

Limerick Gas Works Remediation

Natura Impact Statement

February 2012

For Bord Gais Eireann

Report Ref: 1021927/ R16

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The brief includes an assessment of the previous site usage by review of the sources identified in this report. These effectively provide snapshots of the site through time and although a consistent sequence of site usage has been deduced from these records, the possibility of some activity carried out on the site not being identified on these records cannot be excluded.

New information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Contents

| | | |
|----------|--|-----------|
| 1 | Introduction..... | 1 |
| 1.1 | Terms of Reference | 1 |
| 1.2 | Project Background | 2 |
| 1.3 | Site Description | 2 |
| 1.4 | The Site and its Immediate Setting | 4 |
| 1.5 | Site History | 5 |
| 1.6 | Surrounding Ecological Areas..... | 5 |
| 2 | Appropriate Assessment Screening | 6 |
| 2.1 | Legal Requirements | 6 |
| 2.2 | Reasons for Appropriate Assessment Screening..... | 7 |
| 2.3 | Description of the Natura 2000 Site | 8 |
| 2.4 | Description of the Project..... | 8 |
| 2.5 | Ecological Assessment of the Project Site | 11 |
| 3 | Assessment Criteria..... | 12 |
| 3.1 | Potential Impacts | 12 |
| 3.2 | Direct, Indirect or Cumulative Impacts of the Project by virtue of: | 14 |
| 3.3 | Changes envisaged due to the project on the Natura 2000 Sites:..... | 20 |
| 3.4 | Likely impacts on the Natura 2000 site as a whole in terms of: | 21 |
| 3.5 | Indicators of significance as a result of the identification of effects set out above: | 21 |
| 3.6 | Changes to key elements of the site | 21 |
| 4 | Finding of No Significant Effects Report | 22 |
| 4.1 | Name of Project..... | 22 |
| 4.2 | The Assessment of Significant Effects..... | 23 |

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Appendices

Appendix A SAC 2165 Site Synopsis

Appendix B Site Specific Environmental Assessments and Data

- Ecological Assessments
- Quantitative Risk Assessment, Options Appraisal and Remediation
- Ground Investigation and Groundwater Monitoring Reports
- Air Quality Survey
- Noise Survey
- Vibration Survey
- Traffic Scoping Assessment

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1 Introduction

1.1 Terms of Reference

Bord Gáis is a commercial semi-state organisation that builds, owns and operates natural gas transportation networks in Ireland.

As part of the rationalisation of the gas industry in the mid-1980s Bord Gáis acquired a number of disused gasworks sites. While Bord Gáis did not contribute to the current status of these former gasworks, it is endeavouring to eliminate any potential environmental liabilities and bring the sites back into productive use.

Bord Gáis has already remediated former gasworks sites at Cork and Waterford. Plans are now underway to deal with the former gasworks site in Limerick.

Bord Gais are committed to keeping the general public and those directly affected by the remediation process informed of all remediation proposals as well as the project's progress.

The proposed remediation project will deal with the ground conditions only and any eventual development on the site will be the subject of a separate planning application. The remediation works will be undertaken in two phases: Phase 1 will comprise a 'pump and treat' technique to remove free phase liquids with Phase 2 comprising the stabilisation of the uppermost 3m of made ground across the site.

This report has been prepared to support a planning application to Limerick City Council for the proposed remediation works.

Under the European Commission guidance this report refers to the site as a project and not a plan:

“such a definition of project [i.e. definition of ‘project’ from the EIA Directive] is relevant to defining the concept of plan or project as provided for in the Habitats Directive, which, seeks, as does Directive 85/337, to prevent activities which are likely to damage the environment from being authorised without prior assessment of their impact on the environment”, and goes on to say that “the fact that the activity has been carried on periodically for several years on the site concerned and that a licence has to be obtained for it every year ... does not in itself constitute an obstacle to considering it, at the time of

each application, as a distinct plan or project within the meaning of the Habitats Directive”.

1.2 Project Background

The purpose of the project is to remediate the site to remove existing potential environmental liabilities and physical and chemical constraints to future site redevelopment, in line with the Limerick City Council Development Plan.

The only alternative to remediation at the site would be to follow a ‘do nothing’ strategy, and leave the site in its present condition until a suitable purchaser and final development scheme was proposed. This option was not considered as appropriate as the site would retain the potential liabilities until it became viable for development, which could take some time as the nature of the liabilities would be likely to put off prospective developers. BGN are keen to see the site brought back into use and propose the remediation as the first step to facilitate this.

1.3 Site Description


Limerick lies off the south eastern banks of the River Shannon, with the former gasworks site located to the south west of the town centre.

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Insert 1: Site Location



Site Boundary 

SAC 002165 

Dock Road is present immediately to the north west of the site, with the docks beyond and the River Shannon approximately 100m away. The surrounding land use is a mix of residential, small commercial and industrial businesses.

The River Shannon flows westwards, towards the Atlantic, and the topography rises to the south away from the river. The historically developed nature of the site area and the Dock Road wall limits views of the Shannon, with the skyline dominated by a multi-storey hotel, as shown in the photograph below.

