no later than 2050. Ireland's carbon-neutral commitment for 2050 is binding on the entire state, and not on any individual installation or emitter. In order to achieve carbon neutrality, all residual emissions in Ireland by the target data must be offset or sequestered according to a recognised and verified standard. It is not necessarily the responsibility of individual installations to offset their own residual emissions remaining by the target date. To reach the 2050 milestone, a series of five-year carbon budgets, setting out a carbon reduction trajectory for Ireland, are to be embedded into law. The first two budgets must demonstrate a 51% reduction against a 2018 baseline by 2030.

A key component of meeting this reduction target is the decarbonisation of electricity generation in Ireland. To drive this change Ireland have set a target to generate 70% of grid electricity from renewable sources by 2030, largely from wind. To allow this uptake of renewable energy to happen it is necessary to have in place sources of energy generation that can be efficiently dispatched to cover any imbalances in supply and demand. As the use of coal and peat for electricity generation will cease by 2025 under the 2019 Climate Action Plan, natural gas has been identified in the Climate Action Plan, and the National Energy and Climate Plan, as the only remaining dispatchable power source capable of providing significant security of electricity supply when wind sources are insufficient.

This assessment considered two scenarios; a 'business as usual' baseline scenario where the Proposed Development is not progressed, and a scenario where the Proposed Development is permitted. For the purposes of the GHG assessment, the baseline scenario considers both carbon emissions from the existing site but also Ireland's carbon reduction targets.

The natural gas and electricity demand figures used in this assessment are taken from the Climate Action Plan and the National Energy and Climate Plan forecasts. These gas and power demand forecasts have been developed to support Ireland's 70% of grid electricity from renewable sources by 2030 target and longer term decarbonisation of electricity generation in Ireland. Furthermore, the Proposed Development diversifies the supply of natural gas and electricity to the Irish market. It does not in itself increase demand for natural gas or electricity. In a 'business as usual' scenario, where the Proposed Development is not progressed, this demand would be met by alternative, and potentially more carbon intensive power suppliers[3].

For the ICCI and CCR assessment, the baseline describes the current climate, whilst the project-scenario describes the likely climate during the project-phases. The climate baseline has been developed using historic data obtained from Met Éireann, and the future-baseline from projections modelled by the Irish Environmental Protection Agency.

Construction Phase

Under the Proposed Development, a total of 86kt CO_2e is estimated to be emitted during construction. When considered in the context of Ireland's GHG inventory and carbon reduction targets construction emissions are considered to have a minor adverse impact. No further mitigation measures beyond those already embedded in the design are currently being recommended.

ICCI and CCR were assessed qualitatively for the construction phase, as this phase would be short and in the near future. It is not anticipated that there would be any significant impacts during construction. Embedded mitigation measures were deemed sufficient for construction phase impacts.

Operational Phase

The requirement for the Proposed Development supports the implementation of the National Energy and Climate and Climate Plan 2021-2030. Ireland has set an ambitious target for 70% of electricity generation capacity to be from renewable sources by 2030. It is acknowledged that gas has an increasing part to play in Ireland's energy mix if this renewable energy target is to be met by providing back up to the variable power supplied by renewables.

[3] *This is evidenced by reported awarding of contracts to diesel generators at the ESB Northwall site for the winter 2021/ 22 period due to a shortfall of generation capacity (Irish Times, 2021).*

The proposed Power Plant will not operate at 100% capacity all year round. The actual operation of the plant will be determined by many factors such as power demand itself, the amount of renewable generation on the system, its bid price into the market compared to other generators and the rules of the grid to ensure priority is given to renewable generation. The grid also needs to remain stable and secure with increased high levels of renewable generation. The Applicant commissioned a detailed market analysis report to consider these issues and model the future operation of the Power Plant from 2023 to 2050. The model assumes the government's 70% renewable by 2030 target is met. It also considers the detailed requirements of the system operator (EirGrid) to keep the grid stable and secure. In conclusion, analysis confirmed that the flexibility of the Power Plant, including the BESS, is ideally aligned with a high renewable market from now to 2050. In particular, the Power Plant offers the market high inertia, very low minimum stable generation and fast response capability. The detailed results from the modelling of the Power Plant future operations are confidential, but the CO_2 emissions presented in this chapter are taken from this model.

