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Planning and Environmental Services

## CHAPTER SEVEN BIODIVERSITY

### 7.1 INTRODUCTION

This chapter assesses the potential impacts of the proposed development upon biodiversity. Under the EIA Directive as well as best practice methodology from the EPA, the analysis of impacts to biodiversity is an essential component of the EIA process, and so is a required chapter in any EIAR.

The purpose of this assessment was to:

- Undertake a desktop review of available ecological data for both the receiving environment and greater area, including a review of European sites within 15 km of the project (considered separately as part of the Appropriate Assessment process) and nationally designated sites within 10km;
- Undertake ecological field surveys of the receiving environment;
- Identify flora and fauna present within the footprint of all elements of the project;
- Evaluate the ecological significance of the receiving environment;
- Appraise the potential impacts of the project on the ecology of the receiving environment;
- Consider measures to mitigate the potential negative impact(s) of the project on the ecology of the receiving environment.

#### 7.1.1 Study Area

The proposed development site (Phase 4) is part of a phased development proposal for a large greenfield area or Masterplan Site (MS). This MS is divided into seven different phases of delivery as detailed in Table 1.1 in Chapter 1.0 Introduction. The overall MS layout which illustrates the indicative layout of the subject site and adjoining lands in the ownership of the applicant is displayed on Figure 1.0 in Chapter 1.0 and full details of the proposed development phases are given in Chapter 2.0.

The study area takes a holistic approach and examines the wider MS area whilst focusing on any areas of significance within the proposed development site. The MS is predominantly open farmland and is located approximately 3.5Km from Limerick City centre and is bisected by the L3102, Old Cratloe Road which runs from the Limerick City Centre past Thomond Park Stadium and Limerick Institute of Technology to the north west out of the City towards the N18 road to Ennis. A new road and roundabout have been developed running northeast from the Old Cratloe separating the Neighbourhood Centre, to the west and the Creche to the east.

Whilst the site is rural in character, nearby housing developments and Limerick City are visible. The land slopes from a higher elevation at the east to lower elevations in the west.

The MS area is composed of primarily open grazed farmland. Hedgerows and hedgerow/treeline combinations run along most of the site boundary. However, there is some post and rail fencing in particular where the proposed Neighbourhood Centre section meets the Old Cratloe Road. There are also a number of hedgerows bounding the individual fields within the overall study area.

The majority of the hedgerows are of good quality.



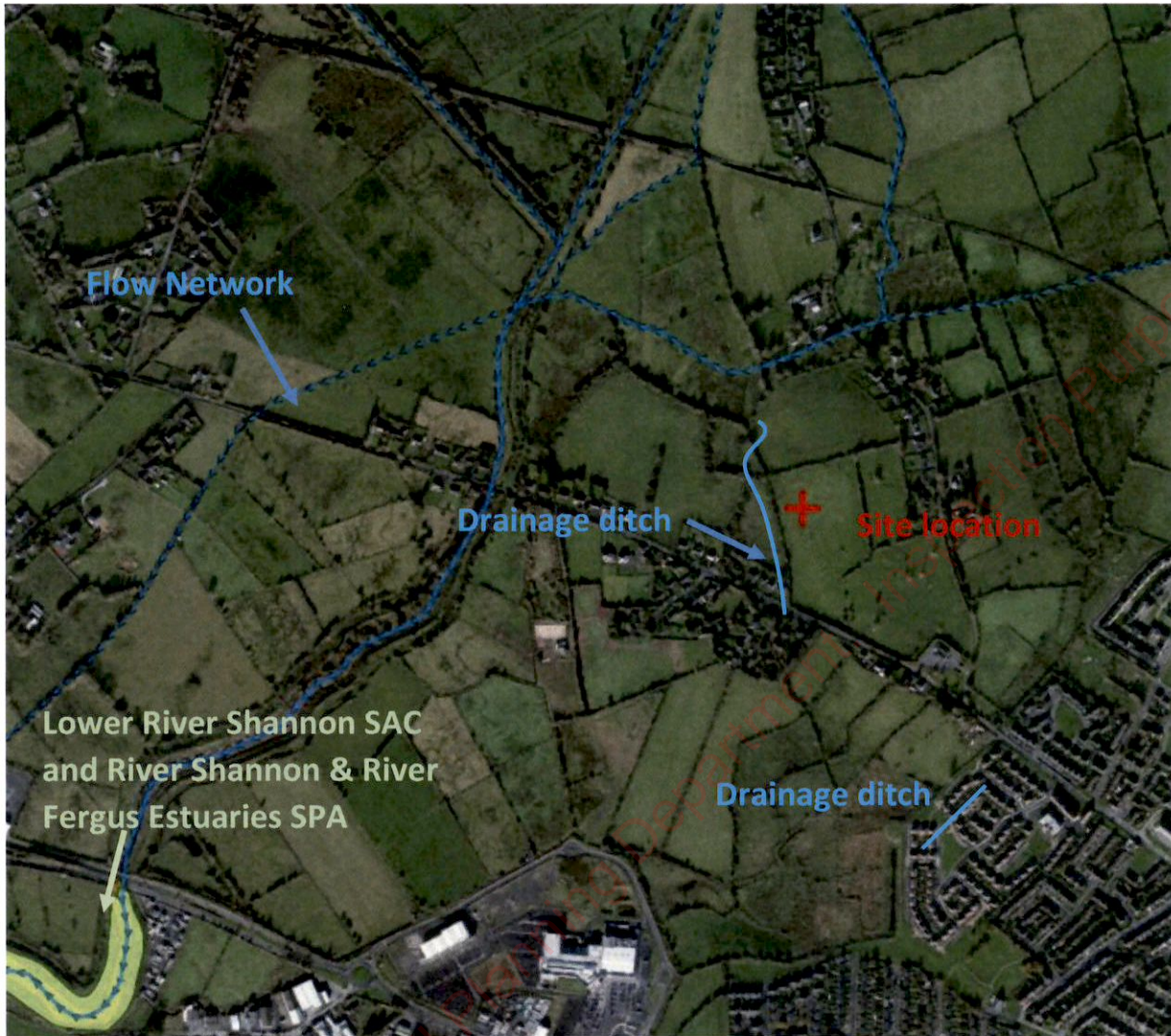


Figure 7.1 Drainage ditch and connection with flow network of European Sites

*\*Note that a portion of the Lower River Shannon SAC overlaps with the River Shannon and River Fergus Estuaries SPA.*

There is a small pool adjacent to a drainage ditch at the western boundary of the site. The drainage channel runs all the way along the western boundary of the site, adjacent to the proposed Phase 4. This drainage ditch flows into the OPW flood relief network which discharges directly into the River Shannon. The portion of the River Shannon where the OPW channels discharge is designated as the Lower River Shannon Special Area of Conservation (SAC) and River Shannon and River Fergus Estuaries Special Protection Area (SPA) (Figure 7.1).

There are also individual mature trees mixed, native and non-native species and in some sections small copses of mature trees.

To the southwest of Old Cratloe Road the fields nearest to the road are relatively dry, but become increasingly wetter to south, outside the overall study area boundary. Adjacent to these fields is a wet grassland habitat.

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Running adjacent to the new distributor Coonagh to Knockalisheen road, which is still under construction, is an OPW flood management drainage channel. The flow in this channel is standing water with no flow during dry periods.

The soil type overlying the bedrock geology, is limestone till from the Crosstown Series, which forms well drained grey/brown podzolics and brown earths, both with basic status.

## 7.2 ASSESSMENT METHODOLOGY

### 7.2.1 Relevant Guidance

The methodology for this assessment has been devised in consideration of the following relevant guidance published by the Environmental Protection Agency (EPA) including 'Guidelines on the information to be contained in Environmental Impact Statements (2002)', 'Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)' (2003) reference was also made to the draft (2015 and 2017) guidelines and 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' (DoECLG, 2013).

Additional guidance available from the EU such as 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment' (2013) has also been considered. The appraisal also takes account of 'Guidelines for Ecological Impact Assessment in the United Kingdom' (2006), CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester both published by the Chartered Institute of Ecology and Environmental Management (CIEEM). The Heritage Council publication 'Best Practice Guidance for Habitat Survey & Mapping' (Smith et al., 2011) is also referenced.

Relevant guidance published by the National Roads Authority (NRA) such as 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (2009a), and 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (2008) have also been followed.

Documentation and guidance available from Limerick City and County Council (LC&CC) including the Limerick Development Plan 2022-2028 (LC&CC, 2022) have been referred to. The OPW Flood Risk Management Plan for Shannon Upper & Lower (OPW, 2018) was also reviewed.

Relevant guidance published by the National Roads Authority (NRA), and applicable to assessing watercourses in Ireland, was also followed, including 'Guidelines for the Assessment of Ecological Impacts of National Road Schemes – Revision 2' (NRA 2009a), 'Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2' (NRA 2009b), 'Environmental Impact Assessment of National Road Schemes – A practical guide' (NRA 2008a) and 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA 2008).

### 7.2.2 Legislative Context

As the Stage 1 Screening Report for Phase 4 (and previously Phase 1, Phase 2 and the Neighbourhood Centre and Crèche) screened in for Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA a Stage two Appropriate Assessment Natura Impact Statement (NIS) was also prepared as part of the original planning application. Therefore, because of the hydrological connection with these two European Sites and potential impact the EU Habitats Directive and EU Birds Directive are relevant to this Environmental Impact Assessment Report as detailed below:

Article 6(1) and article 6(2) of Council Directive 92/43/EEC of 21st May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging developments." (EEC, 1992). Member States are required to establish necessary conservation measures and appropriate statutory measures to ensure the protection of natural habitat types in Annex I and the species in Annex II present on the sites. This includes the avoiding the deterioration of natural habitats as well as the disturbance of any species included in Annex II (EHLG, 2009, p18).

Both the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA sites are European sites and thus Natura 2000 sites (EHLG, 2009, p18).

In addition, flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act 1976, as amended, and the orders and regulations made thereunder, such as the Flora Protection Order

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Suspended solids would be a key parameter here. Likewise, any visual evidence of oil/fuel in water courses would constitute an offence.

The EU Water Framework Directive (2000/60/EC) requires all Member States to protect and improve water quality in all waters so that we achieve good ecological status by 2015 or, at the latest, by 2027. It was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003). It applies to rivers, lakes, groundwater, and transitional coastal waters. The Directive requires that management plans be prepared on a river basin basis and specifies a structured method for developing these plans.