Insert 2: Overview of the site



1.4 The Site and its Immediate Setting

The site is 1.4 ha in size and is roughly rectangular in shape. Site level rises from around 5 m MHD (Malin Head Datum) in the north west to around 8 m MHD at the southern and eastern boundaries.

The site includes a two-storey office block and the protected former Power Generation Building which are both to be retained. Some other smaller structures are present, such as the booster house, which are to be removed prior to remediation works commencing. The existing Above Ground Installation (AGI) and electricity substation are also to be removed with a new electricity substation and a District Regulator Installation (DRI) to be located adjacent to the O'Curry Street boundary. A variety of structures are present in the surrounding area, therefore the on-site structures are not imposing.

Views from the site are restricted by the high perimeter walls and existing structures. The Dock Road wall, which has Protected Status, has a Limestone face up to 5m high. The wall extends into the site and is up to 10m high in one section. Beyond the boundary views are generally limited to the surrounding land uses: three storey housing to the north east, perimeter vegetation and housing residences to the south east, housing and industrial property to the

south west and the perimeter wall and water side buildings / multi-storey hotel to the north west.

Publicly accessible views into the site are available from surrounding residences and the hotel.

The site itself is derelict and contains remnants of the former gasworks. Most vegetation has been removed.

1.5 Site History

The site history is summarised below:

- In the 1830's a limestone quarry was situated in the eastern part of the site, with a small gas works located to the north west;
- By 1872 the gas works occupied the majority of the site, with a small pond located at the edge of the remaining quarry;
- The quarry had been backfilled by 1938, and an electricity substation was located along the north east boundary;
- Coal gas manufacture ceased in 1974 and the works became an oil gas plant until 1986 when natural gas was introduced; and
- Demolition and site clearance took place between 1988 and 1995.

1.6 Surrounding Ecological Areas

There are protected habitats (under National and European legislation, i.e. Natura 2000). The site has no formal conservational designations. The nearest designated habitat is the Lower River Shannon Special Area of Conservation (SAC) (Site Code No. 002165). There is currently no Special Protection Areas (SPA) or Natural Heritage Areas (NHA) near the site, although the River Shannon is proposed for NHA status (Site Code No. 002048). The site does not contain any habitats of ecological value and does not support significant bird populations or species.

2 Appropriate Assessment Screening

2.1 Legal Requirements

Article 6(3) and (4) of the Habitats Directive 92/43/EEC requires an Appropriate Assessment Screen (AAS) of land use plans with respect to ecological implications of any plan or project, whether within or outside a designated site, which does not directly relate to the management of the site but may impact upon its conservation objectives. The purpose of this screening report is to consider whether, based on best available scientific knowledge, the project will have potential impacts upon the conservation objectives of any Natura 2000 sites.

Circular letter SEA 1 / 08 & NPWS 1 / 08, dated 15 February, 2008, Department of the Environment Heritage and Local Government (DoEHLG) states:

Screening for possible impacts:

Any draft land use plan or project (development plans, local area plans, regional planning guidelines, schemes for strategic development zones) or amendment/variation to it proposed under the Planning and Development Act 2000 (as amended) must be screened for any potential impact on areas designated as Natura 2000 sites (normally called Special Areas of Conservation (SACs) or Special Protection Areas (SPAs).

This screening should be based on any ecological information available to the authority and an adequate description of the project and its likely environmental impacts. This should take into account any policies that will set the terms for future development. Up to date maps of Natura 2000 sites, or areas proposed for designation, are available on www.npws.ie. The results of the screening should be recorded and made available to the public.

In any case where, following screening, it is found that the draft plan or amendment may have an impact on the conservation objectives of a Natura 2000 site or that such an impact cannot be ruled out, adopting a precautionary approach:

- an appropriate assessment of the plan must be carried out and
- in any case where a strategic environmental assessment (SEA) would not otherwise be required, it must also be carried out

Natura 2000 sites are protected habitats for flora and fauna of European importance. They comprise Special Areas of Conservation (SACs), designated under the Habitats Directive and Special Protection Areas (SPAs), designated under the Birds Directive.

This Appropriate Assessment screening is carried out in accordance with the 'Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92 / 43 / EEC'.

In the preparation of this assessment reference has been made to the following documents:

- Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities, December 2009. Department of the Environment Heritage and Local Government (DoEHLG).
- MANAGING NATURA 2000 SITES. The provisions of Article 6, of the 'Habitats', Directive 92 / 43 / CEE (European Communities, 2000).
- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92 / 43 / EEC. European Commission, 2001.
- Circular letter SEA 1 / 08 & NPWS 1 / 08 dated 15 February, 2008. Department of the Environment Heritage and Local Government (DEHLG).

2.2 Reasons for Appropriate Assessment Screening

The Natura 2000 sites are located within the likely zone of impact of the project which is currently recommended at a distance of 15km. As stated in section 1.3 the project is located approximately 100m adjacent to a SAC and NHA areas (the latter is proposed). Therefore AAS is required under Article 6(3) and 6(4) of the Habitats Directive.