Direct emissions from the operation of the Proposed Development will equate to approximately 963kt CO_{2e} in 2030, around 2.1% of Ireland's carbon allowance if Ireland's carbon reduction targets are met. As a standalone development, this represents a major adverse impact, however the impact of this development needs to be considered in the context of the key role it will play in assisting Ireland to transition to a low carbon economy.

As previously outlined, the design of the Power Plant and the BESS have been chosen for its flexibility and efficiency. All future energy scenarios, show gas power plant being required in the period to 2050 and beyond. Given that it is accepted by all competent authorities that gas-fired generation will be required, there will be emissions in aggregate from power plant operating in the Single Electricity Market regardless of which individual plant generates the emissions.

The operation of the Single Electricity Market , which takes into account the cost of emissions under the EU Emissions Trading Scheme, dictates that the most efficient and least emitting plant will be dispatched first for energy generation and system stability purpose. The efficiency of the Power Plant combined with its ability to operate at a low minimum generation capacity means that the Power Plant will be dispatched ahead of a less efficient OCGT power plant, as it will provide lower direct emissions and also provide system inertia (and other system services) at a lower output allowing for higher instantaneous renewable (non-synchronous) generation that would otherwise be the case if the Power Plant was not developed.

As the level of renewable generation on the system at any one time increases, thermal power plant has their dispatch quantities decreased by EirGrid to facilitate the output of the renewable power plants. However, a certain number of dispatchable plants must remain on the system to provide the services mentioned above. 'Positioning' is when the grid operator keeps a power plant running so as to be on standby to provide these services to the grid operators in real time. This is a vital process for grid stability; however, with inflexible power plants it can lead to larger than necessary power plants being positioned. This causes increased emissions, increased curtailment of renewables (to make room for the positioned power plant) and increased costs.

The ability of the Power Plant to operate at a 50% blend of hydrogen by design, offers the potential for the Power Plant to become even more efficient in emission terms over the period to 2050 as and when the required policies and supply chains for hydrogen are implemented.

The Proposed Development has a unique location and flexible design that can easily transition to alternative low carbon fuels, subject to future planning applications, once the technology and public policies are established. This capability has been acknowledged by the CRU in their July 7th contributions to the Oireachtas Committee on Environment and Climate Action:

'*Ms MacEvilly said there was not necessarily a contradiction between building new gas infrastructure and quitting fossil fuels as it was expected that biomethane and green hydrogen would eventually replace natural gas in the supply chain.*

CRU chairperson, Aoife MacEvilly told the committee: 'Gas-fired generation will play a pivotal role in underpinning electricity security of supply and the secure electrification of heating and transport.'

Commissioner Jim Gannon added: 'It's not beyond the bounds of commercial or technical possibility that gas terminals that will help us supply security and diversity of supply couldn't also be designed to be converted over time to using hydrogen.'

The specifications of the Proposed Development are such that it would be required to have a GHG Permit, to submit independently verified annual emissions reports, and to surrender sufficient EU Allowances to cover its annual emissions under the terms of the EU Emissions Trading System. Emission trading requirements of this Proposed Development do not alter the significance level.

Climate change projections for the locality of the Proposed Development during its lifespan indicate a changing environment, with warmer and drier summers and wetter winters. ICCI and CCR were assessed semi-quantitatively in this assessment. No ICCI impacts on receptors in the surrounding environment were identified, and embedded design measures were deemed sufficient to reduce the vulnerability of the Proposed Development to climate change impacts during the operational phase.

Cumulative Effects

By its nature the GHG assessment considers cumulative effects. All development results in GHG emissions and consequently all development therefore has the potential to result in a cumulative effect on GHG emissions. By considering GHG emissions from the Proposed Development in the context of the national GHG inventory for Ireland and future GHG reduction targets, as being representative of the global climate, the impact of the scheme is being considered on a national scale.

When addressing the cumulative impact of the Proposed Development it should also be considered on a sectoral scale. While the Proposed Development will result in direct emissions from the combustion of fossil fuel, this is seen as necessary if the overall impact of electricity generation on the climate is to be reduced through the introduction of higher renewable generation capacity.