The river basin for the study area is that of the River Shannon. However, this has a huge catchment area and therefore the waterway corridor as defined for this study is composed of the catchment of streams and OPW channels adjacent to the study area that drain directly into the Shannon River.

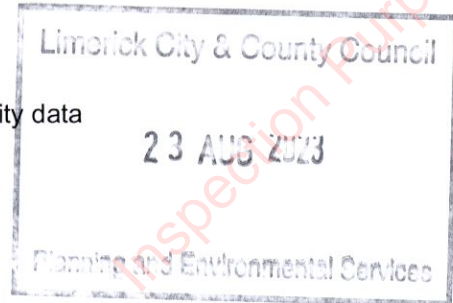
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### 7.2.3 Desktop Study

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the MS site's natural environment. These sources included:

- OSI Aerial photography and 1:50000 mapping
- National Parks and Wildlife Service (NPWS);
- The Ireland Red List No. 10: Vascular Plants (Wyse et al. 2016);
- Teagasc Soil area maps
- Geological Survey of Ireland
- Bat Conservation Ireland (BCI)
- Geological Survey Ireland (GSI) area maps
- Environmental Protection Agency (EPA) water quality data
- Limerick Development Plan 2022 – 2028
- Limerick Heritage Plan 2017-2030
- Limerick City County Biodiversity Plan
- Limerick Actions for Pollinators



### **Designated Nature Conservation Sites**

Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) within 10km of the proposed site were identified as part of this ecological appraisal using in-house GIS systems to interrogate datasets obtained from the NPWS at [www.npws.ie](http://www.npws.ie). These designated sites are described in Table 7.2 of this document.

European (Natura 2000) sites within 15 km of this project, such as Special Areas of Conservation (SACs) and Special Protection Areas for birds (SPAs) were also identified as part of this ecological appraisal and detailed in the Stage 1 Screening Report submitted as part of the planning application for Phase 4.

A separate Appropriate Assessment (AA) screening and Natura Impact Statement was carried out in order to appraise the potential impact on European site specifically for Phase 4 and submitted as part of the initial planning application. The designated sites evaluated are also detailed in Table 7.5 of this document.

### **Flora and Fauna**

A desktop study was undertaken to locate any records of rare or protected flora and fauna that have previously been recorded for the site and surrounding area. Records available on the National Biodiversity Data Centre websites were reviewed, and records of obtained by request from the NPWS were reviewed. Botanical species were assessed in accordance with their occurrence on the Flora Protection Order (2015) and The Ireland Red List No. 10: Vascular Plants (Wyse et al. 2016).

### 7.2.4 Field Survey

An ecological site walkover was carried out over the 15<sup>th</sup> November 2021 and 15<sup>th</sup> June 2022 for the whole MS. Particulars are outlined in Table 7.1 below.



Date	Weather Conditions	Surveyor
15/11/2021	Precipitation: None, Cloud: 4/8-8/8, Visibility: Excellent	JROC
15/06/2022	Precipitation: None, Cloud: 2/8-5/8 Visibility: Excellent	JROC and DOC

**Table 7.1** Baseline Field Assessment Details

### **Habitats**

The habitats within the site of the proposed development were identified and classified according to 'A Guide to Habitats in Ireland' (Fossitt, 2000) during walkover surveys of the site on the dates indicated above in Table 7.1. The dominant plant species present in each habitat type were recorded.

Habitats were appraised and evaluated according to their occurrence as protected habitats under Annex I of the EU Habitats Directive (92/43/EEC) and for their capacity to support rare, threatened and endangered species. The methodology used in this report to assess the impact on habitats is based on NRA guidelines (2009). The habitat mapping exercise had regard to the 'Best Practice Guidance for Habitat Survey and Mapping' (Smith et al., 2011) published by the Heritage Council. Scientific and common names for plants follow Parnell and Curtis (2012).

In addition to habitat identification, each habitat was assessed for its ecological significance, based on the National Roads Authority (NRA) Site Evaluation Scheme (NRA, 2009).

### **Mammals**

Mammal observations or signs were recorded during site walkovers on the dates indicated above in Table 7.1. Field boundaries and densely vegetated areas were walked to search for potential badger setts. Evidence of bat roosts was searched for and information on all potential roosts was recorded according to roost identification guidelines, but no roosts were found. 'Bat Survey Guidelines: Traditional Farm Buildings Scheme', Aughney, T., Kelleher, C. & Mullen, D. (2008).

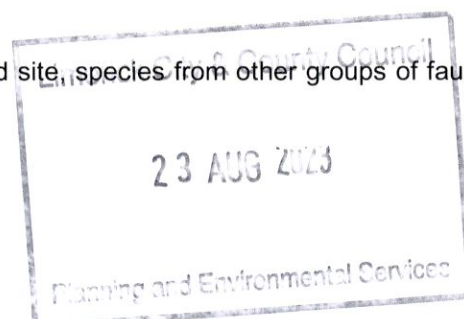
The conservation status of mammals within Ireland and Europe is assessed using one or more of the following documents; Wildlife Acts (1976 - 2010), the Red List of Terrestrial Mammals (Marnell et al., 2009) and NPWS (2013) The Status of EU Protected Habitats and Species in Ireland.

### **Avifauna**

All bird species observed and heard within the study area boundary were noted during the walk over surveys within the site.

### **Other Fauna**

During the course of the walk over surveys at the proposed site, species from other groups of fauna were noted and included in the report.





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### 7.2.5 Evaluation and Impact Assessment

The value of the ecological resources and features or receptors was determined using the ecological evaluation guidance given in the National Roads Authority (NRA) Ecological Assessment Guidelines as outlined in Table 7.2 (NRA, 2009). This evaluation scheme seeks to provide value ratings for ecological receptors, with values ranging from internationally to locally important. Internationally important receptors would include Special Areas of Conservation (SAC) or Special Protected Areas (SPA) while those of national importance would include Natural Heritage Areas (NHA).

This evaluation scheme is aimed at assessing the value of sites (see Table 7.2). It has been adapted here to assess the value of habitats and fauna within one site. The value of habitats is assessed based on condition, size, rarity, conservation and legal status. The value of fauna is assessed on its biodiversity value, legal status and conservation status. Biodiversity value is based on its national distribution, abundance or rarity, and associated trends.

All Irish bat species are protected under the Wildlife (Amendment) Act 2000 and the EU Habitats Directive. Some of the habitats and species identified were selected as key ecological receptors. The NRA (NRA, 2009) refer to key ecological receptors as those ecological features which are evaluated as Locally Important (higher value) or higher and are likely to be impacted significantly by the proposed development. The features that were evaluated as being of Local Importance (higher value) and higher in this study were selected as key ecological features and the impact significance on each of these features was assessed.

#### Ecological Resource Evaluation

Ecological resources are evaluated using the criteria outlined in Table 7.2.

Site Rating	Qualifying Criteria
A - International Importance	SAC, SPA or site qualifying as such. Sites containing 'best examples' of Annex I priority habitats (Habitats Directive). Resident or regularly occurring populations of species listed under Annex II (Habitats Directive); Annex I (Birds Directive); the Bonn or Berne Conventions. RAMSAR site; UNESCO biosphere reserve; Designated Salmonid water
B - National Importance	NHA. Statutory Nature Reserves. Refuge for Flora and Fauna. National Park. Resident or regularly occurring populations of species listed in the Wildlife Act or Red Data List 'Viable' examples of habitats listed in Annex I of the Habitats Directive
C - County Importance	Area of Special Amenity, Tree Protection Orders, high amenity (designated under a County Development Plan) Resident or regularly occurring populations (important at a county level, defined as >1% of the county population) of European, Wildlife Act or Red Data Book species Sites containing semi-natural habitat types with high biodiversity in a county context, and a high degree of naturalness, or populations of species that are uncommon in the county
D - Local importance, higher value	Sites containing semi-natural habitat types with high biodiversity in a county context, and a high degree of naturalness, or populations of species that are uncommon in the locality



	Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
E - Local importance, lower value	Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

**Table 7.2** Ecological Resource Evaluation Criteria (from NRA, 2009)

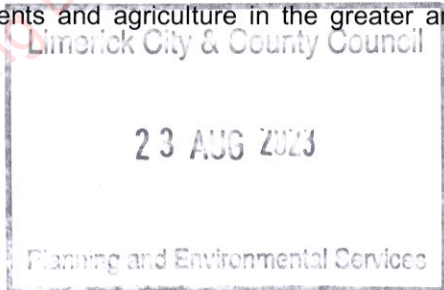
**Assessing Impact Significance**

Once the value of the identified ecological receptors (features and resources) was determined, the next step was to assess the potential effect or impact of the proposed development on the identified key ecological receptors. This was carried out with regard to the criteria outlined in various impact assessment guidelines (NRA, 2009; CIEEM, 2006, 2016 and 2018). The impacts were assessed under a number of parameters such as magnitude, extent, duration and reversibility.

Where impacts are assessed to be significant, mitigation measures have been incorporated into the project design to remove or reduce these impacts. The residual impacts after mitigation were then assessed.

The cumulative impact of the development was also assessed by discussing the impact of the overall development that have planning permission, that are in the planning process, but not yet received permission or other proposed developments that are in existence in the area.

The cumulative impact of neighbouring developments and agriculture in the greater area are also considered.



**7.3 RECEIVING ENVIRONMENT**

**7.3.1 Field Results**

The habitats present within the site were classified based on botanical and physical characteristics according to Fossit’s (2000) classification system. Floral and faunal species directly observed were identified, and signs of cryptic and nocturnal mammals and mammal dwellings were searched for. Large mature trees were also assessed in terms of their potential to provide roosting habitat for bats.

The species recorded during field surveys are assessed side by side with those belonging to the same group (i.e. avifauna, mammals) for which records relating to the study area exist.

**7.3.2 Desktop Study**

As outlined in 7.2.4 above, a desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the MS’s natural environment.

Records of invasive plant species, mammals, birds, and other faunal groups, including common, protected, and invasive species within the two 1km grid squares (R54 and R55) overlapping and surrounding the proposed MS were also retrieved from the NBDC website.



These were used both independently, and also in conjunction with field results as described above.