The project is considered to have an indirect effect on the adjacent Nature 2000 sites as the project specific activities are not carried out directly on these areas.

2.3 Description of the Natura 2000 Site

Special Areas of Conservation (SAC) are prime wildlife conservation areas in the country, considered to be important on a European as well as Irish level. The basic designation for wildlife is the Natural Heritage Area (NHA). This is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection.

2.3.1 SAC: Lower River Shannon

Site Code: 002165

This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site was selected for its lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The site is located approximately 100m north of the project boundary.

Please refer to Appendix A for full Site Synopsis.

2.3.2 NHS: Fergus Estuary and Inner Shannon, North Shore.

No further information is held on the NPWS website.

The site is located approximately 100m north of the project boundary.

2.4 Description of the Project

The purpose of the project is to remediate the site to remove existing potential environmental liabilities and physical and chemical constraints to future site redevelopment in line with the Limerick City Council Development Plan.

A detailed remediation options appraisal for the project was undertaken by Mouchel following site Characterisation works (Site investigation and risk

assessments) and is detailed within the Quantitative Risk Assessment, Options Appraisal and Remediation Report, reference 1021927/R03, March 2010 (and subsequent Addendum report dated January 2012) provided in Appendix B (CD).

The appraisal concluded that the following remediation options are the most appropriate for the site:

- Pump and Treat
- Solidification/ Stabilisation Ex-situ
- Solidification/ Stabilisation In-situ
- Thermal Based Technologies (Thermal desorption or incineration)

It is proposed to undertake remediation works in two distinct phases, as described below;

2.4.1 Phase 1 Works

The first phase of remediation works will involve the removal of free phase liquids. These liquids generally comprise coal tars (predominantly dense non-aqueous phase liquids (DNAPL)) and are present at the base of several underground tanks, within the former quarry and a deep limestone feature located in the western side of the site. The preferred option for removal of the DNAPL has been identified as 'pump and treat' technology.

It is estimated that a total volume of DNAPL requiring removal from site for recycling/ disposal will be approximately 340m³.

Several 'pump and treat' technologies are available and the advice of specialist contractors will be sought to assess the suitability of their proprietary techniques to the contaminants identified on site. The systems are 'closed' with volatile compounds being 'captured' and passed through carbon filters to minimise any odour emissions. It is anticipated that a large proportion of the volatile organic compounds will be removed by this process.

The Phase 1 works are anticipated to take 6-12 months to complete depending on the rate of extraction of free phase liquids achieved.

2.4.2 Phase 2 Works

The second phase of remediation works will involve stabilisation / solidification treatment of the uppermost 3m across the entire site, except where site constraints preclude its use or limestone is encountered at shallower depth. This would ensure that the majority of underground structures are removed to facilitate the possible future redevelopment of the site. It would also identify and allow treatment / removal of other free product present within this 3m depth not removed as part of the Phase 1 works. Any remaining obstructions could be surveyed to record their exact locations for future reference. These underground structures/ foundations etc would be crushed and reused, where possible, as a clean capping layer, anticipated to be some 0.5m deep. Any groundwater encountered during the excavation process would need to pass through a water treatment plant prior to disposal to foul sewer under an appropriate discharge licence obtained from the drainage authority.

The volume of material requiring stabilisation/ solidification is estimated to be in the order of 32,500m³.

Sophisticated stabilisation/ solidification plant is now available and has been used in the UK and Ireland. The plant allows excavated contaminated soils to be placed on conveyor belts, weighed and mixed thoroughly (using paddle mixers) with appropriate binders prior to replacement in the excavations. The binder would be designed by specialist contractors but would usually comprise cement, PFA (pulverised fuel ash) or a mixture, added by approximately 3-5% by weight. The strength of the stabilised material can also be designed to improve geotechnical properties. Granular materials are usually easier to treat than cohesive materials as thorough mixing of the binder is more easily achieved. There are some cohesive fill materials within the former quarry area although the fill is predominantly granular. It is possible that mixing of the granular and cohesive materials may be required prior to introducing the binder.

It is noted that odour emissions during the mixing process are generally low as a 'hood' fits over the mixing tank where air is extracted from the process and passed through carbon filters to minimise any odour emissions. Furthermore, as a large proportion of volatile organic compounds will have already been removed during the Phase 1 works, odour emissions from excavations are not anticipated to be significant.

Ex-situ stabilisation / solidification treatment is considered more appropriate than an in-situ process due the large number of obstructions present in the made ground, identified during the previous ground investigations undertaken.

It is anticipated that the Phase 2 works will be undertaken in approximately 6 months.

2.4.3 *Detailed specification*

A full remediation strategy can be consulted for further details; Mouchel, 2010, Quantitative Risk Assessment, Options Appraisal and Remediation Report, reference 1021927/R03, which is included in Appendix B.

2.5 Ecological Assessment of the Project Site

A site visit was undertaken on the site in August 2009, following site clearance, by Moore Group Environmental Services. At this time the predominant habitats were recolonising bare ground and artificial ground / buildings. This is generally of low ecological value and is typical of urban areas. The report is included in Appendix B (CD).