16. Waste

This chapter presents an assessment of the impacts of the Proposed Project Development with respect to waste management. In the absence of specific guidance on assigning significance for waste management impacts, professional judgement, national and local policy, and recognised best practice have been used to objectively assess the impact of the Proposed Development against the baseline. The existing baseline conditions have been assessed with respect to national waste arisings and the availability and capacity of waste management infrastructure within the study area.

The study area for the assessment of waste management infrastructure capacity for the Proposed Development includes the footprint of the Proposed Development site, within which waste will be generated from the construction and operational activities. The study area will also extend to the whole of Ireland due to the need to consider all available waste management infrastructure capacity in Ireland.

The baseline information on waste arisings and waste management facilities capacity in Ireland has been sourced from the most recent available data published by the Environmental Protection Agency (EPA).

Assuming all waste that cannot be reused is removed from site, the overall estimated Construction and Demolition (CDW) waste arisings would be 0.058% of total national CDW arisings. This is considered not significant.

By applying good industry practice to the management of non-hazardous waste generated by the Proposed Project's construction activities, it is anticipated that an overall recovery rate of 78% can be achieved onsite which exceeds the Government's 70% target for recovery of construction waste.

The estimated operational waste arisings have been compared to the quantity of hazardous and non-hazardous waste collected in Ireland in 2018. Operational waste arisings would be 0.04% of total national waste arisings. This is considered not significant.

17. Material Assets

This chapter presents an assessment of the potential impacts of the Proposed Development on Material Assets. This chapter defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment; and presents the findings of the impact assessment.

This chapter presents an assessment of the potential impacts of the Proposed Development on built services, as well as infrastructure: land use and buildings (on the Proposed Development site). Chapter 11 discusses the assessment of roads and traffic and Chapter 16 discusses waste and as such these topics are not considered in the waste chapter.

In summary:

- It has been assessed that the residual effects from connection works during the construction phase on the existing utilities networks will likely reduce to **slight** with the implementation of embedded mitigation measures.
- The effects from additional demands on existing water supply will remain **moderate** during the construction and **slight** during the operational phase.
- No utilities mitigation or monitoring measures have been proposed during the operational phase of the Proposed Development, which will be designed in accordance with best available techniques for energy efficiency. The effects on the existing gas and electricity supply network will remain **long-term**, **positive**, **high** and **very significant,** if the 220 kV grid connection is consented and becomes operational.
- The effects on existing buildings within the Proposed Development site boundary will remain **permanent**, **neutral** and **imperceptible** as no mitigation is possible to avoid or reduce the effect.
- It is anticipated that effects on the existing grid network from a number of future developments in combination with the future Proposed Development, will result in a **positive** and **significant** cumulative effect.

18. Interactions

This chapter of the EIAR evaluates the potential interaction of effects described within this EIAR, which the Proposed Development may have on the receiving environment and sensitive receptors.

The interaction of effects within the Proposed Development in respect of each of the environmental factors, listed in Article 3(1) of the EIA Directive, have been identified and addressed in detail in the respective chapters in this EIAR. This chapter, however, presents a summary of each assessment of the interaction (interrelationship) of impacts from the Proposed Development between the various environmental factors.

Interactions (or inter-relationship) of effects identified from the Proposed Development are identified between the following environmental aspects:

- Land and Soil;
- Water;
- Biodiversity;
- Air Quality;
- Noise and Vibration;
- Landscape and Visual;
- Traffic and Transport;
- Cultural Heritage;
- Population and Human Health;

- Major Accidents and Disasters;
- Climate;
- Waste; and
- Material Assets.

All potential effects arising from the interactions were identified early in the design process and in preparation of the EIAR and were therefore addressed in the design of the Proposed Development, in addition to the impact assessment studies. As a result, any potential effects were either avoided through design measures or have been addressed through specific mitigation and monitoring measures within respective chapters within this EIAR. No additional mitigation or monitoring measures are proposed in this chapter.