A central element of the desktop study is the collection of data on designated nature conservation sites. Sites of national importance within 10 km of the proposed development site are considered as part of the ecological assessment (within this environmental report). Sites of international importance within 15km of the proposed development site are dealt with separately as part of the Appropriate Assessment (AA) process and discussed in the AA Screening Report and Natura Impact Statement that was submitted as part of the original planning application for Phase 4.

European Sites are included in Table 7.3 and Figure 7.2. Figure 7.3 shows designated nature conservation sites of national importance within 10 km of the proposed development and details of the only Natural Heritage Area within 10km are in Table 7.4.

There were a number of SACs and an SPA within 15km of the proposed development as detailed in Figure 7.2. Natural Heritage (NHA) sites and proposed Natural Heritage Sites (pNHA) sites within a 10Km radius have been identified in Figure 7.3

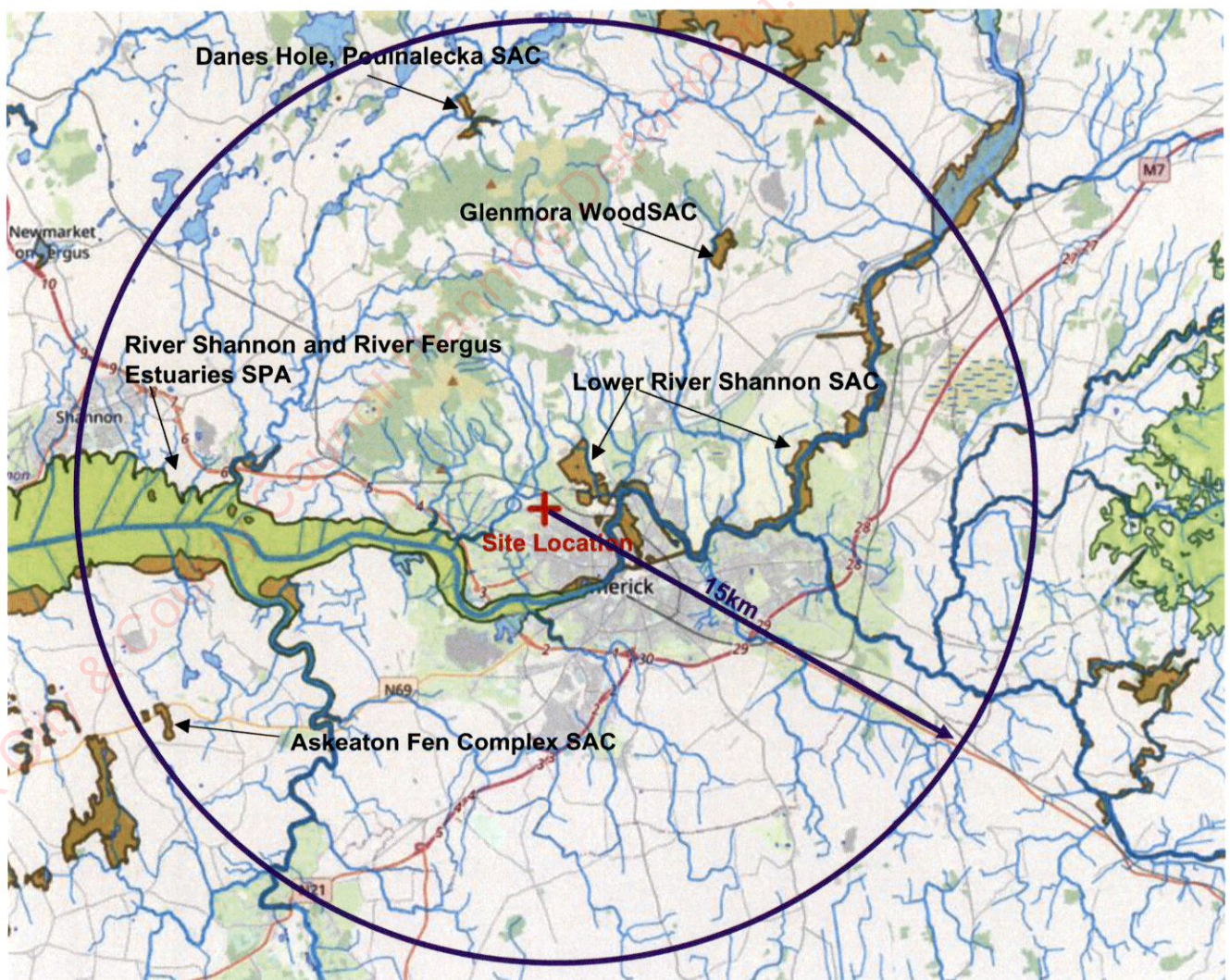


Figure 7.2 Proximity of the development to European Sites within a 15km radius (EPA, 2023).

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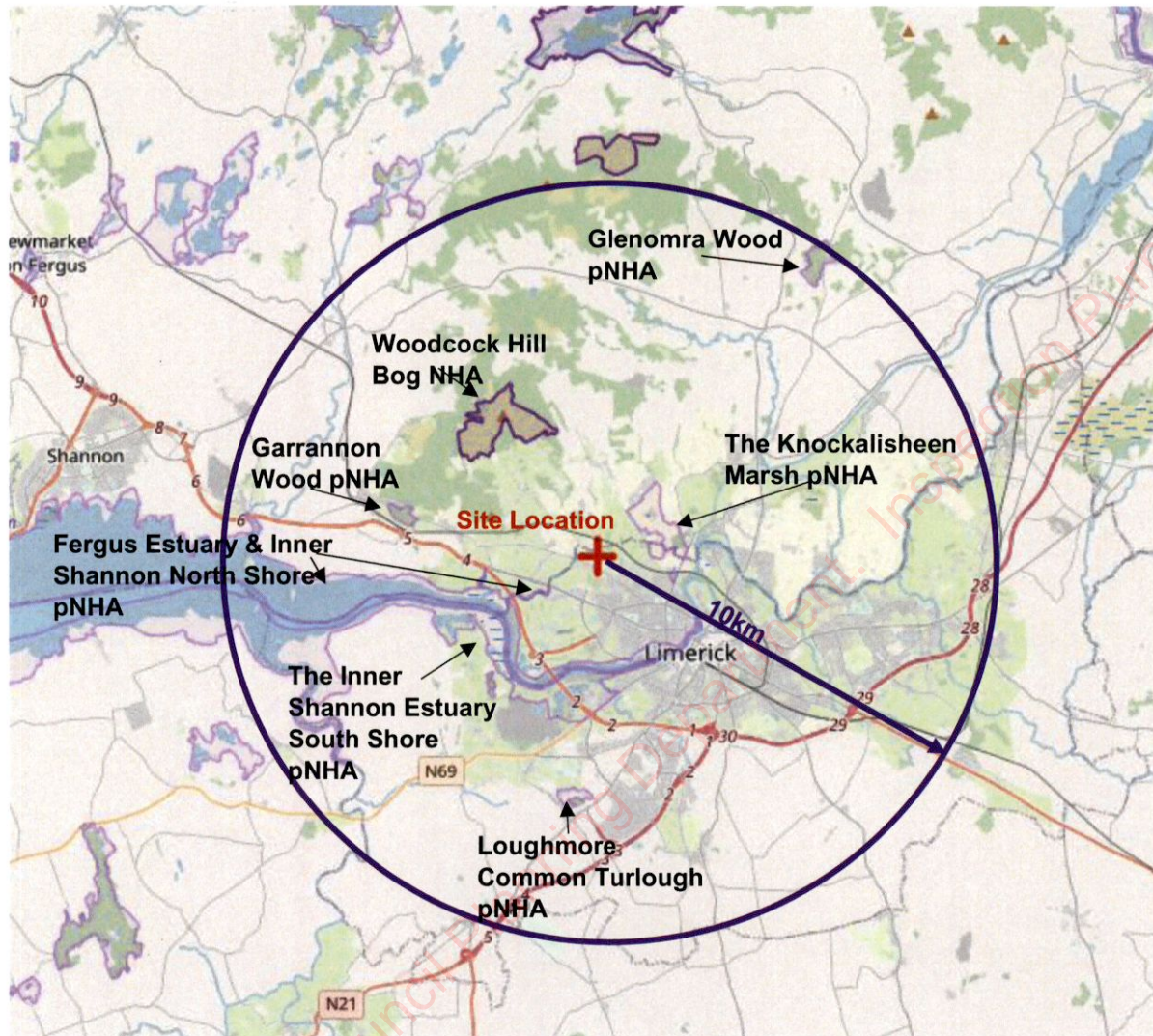
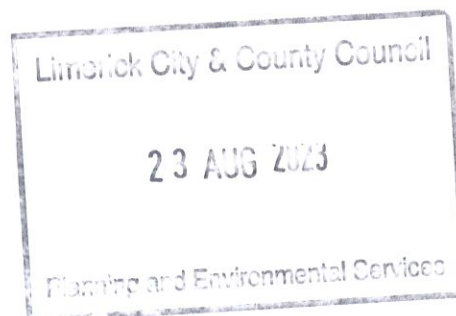


Figure 7.3 Proximity of the development to Natural Heritage Areas within a 10km radius (EPA, 2023)

**Sites of International Importance**

In accordance with Article 6 of the ‘Habitats’ Directive (92/43/EEC) the Stage 1 Screening Report evaluated the potential impacts on all of the European Sites identified in Figure 7.2, as detailed in Table 7.3. and was presented for planning for Phase 4 of the development.

The two sites that were screened in were Lower River Shannon SAC 002165 and River Shannon and River Fergus Estuaries SPA 004077.





Name of Site	Site Code	Approximate distance	Direction	Potential Risk
Lower River Shannon SAC	002165	1.14Km and 1.74Km	North, North East and South West respectively	Yes- Potential Hydrological connectivity and therefore potential pathway for impacts
River Shannon and River Fergus Estuaries SPA	004077	1.74Km	South West	Yes - Potential Hydrological connectivity and therefore potential pathway for impacts
Glenomra Wood SAC	001013	9.6km	South west	No, hydrological connectivity and sufficient geographical separation, so no potential pathway for impacts
Askeaton Fen Complex SAC	0002279	13.8km	North east	No, hydrological connectivity and sufficient geographical separation, so no potential pathway for impacts
Danes Hole Poulnalecka SAC	0000030	12.1km	North	No, Sufficient geographical separation, so no potential pathway for impacts

Table 7.3 European Sites within 15km of the proposed development

### Sites of National Importance

Sites of National Importance in the Republic of Ireland are termed, Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs). While the Wildlife (Amendment) Act 2000 has been passed into law, pNHAs will not have legal protection until the consultative process with landowners has been completed; this process is currently ongoing. Six pNHAs and one NHAs are present within 10 km of the Study Area (Figure 7.3 and Table 7.4).