Information from the OPW's National Flood Hazard Mapping, and from the LCCDP 2010-2016 indicates that the site is not prone to flooding.

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3 Assessment Criteria

The contractor will ensure that the effects arising from planning permissions based on this project will not give rise to adverse effects on the integrity of Natura 2000 sites named in the above sections. Objectives and criteria for determining the needs of such sites can be inferred from the Site Synopsis in Appendix A.

It is important to note that the project will provide for the area improved ground conditions due to the removal of identified contaminants.

The following elements have been discussed as having the potential to impact on the Natura 2000 sites. However, likely mitigation measures to be implemented are also discussed:

3.1 Potential Impacts

3.1.1 *Surface Water Run-Off:*

Future development at this location is not considered as this would be addressed under another project/ plan under future planning application. However the effects of surface water run-off due to project related operation has been assessed.

The site is mainly hardstanding and the processes of the remediation project under Phase 2 will include the removal of the hardstanding on site. This will decrease the available area to which surface water run-off can occur.

Temporary, domestic foul drainage from the site offices will be arranged by the Contractor. It is anticipated this will either require emptying by tanker, with disposal at an agreed disposal facility, or by the provision of a temporary sewer connection to the sewers on O'Curry Street or Dock Road.

Treatment and disposal of groundwater and surface water from the water treatment plant will be the responsibility of the Contractor. Any connection to foul sewer will be provided and operated in accordance with the sewer discharge requirements agreed with Limerick City Council.

3.1.2 Wastewater Treatment:

Wastewater on site will be treated at a site groundwater treatment facility which is required as part of the remediation process. All waste water will be treated and either reused or discharged under a discharge condition.

3.1.3 Traffic:

Traffic effects are considered to be acute over a short period as the remediation operations are conducted within a given time scale. Future developments may affect the Natura 2000 sites if the development increases the surrounding areas traffic flows; however this would be considered under a different application.

The short term effects to the surrounding area are considered due to the need for the transportation of materials to and from site and the removal of possible waste materials. However, as stated above this effect is considered to be related to the duration of the project and is not increasing the traffic flows in the area over the long term. Mitigation of the short term effect to the Natura 200 site from the remediation operations are as follows:

- All to and from site travel should be kept to a minimum and be for project specific purposes.
- The HGV vehicles should take the route which is the furthest distance away from the Natura 2000 sites.
- Vehicles should be cleared of any site spoil (e.g. wheel wash).

Therefore the impacts are short term and mitigation measures will mitigate the possible effects to the Natura 2000 sites.

3.1.4 Waste Management:

As part of the project a Waste Licence will be obtained from the EPA for the processes on site which will detail a waste management plan. The Waste Licence will help prevent and minimise impacts to the surrounding area, promote sustainable reuse and recycling of waste and highlight the waste infrastructure on site which will minimise the short term impacts to the site and surrounding area.

3.1.5 *Human Disturbance:*

The project over its course will only have a short term net increase in the areas working population. This will only be during the duration of the project and it is not envisaged the site operatives will visit or impact the Natura 2000 sites.

In addition, there is already a well established population adjacent to the Natura 2000 sites. The SAC and NHA site is adjoined by a dock area and industrial and commercial premises. It is also considered that the distance from the project site to the Natura 2000 sites is not significant enough to result in any effects on the designated habitats.

As a result, the site is not likely to cause additional threat of human disturbance to the Natura 2000 site arising from the remediation project.

3.2 **Direct, Indirect or Cumulative Impacts of the Project by virtue of:**

3.2.1 *Size and scale, area and land-take:*

The project will remain in the confinement of the site boundary and it is not envisaged that any process akin to the remediation project will encroach on adjacent land including that of the Natura 2000 sites.

3.2.2 *Distance from the Natura 2000 sites or key feature of the site:*

The Natura sites is located 100m from the nearest site boundary which offers a buffer to any effect the remediation process may have on the designated habitat. In addition the area between the site and the SAC and NHA consists of a contiguous urban and industrial area, and is characterised by built-up developments and associated infrastructure such as roads, street, pavements.

3.2.3 *Resource Requirements:*

The ground water resource will be required during the remediation operations. However this is the onsite perched water resource and does not include the underlying aquifer. In all eventualities, any water used on site will be either reintroduced to the underlying ground on site or discharged under a regulated discharge consent.

3.2.4 Emissions and waste (disposal to land, water and air):

Water quality, waste water collection and disposal

Both phases of the project discussed in section 2.4 require water as a function of the remediation process. During phase 1 'pump and treatment', perched groundwater is removed on site and treated via a groundwater treatment plant and either reused in the pump and treatment process or discharged through a regulated discharge consent. During phase 2, pumping may be required to facilitate excavation works. Any pumped water would be passed through a water treatment facility on site prior to discharge. In either case water which is pumped back in the ground is cleaner than when it was removed, or clean water treated via the treatment works is discharged under regulated conditions; in both cases improving the site conditions and potential effect to the surrounding area.