19. Summary of Mitigation

Embedded mitigation measures have been incorporated into the design of the Proposed Development throughout the design process. The environmental impact assessment of the Proposed Development, as described in Chapter 01 – Introduction, facilitated the identification of additional mitigation and monitoring measures to prevent or reduce any likely significant impacts identified in relation to the Proposed Development.

This chapter summarises the impacts assessed, and the mitigation and monitoring measures identified within Chapters 05 to 17 of this EIAR. The embedded environmental controls and all mitigation and monitoring measures detailed herein are included in the Outline Construction Environmental Management Plan, included as Appendix A2-4 in Volume 4.

20. References

Irish Academy of Engineering. (2018). *Natural Gas – Essential for Ireland's Future Energy Security*. Available from: http://iae.ie/wp-content/uploads/2018/08/IAE_Natural_Gas_Energy_Security.pdf.

GLOSSARY & ACRONYMS

AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
ABP	An Board Pleanála
ACA	Architectural Conservation Areas
ACC	Air-Cooled Condenser
ADMS	Atmospheric Dispersion Modelling System
AEP	Annual Exceedance Probability
AGI	Above Ground Installation
AIL	Abnormal Indivisible Loads
ALARP	As Low as Reasonably Practicable
AM	Ante Meridiem
APIS	Air Pollution Information System
Applicant	Shannon LNG Limited
AQLVs	Air Quality Limit Values
AQSR	Air Quality Standards Regulations
ASI	Archaeological Survey of Ireland
ASU	Aquatic Services Unit
ATC	Automatic Traffic Counter
BAT	Best Available Techniques
BBS	Breeding bird survey
BCI	Bat Conservation Ireland
Bcm	Billion cubic metres, gas equivalent
BCT	Bat Conservation Trust
BESS	Battery Energy Storage System
BLEVE	Boiling Liquid Expanding Vapour Explosion
BoCCI	Birds of Conservation Concern in Ireland
BOG	Boil-off Gas
Bq/m^3	Becquerel per cubic metre
BPM	Best Practicable Means
BREF documents	Best Available Techniques Reference Documents
BS	British Standard
BSI	British Standards Institute
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BTO	British Trust for Ornithology
BWI	Bird Watch Ireland
CAFE	Clean Air for Europe
CAP	Climate Action Plan
CBC	Common Bird Census
CBR	California Bearing Ratio
CCC	Clare County Council
CCDP	Clare County Development Plan

CCGT	Combined Cycle Gas Turbines
CCR	Climate Change Resilience
CCTV	Closed Circuit Television
CDP	County Development Plan
CDW	Construction and Demolition Waste
CDWMP	Construction and Demolition Waste Management Plan
CEMP	Construction and Environmental Management Plan
CEMS	Continuous emissions monitoring system
CER	Commission for Energy Regulation
CFRAM	Catchment Flood Risk Assessment and Management
CGSs	County Geological Sites
C_6H_6	Benzene
CHP	Combined Heat and Power
CHS	Cultural Heritage Sites
CH_4	Methane
CH_2O	Formaldehyde
CIEEM	Chartered Institute of Ecology and Environmental Management
CIF	Construction Industry Federation
CIRIA	Construction Industry Research and Information Association
CLP	Classification, Labelling and Packaging
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COC	Constituents of Concern
COMAH	Control of Major Accidents and Hazards
CRAMP	Closure Remediation and Aftercare Management Plan
CRTN	Calculation of Road Traffic Noise
CRU	Commission for Regulation of Utilities
cSAC	Candidate Special Area of Conservation
CSM	Conceptual Site Model
CSO	Central Statistics Office
CTG	Combustion Turbine Generators
CTMP	Construction Traffic Management Plan
CWMP	Construction Waste Management Plan
DAC	Disability Access Certificate
DAHG	Department of Arts, Heritage and the Gaeltacht
DAHGI	Department of Arts, Heritage, Gaeltacht and the Islands
DAU	Development Applications Unit
dB	Decibels
DCCAE	Department of Communications, Climate Action and Environment
DCENR	Department of Communications, Energy and Natural Resources
DCHG	Department of Culture, Heritage and the Gaeltacht (More recently The Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media)
DCM	Dichloromethane
DECC	Department of the Environment, Climate and Communications
DEFRA	Department of Environment, Food and Rural Affairs
DEHLG	Department of the Environment, Heritage and Local Government
DfT	UK Department for Transport