Site Name	Site Code	Approximate Distance	Direction	Potential Risk
Woodcock Hill Bog NHA	002402	4.2km	North west	No, hydrological connectivity and sufficient geographical separation, so no potential pathway for impacts
Fergus Estuary & Inner Shannon North Shore pNHA	002048	1.7km	South west	Yes- Potential Hydrological connectivity and therefore potential pathway for impacts
The Inner Shannon Estuary South Shore pNHA	00435	3.4km	South west	Yes- Potential Hydrological connectivity and therefore potential pathway for impacts
Knockalisheen Marsh pNHA	002001	1.4km	North east	No, hydrological connectivity and sufficient geographical separation, so no potential pathway for impacts
Loughmore Common Turlough pNHA	00438	6.5km	South	No, hydrological connectivity and sufficient geographical separation, so no potential pathway for impacts
Glenomra Wood pNHA	001013	9.6km	North, north east	No, hydrological connectivity and sufficient geographical



				separation, so no potential pathway for impacts
Garrannon Wood pNHA	001012	5.1km	North west	No, hydrological connectivity and sufficient geographical separation, so no potential pathway for impacts

**Table 7.4** National sites within 10km of the proposed development

### 7.3.3 Flora

#### **Protected or Rare Flora**

No rare or protected flora species protected under the Flora Protection Order (2015), listed in Annex II and IV of the EU habitats directive (92/43/ECC), or listed in the Irish Red Data were recorded during the surveys of MS.

#### **Invasive Non-Native Flora**

No non-native invasive species were recorded on the MS. A search of the NBDC was conducted to identify any invasive species within R54 and R55 grid squares covering and adjacent to the development site (Table 7.5).

Common Name	Scientific Name	Invasive Impact	Grid Reference	Record Date
Butterfly-bush	<i>Buddleja davidii</i>	Medium	R559552	15/07/22
Japanese knotweed	<i>Fallopia japonica</i>	High	R551590 R542594	12/02/2018 05/06/2018
Indian balsam	<i>Impatiens glandulifera</i>	High	R541594	23/08/2007

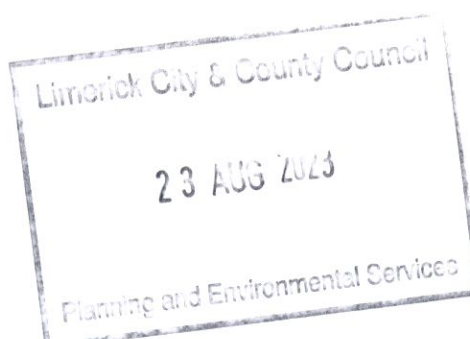
**Table 7.5** Invasive non-native flora records within 2km (Grids R54 and R55) of the site

### 7.3.4 Habitats

There are no habitats within the study area that conform to those listed under Annex I of the EU Habitats Directive. The dominant habitats within the site boundary are Improved Agricultural Grassland/ Dry Neutral Grassland Mosaic (GA1/GS1), Improved Agricultural Grassland (GA1), and Hedgerows/Treelines (WL1/WL2).

There are also areas of Scrub/Scattered Trees Mosaic (WS1/WD5) as well as Scattered Trees (WD5), a Drainage Ditch (FW4), a Pool (FL5), an area of Wet Grassland (GS4) and Spoil and Bare Ground (ED2).

Figure 7.4 shows the habitats mapped for the MS.





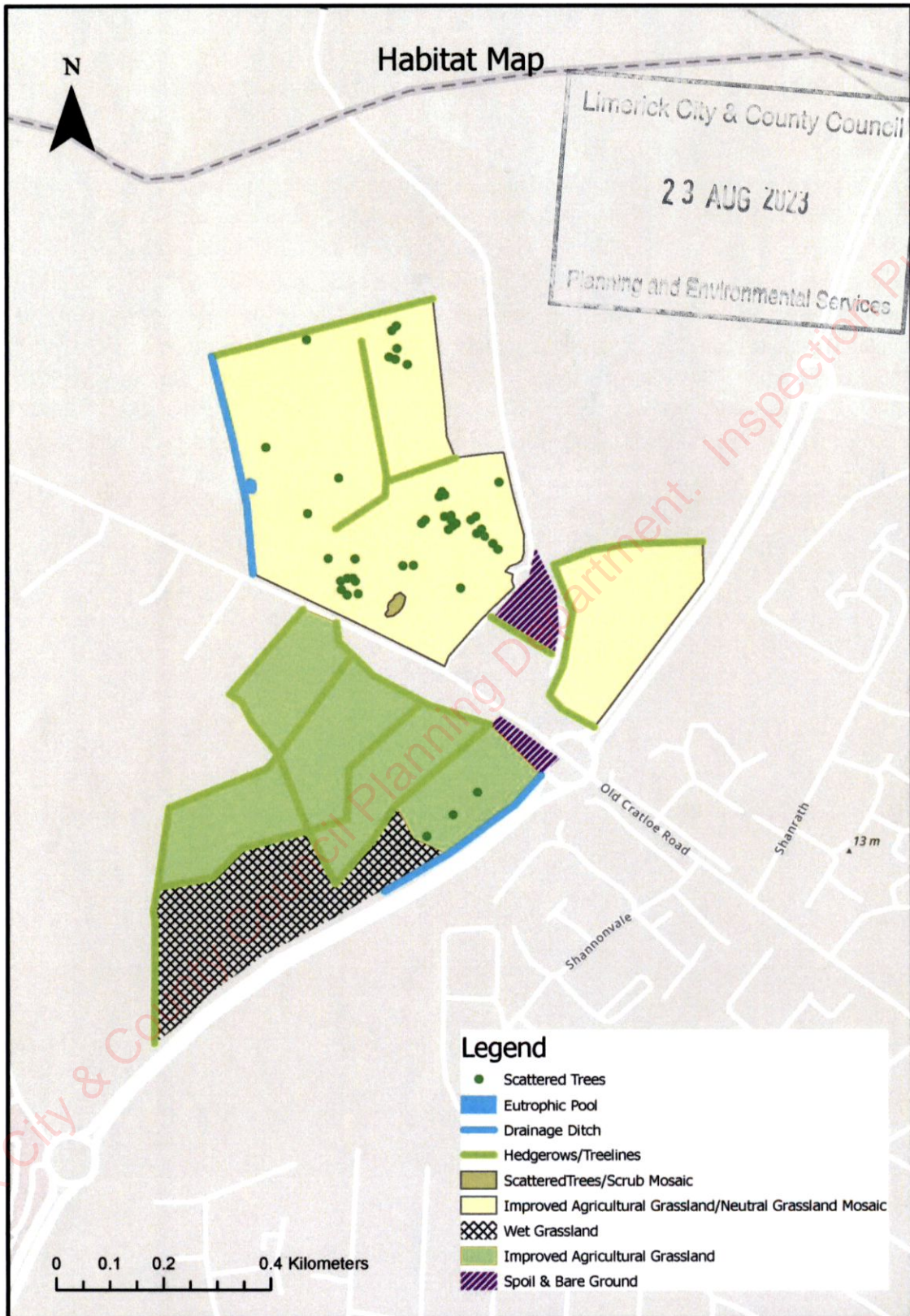


Figure 7.4 Habitat Map of the MS



**Habitats within and adjacent to the Proposed Masterplan Site***GA1/ GS1 Improved Agricultural Grassland/Dry Neutral Grassland Mosaic*

This type of habitat occupies the majority of the site (Figures 7.5 and 7.6). The fields where the proposed Phases 1-4 and the Neighbourhood Centre are located are currently grazed by horses and ponies.

This habitat type is usually seeded with an agricultural mix, suitable for grazing, however on this site, the fields are more indicative of permanent pasture that has been intensively managed. The predominant species present are Rye-grasses *Lolium spp.*, Meadow-grasses *Poa spp.*, Bents *Agrostis spp.*, Timothy *Phleum pratense*, Yorkshire Fog *Holcus lanatus* with Cocks-foot *Dactylis glomerata*, in uncut or less grazed sections. Where sections of the fields are wetter, rush species are present such as Compact rush *Juncus conglomeratus* and Soft rush *Juncus effuses*. The broad leaved species present are Meadow buttercup *Ranunculus acris*, Creeping buttercup *Ranunculus repens*, Nettle *Urtica dioica*, Ragwort (common) *Senecio jacobaea*, Thistle (marsh) *Cirsium palustre*, Thistle (creeping) *Cirsium arvense*, White clover *Trifolium repens*, Dock (common) *Rumex acetosa* and Dock (curled) *Rumex crispus*. These broad-leaved species are indicative of intensively grazed, species poor grassland.



Figure 7.6 shows a portion of the area to be occupied by Phase 4.

*GA1 Improved Agricultural Grassland*

This habitat occupies the fields where the proposed Phase 5 and is typical of a re-seeded grass sward of predominantly Perennial rye-grass *Lolium perenne*, other grass species present are Common bent *Agrostis tenuis*, Creeping bent *Agrostis stolonifera*, Yorkshire Fog *Holcus lanatus*, and Cocks-foot *Dactylis glomerata* in the field margins. The predominant broadleaved species present are Creeping

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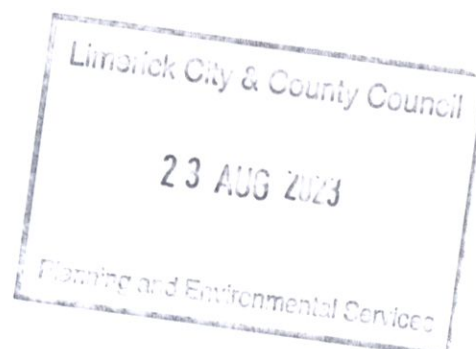


buttercup *Ranunculus repens*, White clover *Trifolium repens*, Red clover *Trifolium pratense*, Dock *Rumex acetosa* and Ribwort plantain *Plantago lanceolata*. Where these fields are wetter Silverweed *Potentilla anserina*, Meadow buttercup *Ranunculus acris* and Rush (Hard) *Juncus inflexus* are present.