Recent assessments, undertaken by Mouchel in 2009 and 2011 (see Appendix B) identified perched water to be present within the made ground horizons. This generally drained away quickly, indicating the presence of impermeable obstructions within the made ground which have created localised areas of perched water. Generally hydraulic continuity exists between the Made Ground and the bedrock due to the granular nature of the made ground, and therefore the groundwater potentially acts as one body.

The water table has been found to generally fall from approximately 7.8m MHD in the south eastern section of the site, to approximately 2.7m MHD in the western section of the site. The general groundwater flow direction appears to be in an approximate westerly direction toward the River Shannon.

The groundwater data implies that there may be two sources of groundwater entering the site:

- Source 1 – Originating from the southern corner of the site from within the rock outcrop; and
- Source 2 – Originating from the south east section where water is draining into the site.

The hydraulic conductivity of both the made ground and the limestone were found to be variable. The values obtained for the made ground would appear to reflect mainly cohesive conditions, whilst in some areas where the made ground may be more granular, higher hydraulic conductivities may be applicable. However, the logs mainly suggest a highly granular made ground of limestone and brick rubble, but with a clay matrix decreasing permeability.

The geometric mean permeability calculated from the full range of data obtained for the limestone is 1×10^{-7} m/s. Based on data known to have been obtained from just the weathered horizon, this would appear to be 1×10^{-6} m/s. This accords with a value from the UK Aquifer Properties database for moderately karstified limestone of 3.3×10^{-6} m/s (0.285 m/day). Within the groundwater modelling the geometric mean (1×10^{-7} m/s) was used. As a result, groundwater flow velocities averaging between 50 and 150 m/year can be expected.

Significant free phase product was identified within underground tanks and the former quarry. In addition, the made ground and limestone aquifer have been significantly impacted with dissolved phase phenols, PAHs (naphthalene in particular), cyanides, sulphate, ammonia, BTEX, TPH and heavy metals.

In addition, localised arsenic, nickel and selenium were identified as hotspots across the site.

The initial groundwater assessment identified that there could be potentially significant risks posed to the River Shannon (an SAC; Natura 2000 site) and the limestone aquifer by the presence of benzene, phenol, ammonium, hydrocarbons (aliphatics C5-10, aromatics C5-8) and to a lesser extent the other lighter aromatic hydrocarbons (C8-21), identified in site soils and groundwater beneath the site.

The hydraulic conductivity and gradient however, suggest that groundwater will take 3.38 years to migrate the 100m, and thus contamination will in most cases take longer, thus allowing for increased degradation and dilution. In addition, the docks (wet dock and graving dock) are likely to impede the flow of groundwater directly to the River Shannon, altering the flow path in a longer, more westerly direction. Thus the travel time will increase allowing for more degradation. Finally, it is possible that the alluvial deposits (predominantly cohesive) encountered near the Dock Road boundary may extend towards the river and be present beneath the river further impeding groundwater flow directly into the river. Therefore although a theoretical risk has been identified, it is unlikely that the site poses an actual risk due to contaminant degradation and increased travel times.

The remediation strategy outlined in Section 2, involves the removal of free phase liquids, predominantly dense non-aqueous phase liquids (DNAPL) by 'Pump and Treat' techniques followed by the removal of sources within the uppermost 3m of made ground. As such the works will result in a beneficial impact to the site and surrounding waters.

Surface water disposal

Under phase 2 of the project the sites hardstanding area will be removed and therefore surface water disposal is not envisaged to be required.

Excavation requirements

As detailed in section 2.4, excavation to an average 3m depth across the site is proposed. These works will be confined within the site boundary. The site is also well horded with an approximate 3m high wall which will limit the effect of the excavations works to the surrounding area. The proposed stabilisation ensures that the majority of material will be re-used on site.

Air quality, dust and odour

Remediation of the site will involve disturbing soil that may be contaminated with various hydrocarbon compounds. Once exposed to the atmosphere, easily volatilised compounds such as Volatile Organic Compounds (VOCs) may be released into the atmosphere. Works may also generate dust, which is not only a nuisance in itself but may contain pollutants.

An Air Quality Survey has been undertaken by Mouchel and is included in Appendix B. Monitoring was carried out over a three month period to establish baseline conditions in order to determine whether future remediation works causes an increase in exposure to pollutants in the local environment including the nearby Natura 2000 site.

Baseline levels of volatile pollutants are currently below the assessment criteria.

The results of the dust monitoring indicate very low concentrations and no nuisance is anticipated from baseline conditions.

The proposed remediation methodologies will minimise odour emissions. Firstly, the 'pump and treat' method uses a 'closed' system in which volatile compounds are captured and passed through carbon filters to minimise odours. Secondly, during the stabilisation / solidification mixing processes a 'hood' fits over the mixing tank where air is extracted from the process and passed through carbon filters, again keeping odours to a minimum. Furthermore, odour emissions from excavations are not anticipated to be significant as the majority of volatiles will have been removed as part of the 'pump and treat' phase of works.

A full specification of works will be prepared following detailed design of remediation works. This will be undertaken in consultation with Limerick City Council and specialist contractors and will detail any mitigation measures required.