DHPLG	Department of Housing, Planning and Local Government
DMP	Dust Management Plan
DMRB	Design Manual for Roads and Bridges
DoECLG	Department of Environment, Community & Local Government
DoEHLG	Department of the Environment, Heritage and Local Government
DQRA	Detailed Quantitative Risk Assessment
DSA	Detailed Site Assessment
DWS	Drinking Water Standards
dwt	Deadweight tonnes
EA	UK Environment Agency
EC	Electrical conductivity
EC	European Commission
EcIA	Guideline for Ecological Impact Assessment
EcMS	Ecology Monitoring Strategy
EHGV	Electric Heavy Goods Vehicle
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
ENTSOG	European Network of Transmission System Operators for Gas
EPA	Environmental Protection Agency
EPUK	Environmental Protection UK
EQSs	Environmental Quality Standards
ERH	Electrical Resistance Heating
ERS	Emergency Release Systems
ESA	Environmental Site Assessment
ESB	Electrical Supply Board
ESBN	Electricity Supply Board Network
ESD	Emergency Shutdown
ESD	Effort Sharing Decision
ESM	Environmental Sensitivity Mapping
ESR	Effort Sharing Regulation
ETS	Emissions Trading Scheme
EU	European Union
F&G	Fire and Gas
FGS	Fire and Gas System
FRA	Flood Risk Assessment
FSRU	Floating Storage Regasification Unit
GAC	Generic Assessment Criteria
gCO2	Carbon dioxide equivalent
GHG	Greenhouse Gas
GGBS	Ground Granulated Blast Furnace Slag
GIIGNL	International Group of Liquefied Natural Gas Importers
GIS	Geographic Information System
GLAs	Gas unloading arms
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GNI	Gas Networks Ireland
GSI	Geological Survey Ireland

GSU	Generator step-up transformer
GTV	Groundwater Threshold Values
GWB	General Watching Brief
GWh/day	Gigawatt hours per day
GWTP	Groundwater Treatment Plant
Ha	Hectares
HAZID	Hazard Identification
HAZOP	Hazard and Operability
HC	Hydrocarbons
HDV	Heavy Duty Vehicles
HE	Historic England
HE	Highways England
HEFS	High-End Future Scenario
HFC	Hydrofluorocarbons
HFO	Heavy Fuel Oil
HGV	Heavy Goods Vehicle
HMP	Habitat Management Plan
HNS	Hazardous and Noxious Substances
HRSG	Heat recovery Steam Generator
HSA	Health and Safety Authority
HSE	Health Service Executive
HUDU	Healthy Urban Development Unit
HV	High Voltage
HVAC	Heating, ventilation and air conditioning
Hz	Hertz
IAA	Irish Aviation Authority
IAE	Irish Academy of Engineering
IAQM	Institute of Air Quality Management
ICCI	In-combination Climate Change Impact
ICE	Inventory of Carbon and Energy
ICF	Irish Concrete Federation
ICM	Integrated Catchment Modelling
ICSS	integrated control and safety system
IE	Industrial Emissions
IEA	International Energy Association
IEC	International Electrotechnical Commission
IED	Industrial Emissions Directive
IEL	Industrial Emissions Licence
IEMA	Institute of Environmental Management and Assessment
IFI	Inland Fisheries Ireland
IGC Code	International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
IGI	Institute of Geologists of Ireland
IGN	International Gas Union
IGV	Interim Guidelines Values
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IPH	Institute of Public Health