This habitat type is also present in adjacent fields to the north of the MS outside of the red line boundary.



Figure 7.5 FL5 Eutrophic Pool within the area to be occupied by Phase 4







**Figure 7.6** GA1/GS1 Improved Agricultural Grassland/Dry Neutral Grassland Mosaic also showing the western boundary adjacent to where Phase 4 will be located.

#### GS4 Wet Grassland

Adjacent to and south of the area where Phase 5 is located but within the red line boundary of the MS, the fields become increasingly wetter and grade into GS4 Wet Grassland. This habitat is also present in the adjoining OPW channel where there is limited standing water. The predominant species present are Meadow foxtail *Alopecurus pratensis*, False oat-grass *Arrhenatherum elatius*, Cocks-foot *Dactylis glomerata*, Yorkshire Fog *Holcus lanatus*, Sweet vernal grass *Anthoxanthum odoratum*, Common reed *Phragmites australis*, Wood club-rush *Scirpus sylvaticus*, Yellow Flag (Iris) *Iris pseudacorus*, Rush (Hard) *Juncus inflexus*, Greater birds-foot trefoil *Lotus pedunculatus*, March cinquefoil *Comarum palustre*, Marsh bedstraw *Galium palustre*, Silverweed *Potentilla anserina*, Purple-loosestrife *Lythrum salicaria*, Hoary willowherb *Epilobium parviflorum*, Vetch (Bush) *Vicia sepium*, Sorrel *Rumex acetosa*, Meadow sweet *Filipendula ulmaria*, Common valerian *Valeriana officinalis*, Clovers (red) *Trifolium pratense*, Creeping buttercup *Ranunculus repens* and Grey willow *Salix cinerea* (Figures 7.7 and 7.8).

#### ED2 Spoil and Bare Ground

Adjacent to the newly constructed road, there are two areas of spoil and bare ground on either side of the road. In places these have become colonised predominantly with Oil seed rape *Brassica napus* and some Dock *Rumex obtusifolius* (Figure 7.9). In addition, there is an area of spoil where the Crèche is to be located and has been partly colonised with similar species.

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#### FW4 Drainage ditch

There is a drainage ditch on the western boundary of the MS, whilst connected to the flow network of the Lower River Shannon SAC and River Shannon and River Fergus SPA, contained no moving water at the time of surveying. In preceding days there had been moderate rainfall. As this ditch is bounded by a hedge bank containing prolific Bramble *Rubus fruticosus agg.*, it was difficult to access full, however Yellow Flag (Iris) *Iris pseudacorus* is present in places where water levels are reduced.

The second drainage ditch is an OPW drainage channel (Figure 7.7), which was partially dry and the species indicative of the adjacent GS4 Wet Grassland, where there was standing water. Common Water-starwort *Callitriche stagnalis*, Yellow Flag (Iris) *Iris pseudacorus*, Common reed *Phragmites australis*, Floating sweet-grass *Glyceria fluitans* and Water-cress *Nasturtium officinale* are present.

#### FL5 Eutrophic (lakes) pond

A small pond is also positioned adjacent to the western boundary of the MS on the edge of the main field where Phase 4 is to be located, that appears to be rainfall fed, rather than from the drainage ditch (Figure 7.9). The horses and ponies evidently use this pond for drinking, due to the numerous hoof prints present. Species present within this habitat are Grey willow *Salix cinerea*, Yellow Flag (Iris) *Iris pseudacorus*, Purple-loosestrife *Lythrum salicaria*, Bramble *Rubus fruticosus agg.*, Compact rush *Juncus conglomeratus* and Soft rush *Juncus effuses* at the water's edge, with Duckweed (common) *Lemna minor* in the open water. Whether this pond is artificial or natural is unknown. However, in the north-west corner of the site, there is a former artificial pond that is fed by a clay drainage pipe, which is currently dry and contains no water.



Figure 7.7 GS4 Wet Grassland and FW4 Drainage Ditch (OPW channel)



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Figure 7.8 GS4 Wet Grassland



Figure 7.9 ED2 Spoil and Bare Ground



#### WS1/WD5 Scrub/Scattered Trees Mosaic

Within the open grassland area there is small copse/scrub area, which looks as though it may be a remnant of an old hedgerow. The species are a mixture of planted and self-seeded native species, such as Hawthorn *Crataegus monogyna* and Elder *Sambucus nigra*, with planted Black poplar *Populus nigra*. Bramble *Rubus fruticosus* agg. is the other main species present.

#### WD5 Scattered Trees

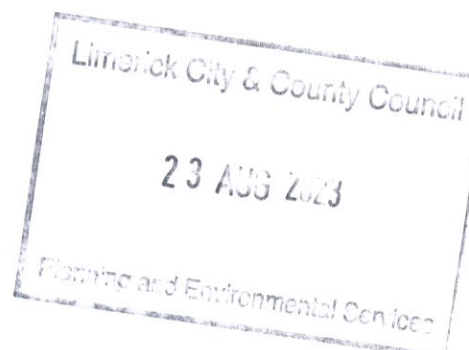
Within the GA1/GS1 Improved Agricultural Grassland/Dry Neutral Grassland Mosaic where Phases 1-4 and the Neighbourhood centre are proposed, there are a number of scattered trees and in places these occur in groups. The species are Alder *Alnus glutinosa*, Horse chestnut *Aesculus hippocastanum*, Black poplar *Populus nigra*, Black maple *Acer nigrum* and Spruce species *Picea spp.* and Grey willow *Salix cinerea*.

#### WL1/WL2 Hedgerows/Treelines

There are boundary hedgerows to the north of the site and perpendicular to these is a hedgerow that partially bisects the field. The predominant species in the hedgerows are Hawthorn *Crataegus monogyna*, Blackthorn *Prunus spinosa*, Ash *Fraxinus excelsior*, Elder *Sambucus nigra* and Crab apple *Malus sylvestris*. Other woody species such as Field rose *Rosa arvensis*, Bramble *Rubus fruticosus* agg. and Ivy *Hedera helix* are present.

Where Phase 2 is located there is a one hedgerow that is adjacent to the road where the species present are predominantly Blackthorn *Prunus spinosa* and Ash *Fraxinus excelsior* with some Sycamore *Acer pseudoplatanus* and Spindle *Euonymus europeaus*. Other species present are Bramble *Rubus fruticosus* agg. and Ivy *Hedera helix*. Nettle *Urtica dioica* is abundant indicating nutrient enrichment. There is also a hedge to the north of this portion of the site, which has similar species to that above.

The western MS boundary is also the boundary of Phase 4 where there is a hedgerow/treeline forming the field boundary with adjacent housing and agricultural land. There is a drainage ditch running on the other side of this hedgerow/treeline. The predominant species present in this habitat is predominantly Blackthorn *Prunus spinosa* with Ash *Fraxinus excelsior*, Grey willow *Salix cinerea*, Crab apple *Malus sylvestris* and Hawthorn *Crataegus monogyna*. Other species such as Field rose *Rosa arvensis*, Bramble *Rubus fruticosus* agg. Ivy *Hedera helix*, are present with Compact rush *Juncus conglomeratus*, where the ground is wetter (Figure 7.10).







**Figure 7.10** WL1/WL2 Hedgerow/Treeline at the western MS and Phase 4 boundary and GA1/ GS1 Improved Agricultural Grassland/Dry Neutral Grassland Mosaic.

Habitat	Evaluation	Rationale	Selection as a key ecological receptor
GA1/ GS1 Improved Agricultural Grassland/Dry Neutral Grassland Mosaic	Local Importance (lower value)	Highly modified habitat, but potential for a range of wildlife	Yes
GA1 Improved Agricultural Grassland	Local Importance (lower value)	Highly modified habitat, but potential for a range of wildlife	Yes
GS4 Wet Grassland	Local Importance (higher value)	Semi-natural habitat; potential for a range of wildlife; outside the development footprint, but within the red line boundary.	No
ED2 Spoil and Bare Ground	Local Importance (lower value)	Highly modified habitat, but potential for a range of wildlife	Yes
FW4 Drainage ditch FW4 OPW Drainage ditch	Local Importance (higher value) Local importance (lower value)	Semi-natural habitat; potential for a range of wildlife Man-made feature with runoff from road. Outside of MS.	Yes Yes

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FL5 Eutrophic (lakes) pond	Local Importance (lower value)	Semi-natural habitat; potential for a range of wildlife. However, nutrient enriched from horse manure.	Yes
WS1/WD5 Scrub/Scattered Trees Mosaic	Local Importance (lower value)	Semi-natural/modified habitat; potential for a range of wildlife, but remnant of earlier hedgerow	Yes
WD5 Scattered Trees (non-native)	Local Importance (lower value)	Mixture of native and non-native species, habitat; potential for a range of wildlife	Yes
WD5 Scattered Trees (native)	Local importance (lower value)		
WL1/WL2 Hedgerows/Treelines	Local Importance (higher value)	Semi-natural habitat; potential for bat roosts in trees with thick growths of ivy; proximity to development footprint;	Yes

Table 7.6 Evaluation of habitats within the study area (NRA, 2009)

### 7.3.5 Fauna

#### Birds

During the walkover surveys on the 15<sup>th</sup> November 2021 and 15<sup>th</sup> June 2022 a number of bird species were observed or heard as detailed in Table 7.7.

The hedgerows, blocks of woodland, and scrub within and bounding the site are likely to be used by Robin and other species for nesting. Robin and other species are also likely to forage within these areas. Robin may also forage within the fields themselves. Starling may forage within fields within the proposed development site, favouring grassland habitats. They may use crevices and cracks within trees along the field boundaries and woodlands within and bounding the site to breed. Swallow and House Martin may forage on the wing over the open grassland habitats within the proposed development site boundary. However, there is no potential breeding habitat for either of these species within the proposed development site.

No overwintering waterfowl species were identified on the site.

No rare or species of conservation concern were recorded on the site at the time of surveying. (Kingston, 2012).