Mitigation measures are likely to include the following:

- monitoring of wind direction, mean wind speed, precipitation and olfactory indicators of odours on site;
- monitoring of dust deposition at site boundaries;
- the use of dust and odours control measures, including damping down, sealing/covering stockpiles and selecting working areas relative to wind direction and speed; and
- the use of odour control spray systems.

These measures will reduce the risk to the Natura 2000 sites located to the north of the site.

3.2.5 *Transportation requirements*

The project will consist of a number of remediation processes on site which require resources and plant to carry out these operations.

A traffic scoping assessment has been undertaken, which comprised a site walkover to establish the areas of potential concern based on the likely site activities during remediation and included a site meeting with a representative of LCC. A copy of the traffic scoping assessment is included in Appendix B (CD).

The assessment provides a summary of the scoping meeting regarding all traffic required for removal of material from the former Gasworks site, Dock Road Limerick including construction traffic, staff, general maintenance and delivery vehicles.

Any material requiring removal is expected to be removed by road either to Limerick Docks or to a facility in Ireland east of Limerick. 2 to 3 construction vehicles arriving at and leaving the site per day have been assumed.

The possible impact on highway capacity of this traffic was discussed on site and it was confirmed by LCC due to the minimal impact expected that capacity assessments would not be required.

LCC have stated that they would prefer construction traffic not to enter or leave the site through Limerick City Centre and that the new Limerick Tunnel Link be used to access the N7.

At this stage, therefore, it is intended that HGVs would turn left out of the site onto Dock Road (N69), before joining the N7 via the new Limerick Tunnel Link road and onto the motorway network (M7) which leads to the east.

The possibility of increasing movements as a “one off event” in order to take material to the Dock for travel by sea were discussed. LCC will require a Traffic Management Plan to be agreed between them and Bord Gáis in order for vehicles to access the site safely and not have a detrimental affect on others using the local highway network.

Road Permits will require to be sought in order to transport Abnormal Loads, Wide Loads and Contaminated Material from LCC and each County which material is being carried through to their destination.

There are Protected Structures on the site and agreement will be required between LCC’s planning department and Bord Gáis to ensure that these structures are not compromised during the remediation process.

Provisions will be made to minimise the exposure of any site spoil from excavations to the surrounding area. In addition, the distance between the Natura 2000 sites and the site and well established aforementioned road network; it is not considered that these proposals will impact upon the designated habitats within the Natura 2000 site.

3.2.6 *Noise Nuisance*

A Preconstruction Background Noise Level Survey has been undertaken by Mouchel and is included in Appendix B. Background noise levels at nearby noise sensitive receptors to the Gasworks site have been quantified so as to enable potential future noise impacts associated with the proposed remediation of the Gasworks site to be accurately assessed.

The remediation of the site will create a temporary increase in noise levels in the vicinity and will have some impact on local environment and people. It will also impact on the personnel working on the site remediation itself. Sources of the increased noise will include construction traffic and on-site plant.

A full specification of works will be prepared following detailed design of remediation works. This will be undertaken in consultation with LCC and the EPA and specialist contractors and will detail any mitigation measures required.

The Contractor shall employ the best practical means to minimise noise and vibration produced by his operations. Measures are likely to include the following:

- limitation of site working hours;
- the use of screening between noise sources and receiving positions;
- the use of exhaust silencers on vehicles and mechanical plant;
- the use of 'sound reduced' compressors and pneumatic percussive tools fitted with mufflers or silencers; and
- shutting down machinery / plant or throttling down to a minimum when not required for use.

All these measures will reduce the potential impact of noise to the designated habitat

3.2.7 *Duration of the project, operation and decommissioning*

The project will seek to balance development with environmental protection and conservation. The project is undertaken within a defined period which will minimise the long term effects. The remediation goal is ultimately to promote sustainable use of resources, including reduction and re-use of waste related to the sites historical use via a well defined remediation project.

Any waste material will be disposed of by an EPA licensed contractor and in accordance with all relevant waste legislation; principle managed by the sites waste licence. Due to the distance to the Natura 2000 sites, machinery will not infringe on land within the SAC and NHA boundary at any time.

3.3 **Changes envisaged due to the project on the Natura 2000 Sites:**

The project is not considered to impact on or cause the following aspects of the designated habitat:

- Reduction of habitat area
- Habitat or species fragmentation
- Disturbance to key species

- Reduction in species density
- Changes in key indicators of conservation value (water analysis, etc)

The latter point is controlled under the environmental objectives of the River Basin Management Plans for the River Shannon basin and the project will be required not to cause ill effect to these objectives.

It is considered that the project will not have a significant impact upon climate change. However, during the assessment of contractors tenders and proposed methods of working, sustainable approaches will be marked favourably.

3.4 Likely impacts on the Natura 2000 site as a whole in terms of:

3.4.1 Interference with the key relationship that define the structure of the site

Due to the buffer zone between the project site and the designated habitat areas, any processes involved in the remediation are not considered to interfere with the key relationships that define the structure of the Natura 2000 sites.