IPIECA	International Petroleum Industry Environmental Conservation Association
IPPC	Integrated Pollution Prevention Control
iSEM	Integrated Single Electricity Market
ISMP	Invasive Species Management Plan
ISO	International Organization for Standardisation
IVC	Irish Vegetation Classification
IWeBS	Irish Wetland Bird Survey
JTC	Junction Turning Counts
KCC	Kerry County Council
KER	Key Ecological Receptors
Kg	Kilogram
km	Kilometre
Km^2	Square Kilometre
ktoe	Tonne of oil equivalent
kV	Kilovolt
LAP	Local Area Plan
Laeq	Noise – Terms – Energy Averaging
LCA	Landscape Character Assessment
LCAs	Landscape Character Areas
LCPD	Large Combustion Plant Directive
LCT	Landscape Character Types
LGV	Light Goods Vehicle
LNG	Liquefied Natural Gas
LNGC	Liquefied Natural Gas Carrier
LNG Regasification	Process that converts LNG to a gaseous state by heating the LNG using either seawater or gas-fired water heaters
LoW	List of Wastes
LPA	Local Planning Authority – Kerry County Council
L/s	Litres per second
LV	Low Voltage
LVs	Limit Values
LVIA	Landscape and Visual Impact Assessment
m	Metre
MA&D	Major Accidents and Disasters
MAH	Major Accident Hazard
MAPP	Major Accident Prevention Policy
MARPOL	International Convention for the Prevention of Pollution
MASP	Metropolitan Area Strategic Plans
MATTE	Major Accident to the Environment
m bct	Metres below casing top
m bgl	Metres below ground level
MCC	Motor Control Centres
MDL	Method Detection Limit
MDO	Marine Diesel Oil
MEL	Minerex Environmental Limited
MFO	Marine Fuel Oil
mg/l	Milligram per litre

MHWS	Mean High Water Spring
MIC	Maximum Instantaneous Charge
Million Sm^3/d	Million Standard Cubic Metres per Day
MIP	Membrane Interface Probe
mm	Millimetres
MMBtu	Metric Million British Thermal Unit
mm/hr	Millimetre per hour
MMP	Mobility Management Plan
MMQ	Maximum Mean Queue
mm/s	Millimetre per second
MNA	Monitored Natural Attenuation
m OD	Metres Ordnance Datum
MRFS	Mid-Range Future Scenario
m/s	Metre per second
Mt	Million tonnes
$MtCO_2e$	Million tonnes of CO_2 equivalent
MPTA	Million tonnes per year
MTOE	Million tonnes of oil equivalent
MV	Medium voltage
MW	Mega watt
MWhr	Mega watts per hour
m^2	Square metre
m^3	Cubic metre
M^3/day	Cubic metre per day
M^3/hr	Cubic metre per hour
N	Ammoniacal nitrogen
NAC	Noise Advisory Council
N/A	Not Applicable
NBDC	National Biodiversity Data Centre
NCDWC	National Construction and Demolition Waste Council
NCP	National Contingency Plan
NDBC	National Biodiversity Data Centre
NDP	The National Development Plan
NECP	National Energy & Climate Plan
NF_3	Nitrogen trifluoride
NFPA	National Fire Protection Association
NHS	National Health Service
NIAH	National Inventory of Architectural Heritage
NIEA	Northern Ireland Environment Agency
NIS	Natura Impact Statement
NLS	National Landscape Strategy
NMI	National Museum of Ireland
NMPF	National Marine Planning Framework
NMS	National Monument Service
NO	Nitric Oxide
N_2O	Nitrous Oxide
NO_2	Nitrogen Dioxide

NO_x	Oxides of Nitrogen
NORA	National Oil Reserves Agency
NPF	National Planning Framework
NPO	National Policy Objectives
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NRA	Navigation Risk Assessment
NRMM	Non-Road Mobile Machinery
NSO	National Strategic Outcome
NSR	Noise Sensitive Receptor
NSS	National Spatial Strategy
NTS	Non-Technical Summary
O_3	Ozone
OCEMP	Outline Construction Environmental Management Plan
OCTMP	Outline Construction Traffic Management Plan
OD	Ordnance Datum
OEE	Office of Environmental Enforcement
OMP	Odour Management Plan
OPW	Office of Public Works
OS	Ordinance Survey
OSI	Ordinance Survey Ireland
PAH	Polycyclic Aromatic Hydrocarbons
PBU	Package boiler units
PC	Process Contribution
PCS	Power conversion system
PCU	Passenger Car Unit
PDC	Power Distribution Centre
PEC	Predicted Environmental Concentration
PFC	Perfluorocarbons
PFP	Passive fire protection
PM	Post Meridiem
PM_{10}	Particulate Matter (smaller than 10 microns in diameter)
$PM_{2.5}$	Particulate matter (smaller than 2.5 microns in diameter)
pNHA	Proposed Natural Heritage Area
PPE	Personal Protective Equipment
ppm	Parts per million
PPUs	Pilot Portable Units
ppv	Peak Particle Velocity
PRF	Potential Roost Feature
Proposed Development	Proposed combined cycle natural gas plant with three combustion turbines, a battery energy storage system, and a liquefied natural gas Terminal, known collectively as the Shannon Technology and Energy Park
Proposed Development Site	52 ha location on the Shannon Estuary between Tarbert and Ballylongford in Co. Kerry on which the Proposed Development will be constructed
PSA	Preliminary Site Assessment
PSS	Process Safety System
psu	Practical salinity unit
QC/DC	Quick Connect/ Disconnect Coupling