Common Name	Scientific Name	Status BOCCI
Blackbird	<i>Turdus merula</i>	
Blue tit	<i>Parus caeruleus</i>	
Bulfinch	<i>Pyrrhula pyrrhula</i>	
Carrion crow	<i>Covus corone corone</i>	
Chaffinch	<i>Fringilla coelebs</i>	



Field fare	<i>Turdus pilaris</i>	
Goldfinch	<i>Carduelis carduelis</i>	
Great tit	<i>Parus major</i>	
House sparrow	<i>Passer domesticus</i>	Amber
Robin	<i>Erithacus rubecula</i>	
Starling	<i>Sturnus vulgaris</i>	Amber
Wren	<i>Troglodytes troglodytes</i>	

**Table 7.7** Birds identified during the walkover surveys and their status in terms of the Birds of Conservation Concern in Ireland

### Mammals

There was evidence of possibly a Fox *Vulpes vulpes* burrow that is not currently in use as well as tracks in various locations within the study area.

There was no evidence of Otter *Lutra lutra* the study area. However, recorded on the NBDC, the most recent records were in Grids R575576 and R575573, which are within a 5km of the study area, recorded as part of the Mammals of Ireland Survey 2016-25 (Biodiversity Ireland, 2023).

No dawn or dusk survey for bats has been completed on the site. However, trees within the copses and hedgerows were checked for likely roosts, and none were identified during the walkover surveys. There were no derelict or unoccupied buildings within the overall study area that would provide suitable bat roosting sites.

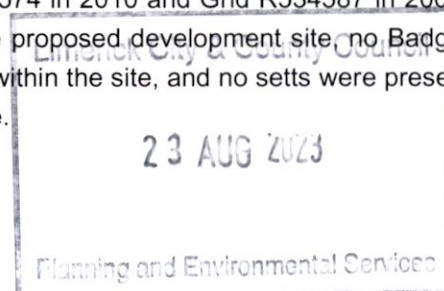
A range of bat species records were retrieved from the NBDC within the 2km grid square of the development site as detailed in Table 7.8.

Species Name	Common	Scientific Name	Grid	Date
Soprano pipistrelle bat		<i>Pipistrellus pygmaeus</i>	R568563	07/06/2007
			R540560	01/06/2005
			R568563	07/06/2007
			R530560	01/06/2005
Daubenton's bat		<i>Myotis daubentonii</i>	R540560	01/06/2005
			R530560	01/06/2005
			R530550	01/06/2005
			R540550	01/06/2005

**Table 7.8** Bat species recorded within 2km of the development site (Biodiversity Ireland, 2023)

Irish Hare could potentially use the site's hedgerows and would favour grassland habitats, although there are no records in the vicinity of the development site.

While Badger is recorded within the local area (in Grid R545574 in 2010 and Grid R534587 in 2009) and could potentially forage within and commute through the proposed development site, no Badger signs such as snuffles, latrines, or droppings were observed within the site, and no setts were present in densely vegetated areas within and in the vicinity of the site.





Hedgehog could potentially be present within the site; they are known to nest in hedgerows. As such, there is potential for this species to forage, nest and/or hibernate within and in areas bounding the proposed development site.

Irish stoat are known to predate on a variety of prey, including Rabbits, and birds and their eggs, and also to utilise a variety of den sites, including those excavated by other mammal species and accumulations of stones. As such, there is potential for this species to forage and breed within and in areas bounding the proposed development site. However, there are no records for stoat in the vicinity of the development site.

There are also no records of the high-impact invasive mammal species American Mink *Mustela vison* within the two 2km grid square or of Brown Rat *Rattus norvegicus*.

### Other Fauna

Common frog *Rana temporaria* were not recorded on site during the walkover surveys and as both the drainage ditches contain standing water, together with the small pool, there is a likelihood that frogs could spawn in these habitats and therefore a further survey should be completed in March prior to construction. According to the NBDC records, Common frog was recorded in Grid 567510 on the 01/03/202. Smooth newt *Lissotriton vulgaris* was recorded in Grid 515545 on 04/04/2020, but not recorded on the site during the walk over surveys. Similarly, these were not done at the optimum time for surveying the aquatic habitats and as for the Common frog, surveys should be completed in March for these species and other amphibians.

Emerald damselfly *Lestes sponsa*, Speckled wood butterfly *Pararge aegeria* and Cabbage white butterfly *Pieris rapae* were recorded on the development site during the walk over survey on 15<sup>th</sup> June 2021.

## 7.4 DESCRIPTION OF EFFECTS

### 7.4.1 'Do-Nothing' Scenario

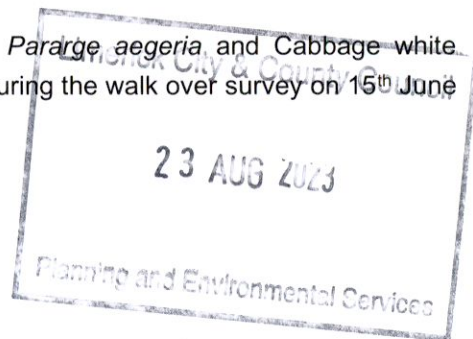
If the proposed development was not to proceed on the subject site and on the overall Masterplan site, the existing biodiversity would be left undisturbed and no likely effects would occur.

Most of the habitats to be affected have been significantly modified from their natural state by human activity. Formally disturbed areas and areas that have been left unmanaged are being recolonised by vegetation. The general pattern of succession from recolonising bare ground to patches of grassland to woodland would be expected to continue.

In the event that the proposed development does not proceed then the lands will likely continue in agricultural use.

### 7.4.2 Construction Effects

Of principal concern is the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA and the hydrological connectivity of these habitats with the development site. Also of concern are the Fergus Estuary & Inner Shannon North Shore pNHA and The Inner Shannon Estuary South Shore





pNHA, which overlap with the two European Sites. As detailed in the Stage 1 Appropriate Assessment Screening report accompanying the planning application, the potential significant effects on the Qualifying Interests of the European Sites and thus National Sites, is principally in the form of emissions to surface water during the construction phase.

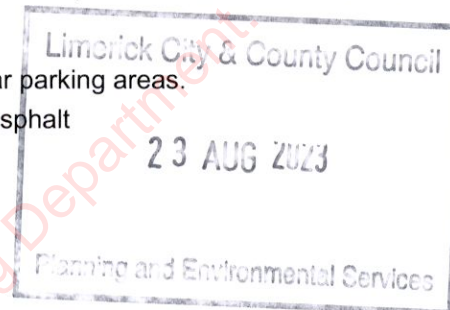
Within the MS site and the proposed Phase 4 development, the major concern is that of habitat loss. Other concerns on habitats and their species that are being retained within the development site and in the surrounding area, would be pollution, emissions to surface water as well as noise and dust.

#### 7.4.3 Operational Effects

Encroachment by development and increased human disturbance of birds and other wildlife are areas where the potential for impacts exists.

The potential for hydrological impacts resulting from the proposed development can be expected to be as a result of surface water draining and storm water drainage. However, a range of Sustainable Drainage Solutions (SuDs) have been designed to intercept the surface water and storm water to prevent these impacts as follows:

- Permeable paving will be used to construct car parking areas.
- Public road areas to be finished with porous asphalt
- Stone soakaways
- Swales
- Bio-retention strips
- Tree pits
- Swale
- Cubic M3 attenuation system



As such, rainfall and storm water within the proposed development site will be diverted away from the likely path towards the drainage channels with the implementation of the various SuDs measures. The excess flow from the soakaways (i.e. that which does not percolate through the ground) will be discharged to the cubic M3 attenuation tank. The discharge of surface water will be subject to standard environmental mitigation measures including a Class 1 Bypass Separator with an alarm and dial out facility, thereby preventing the discharge of emissions to the drainage ditch. Therefore, there will be no direct emissions of water discharge to the drainage ditch that are within the flow network that connects to the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA. Phase 2 surface water and storm water runoff discharges to a swale that runs along the edge of the road and discharges into an OPW channel approximately 500m from the MS.

Foul water from all phases will discharge directly into the foul drainage system for Limerick City.

#### 7.4.4 Cumulative Effects

This proposed development must be seen as part of a wider phased development of the surrounding lands. It is Delivery 6, Phase 4 of an overall planned development of five phases and seven delivery packages comprising as detailed in Chapter 1.0 Table 1.1. To date Phase 1 has been granted permission although it is currently subject to a third party appeal to An Bord Pleanála. Phase 2 comprising 86 no. residential units and the proposed creche have also been granted permission. See

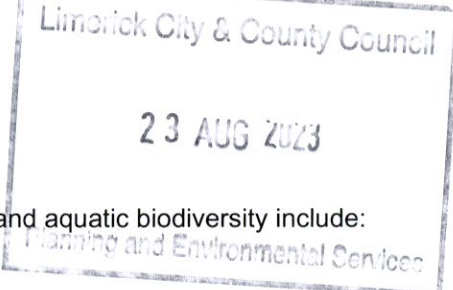


the Masterplan Drawing detailed in Chapter 2.0. Notwithstanding the Masterplan being advanced as separate phases of development, this assessment has regard to Phase 1, 2 and the creche, all of which have been granted permission and the other remaining phases as proposed insofar as information is available. A number of the identified impacts can also act cumulatively with other impacts from similar developments in this area of Limerick. These primarily arise through the additional loading to wastewater treatment plants in Limerick City.

In order to reduce the runoff or rainwater and storm water into the wastewater treatment system, all surface water will be collected and treated separately through SuDs measures or attenuation system, as detailed above, before being discharged to water courses, thus reducing the cumulative impact to of wastewater to some extent.

Based on the information in this report, the proposed Phase 4, will not have a significant adverse effect on the natural environment.

A search was made of Limerick County Council planning website for other developments in the vicinity of the proposed development. The only other significant development in the vicinity of the site was the construction of a new road network (Coonagh to Knockalisheen Distributer Road). However, at the time of surveying the construction of this road development was partially complete and has been halted. Access roads for Phase 4 have been constructed and will provide access to the site for all construction traffic.



**7.5 LIKELIHOOD OF SIGNIFICANT EFFECTS**

The potential impacts of the proposed development on terrestrial and aquatic biodiversity include:

- Impacts on Habitats
- Impacts from non-native invasive species
- Predicted impacts on water quality and aquatic ecology during construction
- Predicted impacts on water quality and aquatic ecology during operation
- Predicted Impacts on fauna during operation – Air
- Potential impacts on protected mammals – bats and otter during construction and operation
- Potential impacts on birds during construction and operation
- Potential impacts on other fauna during construction and operation.

The potential impacts and likelihood of significant effects are detailed in Table 7.9.