3.4.2 Interference with key relationships that define the function of the site:

The project will ensure that the processes involved will not give rise to significant adverse direct, indirect or cumulative impacts on the integrity or defined functions of any of the Natura 2000 sites.

3.5 Indicators of significance as a result of the identification of effects set out above:

Due to the confinement of the site activities and the buffer zone the project will not impact the Natura 2000 site. As a result habitat loss, fragmentation, disruption and disturbance are not applicable as indicators.

3.6 Changes to key elements of the site

No impact as a result of the project activities are envisaged to key elements of the Natura 2000 site. The main key element of the Natura 2000 site is water quality. The processes employed onsite will not impact this key element as any interaction with groundwater will be limited to perched ground water. The recovery of free phase DNAPL and stabilisation of the top 3m of the site will deliver likely long term benefits to the water quality of the Natura 2000 site.

4 Finding of No Significant Effects Report

4.1 Name of Project

Proposed Limerick Gas works Remediation.

4.1.1 *Name and location of Natura 2000 sites*

Site Name: Lower River Shannon

Site Code: 002165

Refer to Appendix 1 for Site Synopsis.

4.1.2 *Description of the plan or project*

Refer to Section 2.4.

4.1.3 *Is the project or plan directly connected with or necessary to the management of the site (provide details)?*

This Natura Impact Statement has shown that the proposed project is not directly connected with or necessary to the management of a Natura 2000 site.

4.1.4 *Are there other projects or plans that together with the project or plan being assessed could affect the site (provide details)?*

The LCCDP 2010-2016 sits within a hierarchy of national and regional planning policy documents. In essence, the Project supports the principles of the National Spatial Strategy (NSS) 2002-2020 and the Mid West Regional Planning Guidelines (RPGs) 2010-2022 in terms of the regeneration of parts of Limerick City. The main environmental objectives of these policies and strategies are to protect the environment and to maintain a sustainable environment.

4.2 The Assessment of Significant Effects

4.2.1 Describe how the project or plan (alone or in combination) is likely to affect the Natura 2000 site.

The project has been shown via Appropriate Assessment Screening not to be directly connected with or necessary to the management of the identified Natura 2000 site. It is also considered not to be linked together with a project or plan which may affect the Natura 2000 sites. As is outlined in Section 2.2, the proposed project, which seeks to remediate the subject site from contamination from the previous use as a gas works, will not give rise to any significant effects on the Natura 2000 sites.

4.2.2 Explain why these affects are not considered significant

Under Article 6 of the Habitats Directive the term 'significance' is taken to mean an effect on the integrity of the SAC. It is considered that the proposed project will not give rise to any significant effects on the Natura 2000 site, and thus affect its integrity, due to the following reasons:

Distance: The distance between the project site and the designated habitats is sufficient to attenuate any on-site activities; and these are not significant enough to result in any effect on the designated habitats.

Site Location: The area between the site and the SAC and NHA consists of a contiguous urban and industrial area, and is characterised by built-up developments and associated infrastructure such as roads, street and pavements; all causing no likely direct/indirect or cumulative impacts on the Natura 2000 sites

Existing policies in the LCCDP 2010-2016 and other plans & guidelines:

- A review of the Limerick City Council Development Plan 2010-2016 found that there are sufficient policies and objectives in place to enable the Natura 2000 site to be protected.
- The requirements of the Draft River Basin Management Plan (RBMP) for the Shannon International River Basin District (December 2008) will require Limerick City Council to ensure compliance with the environmental objectives set out in the RBMP. Safeguarding of these water resources will offer protection to the Natura 2000 site.

- It is the policy of Limerick City Council that any new development meets the requirements of the European Water Framework Directive (2003) and the Council promotes the implementation of Water Quality Management Plans in accordance with this directive.
- Limerick City Council will ensure that all new development proposals comply fully with the requirements of The Planning System & Flood Risk Management Consultation Draft Guidelines for Planning Authorities (2008).
- It is the intention of Limerick City Council to implement the provisions of the Replacement Waste Management Plan for the Limerick/Clare/Kerry Region 2006 – 2011. The main objectives of the plan focuses on the prevention, minimisation, reuse and recycling of waste.
- It is the intention of Limerick City Council to implement the 'Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River sites' (Eastern Regional Fisheries Board).

4.2.3 *Screening Conclusion*

The finding of this Natura Impact Statement is that the proposed project does not require full Appropriate Assessment.

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SITE SYNOPSIS

SITE NAME : LOWER RIVER SHANNON

SITE CODE : 002165

This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the sub-catchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarne. Rivers within the sub-catchment of the Mulkear include the Killeenagarrieff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia.

The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigne River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulmasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulmasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green

algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Club-rushes (*Scirpus maritimus*, *S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Sea-spurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*).

Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Cloonconeen Pool. Cloonconeen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa*, *Cerastoderma glaucum*, *Lekanesphaera hookeri*, *Palaemonetes varians*, *Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of Stonewort (*Chara canescens* and *Chara cf. connivens*).