QI	Qualifying Interest
QRA	Quantitative Risk Assessment
RPT	Rapid Phase Transition
RBMP	River Basin Management Plan
RES-E	Renewable Energy Sources for Electricity
RFC	Ratio of Flow to Capacity
SFPC	Shannon Foynes Port Company
RHM	Register of Historic Monuments
RMP	Record of Monuments and Places
RO	Recognized Organizations
RPO	Regional Policy Objective
RPS	Record of Protected Structures
RSA	Road Safety Audit
RSES	Regional Spatial and Economic Strategy
RSO	Recognized security organization
SAC	Special Area of Conservation
SCI	Special Conservation Interest
SEA	Strategic Environmental Assessment
SEAI	Sustainable Energy Authority of Ireland
SEAPT	Shannon Estuary Anti-Pollution Team
SED	Solvent Emissions Directive
SEMO	Single Electricity Market Operator
SF_6	Sulphur hexafluoride
SHG	Shannon Group
SI	Statutory Instrument
SID	Strategic Infrastructure Development
SIFP	Strategic Integrated Framework Plan
SIGTTO	Society of International Gas Tanker and Terminal Operators
SIS	Safety Instrumented Systems
SLw	Sound Power Level
SLWL	Summer Load Water Line
Sm^3/d	Standard Cubic Metres per Day, cubic metre natural gas at 101,325 Pa and 15°C, dry
SMR	Sites & Monuments Record
SNH	Scottish National Heritage
SO_2	Sulphur Dioxide
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SPA	Special Protection Area
SRTM	Shuttle Radar Topography Mission
SS	Suspended Solids
SSAC	Site Specific Assessment Criteria
STCW	Standards of Training, Certification & Watchkeeping for Seafarers
STEP	Shannon Technology and Energy Park
SWMP	Site Waste Management Plan
t	Tonnes
tCO2e	Tonnes of carbon dioxide equivalent
TEN-E	Trans-European Networks for Energy

THC	Total Hydrocarbons
TII	Transport Infrastructure Ireland
TMP	Traffic Management Plan
TNSS	Tills derived from Namurian Sandstones and Shales
TOC	Total Organic Carbon
TP	Trial Pit
TPH	Total Petroleum Hydrocarbons
TR	Temporary refuge
TRL	Transport Research Laboratory
TTA	Traffic and Transport Assessment
TWh	Terawatt hours
TWhr/yr	Terawatt-hour-per-year
UAIA	Underwater Archaeological Impact Assessment
UK	United Kingdom
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
V	Voltage
VOC	Volatile Organic Compound
VP	Vantage Point
VTMIS	Vessel Traffic Management Information System
WBH	Water Bath Heaters
WERLA	Waste Enforcement Regional Lead Authority
WFD	Water Framework Directive
WFD	Waste Framework Directive
WID	Waste Incineration Directive
WLU	Wildlife Licensing Unit
WMP	Waste Management Plan
WRAP	Waste and Resources Action Plan
WWTP	Wastewater treatment plant
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility
µg/m3	Microgram per cubic metre
µm	Micrometre
%	Percent
>	Greater than

Acoustic Glossary

Please see the acoustic glossary in appendix A9-1 for a detailed summary of key acoustic terms.

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