Impact	Residual Effect
Impacts on Habitats	The habitats to be directly affected consist primarily of modified habitats of reasonable ecological value and classified as Local Importance (Lower value). The impact on these habitats will be long term and significant. However measures have been implemented to reduce the impact by creating replacement habitats. The impacts on those habitats that are classed as Local importance (Higher Value) will



	<p>be short term and imperceptible, provided mitigated measures are employed. The ecological effect from dust generation during construction will be short term and imperceptible.</p>
<p>Impacts from non-native invasive species</p>	<p>Buddleia and this species was recorded outside the proposed development site. There will be no ecological effect from this invasive species. Indian balsam and Japanese knotweed were also recorded in the 2km squares adjacent to the development site. Although not within the site, these species are highly invasive and should they become established during the construction phase then appropriate actions to record and remove them will be required.</p>
<p>Predicted impacts on water quality and aquatic ecology during construction</p>	<p>No watercourses of high sensitivity to pollutants or high conservation value occur in close proximity to the development site. However through the flow network there is connectivity with European Sites and National Sites. Therefore, mitigation measures have been incorporated into the overall development to prevent any residual effects on aquatic habitats in Section 7.6. However, there is low risk of significant effects on water quality due to the distance involved and the dilution provided in the aquatic environment, the impacts on water quality will be imperceptible and the effect on aquatic ecology will be imperceptible.</p>
<p>Predicted impacts on water quality and aquatic ecology during operation</p>	<p>Following implementation of the SuDs measures, the resultant surface water system has sufficient capacity to adequately deal with any surface water arising from the overall site during operation. The proposed development is predicted to have an overall neutral long-term impact on water and hydrology with the development site.</p> <p>There will be no significant residual effect on hydrology, drainage characteristics of the site or water quality during operation.</p> <p>Based on the above it has been concluded that the impact on local water quality, water quality in downstream receptors and aquatic ecology will be imperceptible during operation.</p>
<p>Potential impacts on protected mammals – bats and otter</p>	<p>The impact on bats will be localised and will not significantly impact on overall bat populations as there will no significant loss of critical resources for bats. Overall, the impact on feeding habitat for bats is predicted to be permanent and not significant. Otter could potentially forage in the drainage ditches adjacent to the site boundaries. The proposed works will result in an increase in noise and disturbance. However it will be of limited significance in the context of Otters' largely nocturnal habits, ability to move away from short-term disturbance and the negligible significance of increased noise and disturbance in the context of the levels already generated by the adjoining housing developments. The impact on Otter, if they utilise the site, would be not</p>

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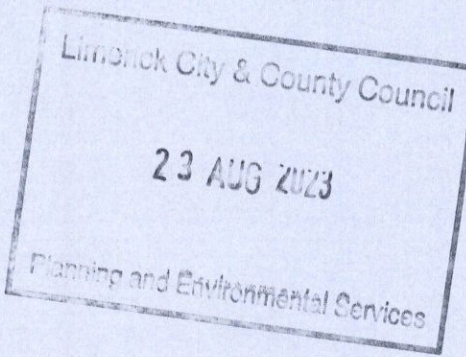
	significant in the short term and imperceptible in the long term.
<p>Potential impacts on birds during construction and operation</p> 	<p>Whilst works could potentially disrupt feeding patterns, given the availability of similar habitat in the surrounding area and the ability of birds to move away from disturbance, the impact on the feeding behaviour of these species would be not significant during construction. Any impact on these species would not be significant during construction and imperceptible during operation. During the operational phase, the levels of activity will stabilise and birds in the surrounding landscape will be expected to habituate to any increased noise and disturbance levels. The impact on terrestrial birds, in habitats adjoining the proposed development site is therefore predicted to be permanent and imperceptible during operation. During operation, the existing storm water management systems have been designed to ensure that there are no significant effects on surface or ground water quality. The impact on surface water quality and on prey availability for birds feeding in aquatic or estuarine habitats downstream of the facility will be imperceptible during construction and operation.</p>
<p>Potential impacts on other fauna during construction and operation</p>	<p>Mammal species which are protected under the Irish Wildlife Act 1976, as amended, occur or could potentially occur within the proposed development site. No habitats of significant value with regard to amphibians or reptiles will be affected by the proposed works. The work areas are only likely to support common invertebrate species. The effect on these species will be not significant in the short term and imperceptible in the long term.</p>

Table 7.9 Potential impact and residual effects on habitats

**7.5.1 Construction Effects**

Construction activities are likely to generate some noise and dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations.

Given that there are only two High Value habitats in proximity to the development site, dust suppression measures as detailed in Chapter 7.0 shall be employed to reduce impact. However, any impacts from dust generation will be short-term and can be minimised with correct site management procedures.

There will be some rock breaking on the MS and noise disturbance to wildlife can be minimised throughout the construction phase, by operating during day light hours only.

No disturbance to habitats or flora outside the proposed development area will occur. All works and temporary storage of material will be restricted to the immediate footprint of the development, which will



be wholly within the development site boundary. Designated access points will be established within the site and all construction traffic will be restricted to these locations.

A Construction Environmental Management Plan shall be prepared by the appointed contractor prior to commencement of development to include a range of standard surface water control measures during construction. However, the following site specific measures shall be implemented to protect existing habitats:

In order to prevent flow into the drainage ditches, silt fencing with geotextile membrane shall be erected around the site to prevent any discharge to water courses. To further protect the drainage ditches identified in Figure 7.1, berms shall be constructed. This is particularly important as the overall MS is at a higher elevation than both of the ditches and the likelihood of discharge from the construction site during periods of rainfall are high.

In addition, a lined attenuation pit shall be constructed at the lowest point to capture any surface water during the construction phase.

The water quality mitigation measures outlined above will ensure otter and aquatic species are not negatively impacted by a decline in water quality.

**7.5.2 Operational Effects**

**Surface Water Drainage Infrastructure.**

Due to the inclusion of Sustainable Drainage Solutions (SuDs), soakaways, and attenuation system within the design of the development, the impact on the aquatic habitats, in particular will be removed during the operation of the Masterplan development and the proposed Phase 4.

While the proposed operational phase water management strategies will be specific to the MS development, they will also serve to minimise potential operational phase run-off impacts into the wider environment including the Lower River Shannon SAC and other designated sites even if not primarily designed to address any particular risks to the SAC/other designated sites as such. The retained drainage ditches will be outside of the boundary treatments for the Masterplan development.

Taking the above into consideration, potential operational phase impacts in relation to surface water drainage on designated sites are considered imperceptible and neutral.

**Habitats**

Impacts on terrestrial habitats are generally restricted to the direct removal of habitats and possible impacts from the spread of invasive species. Based on the criteria outlined by EPA, 2017, as described above, the predicted impacts are detailed in Table 7.10

Habitat	Evaluation	Potential Impact
GA1/ GS1 Improved Agricultural Grassland/Dry Neutral Grassland Mosaic	Local Importance (Lower Value)	Loss of large areas. Heavily grazed and lower value habitat. Negative, Significant. Permanent impact.

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GA1 Improved Agricultural Grassland	Local Importance (Lower Value)	Loss of large areas. Poor diversity. Negative. Imperceptible. Permanent impact
GS4 Wet Grassland	Local Importance (Higher Value)	Outside of the development, therefore no loss of habitat. Positive. Imperceptible. Short term impact.
ED2 Spoil and Bare Ground	Local Importance (Lower Value)	Loss of small areas of low value habitat. Negative. Imperceptible. Long term impact
FW4 Drainage ditch	Local Importance (Higher Value)	No loss of habitat. Neutral. Imperceptible. Short term impact.
FL5 Eutrophic (lakes) pond	Local Importance (Lower Value)	Loss of habitat. Negative. Significant. Permanent impact.
WS1/WD5 Scrub/Scattered Trees Mosaic	Local Importance (Lower Value)	Within exclusion zone where archaeological feature is contained. Positive. Imperceptible. Short term impact
WD5 Scattered Trees (non-native)	Local Importance (Lower Value)	Loss of non-native trees. Negative. Not significant. Permanent impact.
WD5 Scattered trees (native)	Local importance (Lower Value)	Loss of native trees. Negative. Significant. Permanent impact. Trees where the archaeological feature is present will be retained.
WL1/WL2 Hedgerows/Treelines	Local Importance (Higher Value)	A number of hedgerows will be removed as part of the development. Negative, Significant, Long term impact. However, new native species hedgerows will be planted to replace these (Figure 7.11). The boundary hedgerows of the development site area will be retained and some of the internal hedgerows will be retained where possible. Neutral. Imperceptible. Short term impact

**Table 7.10** Evaluation of potential impact of the construction phase on habitats

As detailed above there will be some significant direct loss of habitats as a result of the proposed development. However the habitats that will be lost as a result of the overall Masterplan development will be replaced with compensatory habitats that have the potential to be of higher conservation value and therefore the overall evaluation of the biodiversity will be that of net gain. Details of the habitats to be retained and newly created habitats are detailed in Figure 7.11. Details of the habitats to be lost and compensation measures are detailed in Table 7.11.

Habitat to be Removed	Compensation Habitat	Impact Classification	Biodiversity Net Loss/Net Gain
WL1/WL2 Hedgerows/Treelines	Replacement native species hedgerows	Positive	Net gain as more hedgerows will be planted than those removed in the overall MS.
WD5 Scattered trees (native)	Native or pollinator friendly species will be planted in green areas	Positive	Net gain as more trees will be planted than those removed
WD5 Scattered Trees (non-native)	Native or pollinator friendly species will be planted in green areas	Positive	Net gain as more trees will be planted than those removed
FL5 Eutrophic (lakes) pond	Replacement pond	Positive	Net gain as the proposed new pond will be of a larger size and the water quality is likely to be of

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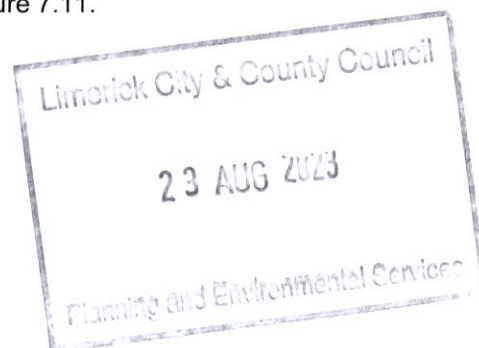
			improved quality as there will be no horse grazing or runoff from farming activities.
GA1/ GS1 Improved Agricultural Grassland/Dry Neutral Grassland Mosaic	Green areas to be planted with native wildflower and grass seed mix and managed with a reduced mowing regime during the summer months to provide a habitat for pollinators. In addition, an area will be retained as a new wet grassland that was formerly Improved Agricultural Grassland.	Neutral	Although the existing area of Improved Agricultural Grassland/Neutral Grassland is larger than the proposed green areas and new wet grassland, both of these measures will have a greater potential for increased biodiversity and therefore there will be no net loss overall.
GA1 Improved Agricultural Grassland	Green areas to be planted with native wildflower and grass seed mix and managed with a reduced mowing regime during the summer months to provide a habitat for pollinators.	Neutral	Although the existing area of Improved Agricultural Grassland is larger than the proposed green areas and new wet grassland, both of these measures will have a greater potential for increased biodiversity and therefore there will be no net loss overall.