Most of the site west of Kilcredaun Point/Kilconly Point is bounded by high rocky sea cliffs. The cliffs in the outer part of the site are sparsely vegetated with lichens, Red Fescue, Sea Beet (*Beta vulgaris*), Sea Campion (*Silene maritima*), Thrift and Plantains (*Plantago* spp.). A rare endemic Sea Lavender (*Limonium recurvum* subsp.

pseudotranswallinum) occurs on cliffs near Loop Head. Cliff-top vegetation usually consists of either grassland or maritime heath. The boulder clay cliffs further up the estuary tend to be more densely vegetated, with swards of Red Fescue and species such as Kidney Vetch (*Anthyllis vulneraria*) and Bird's-foot Trefoil (*Lotus corniculatus*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the pcSAC.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

- stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps).
- shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*).
- Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.
- sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*).

Flowing into the estuaries are a number of tidal rivers.

Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Semi-natural habitats, such as wet grassland, wet woodland and marsh occur by the rivers, however, improved grassland is most common. One grassland type of particular

conservation significance, *Molinia* meadows, occurs in several parts of the site and the examples at Worldsend on the River Shannon are especially noteworthy. Here are found areas of wet meadow dominated by rushes and sedges and supporting a diverse and species-rich vegetation, including such uncommon species as Blue-eyed Grass (*Sisyrinchium bermudiana*) and Pale Sedge (*Carex pallescens*).

Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalis antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick.

Alluvial woodland occurs on the banks of the Shannon and on islands in the vicinity of the University of Limerick. The woodland is up to 50m wide on the banks and somewhat wider on the largest island. The most prominent woodland type is gallery woodland where White Willow (*Salix alba*) dominates the tree layer with occasional Alder (*Alnus glutinosa*). The shrub layer consists of various willow species with sally (*Salix cinerea* ssp. *oleifolia*) and what appear to be hybrids of *S. alba* x *S. viminalis*. The herbaceous layer consists of tall perennial herbs. A fringe of Bulrush (*Typha* sp.) occurs on the riverside of the woodland. On slightly higher ground above the wet woodland and on the raised embankment remnants of mixed oak-ash-alder woodland occur. These are poorly developed and contain numerous exotic species but locally there are signs that it is invading open grassland. Alder is the principal tree species with occasional Oak (*Quercus robur*), Elm (*Ulmus glabra*, *U. procera*), Hazel (*Corylus avellana*), Hawthorn (*Crataegus monogyna*) and the shrubs Guelder-rose (*Viburnum opulus*) and willows. The ground flora is species-rich.

Woodland is infrequent within the site, however Cahiracon Wood contains a strip of old Oak woodland. Sessile Oak (*Quercus petraea*) forms the canopy, with an understorey of Hazel and Holly (*Ilex aquifolium*). Great Wood-rush (*Luzula sylvatica*) dominates the ground flora. Less common species present include Great Horsetail (*Equisetum telmateia*) and Pendulous Sedge (*Carex pendula*).

In the low hills to the south of the Slievefelim mountains, the Cahernahallia River cuts a valley through the Upper Silurian rocks. For approximately 2km south of Cappagh Bridge at Knockanavar, the valley sides are wooded. The woodland consists of Birch (*Betula* spp.), Hazel, Oak, Rowan (*Sorbus aucuparia*), some Ash (*Fraxinus excelsior*) and Willow (*Salix* spp.). Most of the valley is not grazed by stock, and as a result the trees are regenerating well. The ground flora feature prominent Greater wood-rush and Bilberry (*Vaccinium myrtillus*) with a typical range of woodland herbs. Where there is more light available, Bracken (*Pteridium aquilinum*) features.

The valley sides of the Bilboa and Gortnageragh Rivers, on higher ground north east of Cappamore, support patches of semi-natural broadleaf woodland dominated by Ash, Hazel, Oak and Birch. There is a good scrub layer with Hawthorn, Willow, Holly and Blackthorn (*Prunus spinosa*) common. The herb layer in these woodlands is often open with a typically rich mixture of woodland herbs and ferns. Moss species diversity is high. The woodlands are ungrazed. The hazel is actively coppiced in places.

There is a small area of actively regenerating cut away raised bog at Ballyrorheen. It is situated approx. 5km north west of Cappamore Co. Limerick. The bog contains some wet areas with good moss (*Sphagnum*) cover. Species of particular interest include the Cranberry (*Vaccinium oxycoccos*) and the White Sedge (*Carex curta*) along with two other regionally rare mosses including *S. fimbriatum*. The site is being invaded by Birch (*Betula pubescens*) scrub woodland. Both commercial forestry and the spread of rhododendron has greatly reduced the overall value of the site.

A number of plant species that are Irish Red Data Book species occur within the site - several are protected under the Flora (Protection) Order, 1999:

- Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
- Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
- Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
- Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
- Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
- Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
- Convergent Stonewort (*Chara connivers*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504; 1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank.

A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregrine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987)

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaite Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaite Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey.

Two additional fish of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon.

Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River.

There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through over-grazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale.

In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may oust less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds.

Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats.

Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the

E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.

This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country. Most of the estuarine part of the site has been designated a Special Protection Area (SPA), under the E.U. Birds Directive, primarily to protect the large numbers of migratory birds present in winter.

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