**Table 7.11** Habitats to be removed and resultant biodiversity net loss/net gain

The impact during operation on the boundary treelines/hedgerows will be minimised with the inclusion of walls around the development and therefore the impact is considered to be imperceptible and neutral.

As the additional native and/or non-native pollinator friendly trees and native hedgerow planting and grassy areas within the MS matures they will enhance the quality of the foraging habitat on the site as well as providing additional cover for fauna while maintaining and/or providing wildlife corridors/green infrastructure across the study site.

As per the construction phase, the Landscape Masterplan associated with the development will also be relevant to other fauna including bats during the operational phase by creating new linear hedgerows hedgerows for bats to use as the vegetation matures while also retaining existing boundary hedgerows and some of the internal hedgerows as detailed in Figure 7.11.





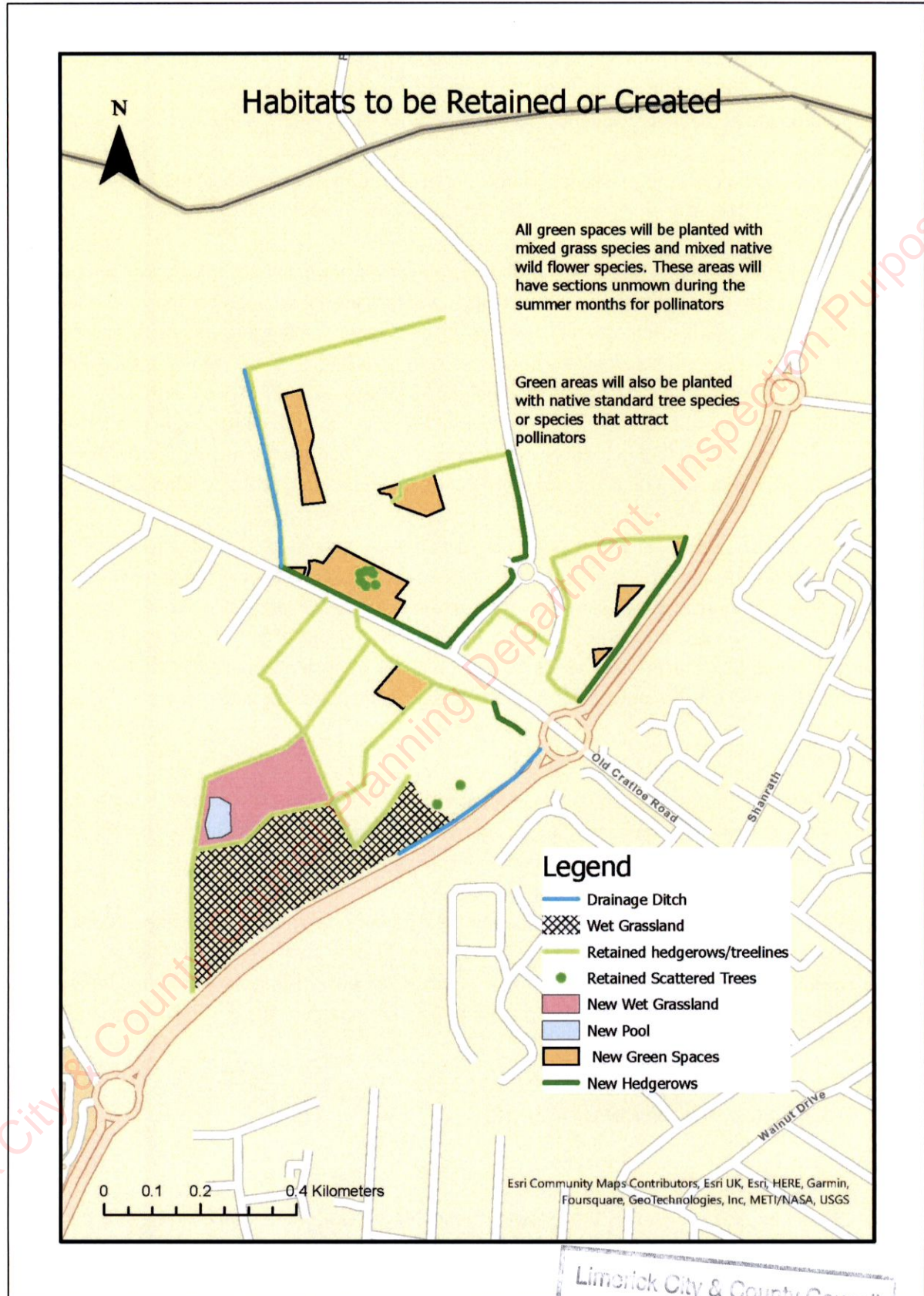


Figure 7.11 Habitats to be retained or created within the MS.



## Bats

Although no bat roosts were found on the MS, bats are known to be in the area as detailed in Table 7.8 and may use the development for foraging. Therefore operational stage disturbance effects which includes disturbance of fauna, particularly bats arising from artificial light spillage into the environment from the associated lighting scheme. Lighting types that emit a narrow spectrum with no UV (e.g. low pressure sodium) attract relatively less insects than broad spectrum types with high or low UV (e.g. high pressure sodium, Metal halide and mercury; see Bat Conservation Ireland 2010, Stone 2013).

Therefore, the narrow spectrum types with no UV have a relatively lower impact on bats by not attracting their insect prey base away from the nearby habitats where bats will be searching for prey (see Bat Conservation Ireland 2010, Stone 2013). The use of directional lighting and luminaire accessories (shield, louvre) are also very successful approaches to reducing light spillage nuisance into the surrounding environment (see Bat Conservation Ireland 2010, Stone 2013, BCT & ILP 2018) in relation to bats. In this case, areas of the MS that are considered sensitive to artificial lighting in relation to bats coincide with new/existing wildlife corridors comprising of linear hedgerows and hedgerows/treelines. This has been taken into account by the proposed public lighting design for the residential scheme.

There will be additional human activity/vehicular disturbance during the operational phase of the proposed development which will lead to a slight increase in noise levels at the site. However, fauna species confirmed present at the site are likely to be already relatively tolerant of noise as the proposed development site is situated on the edge of an urban/suburban environment and as such there is no predicted significant effect on faunal species as a result of disturbance associated with the operational phase of the proposed MS development. Therefore impact is imperceptible and neutral.

### Other Impacts.

As outlined above, potential operational phase impacts on designated sites via other impacts such as disturbance/displacement on relevant fauna, recreational activity and flooding/floodplain are not relevant here and are therefore considered imperceptible neutral.

The existing eutrophic pool is of poor quality due to the extensive trampling by horses and ponies and deposition of horse manure and thus the level of biodiversity in this pool is very low. The two drainage ditches which are of Higher Value will remain undisturbed and mitigation measures have been suggested in Section 7.5 to ensure that the water quality is not impacted during the construction phase.

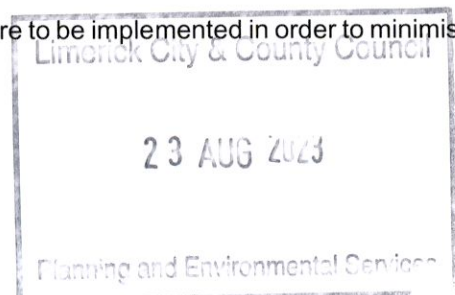
## 7.6 REMEDIAL & MITIGATION MEASURES

### 7.6.1 Construction Phase

As part of the proposed development the following measures are to be implemented in order to minimise the potential impacts on the existing ecology.

#### 7.6.1.1 Mitigation by Avoidance / Design

No mitigation proposed.





### 7.6.1.2 Mitigation by Prevention

BIO CONST 1: In order to prevent flow into the drainage ditches, silt fencing with geotextile membrane shall be erected around the site to prevent any discharge to water courses. To further protect the drainage ditches identified in Figure 7.1, berms shall be constructed. This is particularly important as the overall MS is at a higher elevation than both of the ditches and the likelihood of discharge from the construction site during periods of rainfall are high.

BIO CONST 2: A lined attenuation pit shall be constructed at the lowest point to capture any surface water during the construction phase.

BIO CONST 3: The phased ground clearance works for the proposed development that involve the removal/disturbance of any hedgerow, treeline or occasional mature trees, will be undertaken outside of peak bird breeding season (March 1<sup>st</sup> to August 31<sup>st</sup> inclusive); if hedgerow clearance cannot be limited to outside this period, a qualified ecologist will be required to oversee clearance operations, with works being halted in the event that nesting birds are observed.

BIO CONST 4: Construction operations shall take place during the hours of daylight to minimise disturbances to roosting birds.

BIO CONST 5: If site lighting is required during construction works here it will be placed with consideration of and away from the potential foraging/roosting areas of protected species associated with the wider area such as hedgerows/treelines

BIO CONST 8: Construction operations within the proposed development site will take place during the hours of daylight to minimise disturbances to faunal species at night. No badger or otter activity was observed during the walk over surveys.

BIO CONST 9: A pre-construction mammal survey will be undertaken within the footprint of the development in order to confirm that none of these species have colonised the site following the walkover surveys. In the event that a badger sett or otter spraint or holts should be encountered at any point, the NPWS will be informed and in the case of badger, NRA Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes will be followed. Should evidence of Otters be found then a derogation licence will be required.

BIO CONST 10: As part of best practice construction measures a preconstruction bat survey shall be carried out within the site prior to construction to reconfirm the findings of preplanning surveys (no roosts were detected during the walkover surveys). If any roosts are found during these surveys a relevant bat derogation licence shall be sought prior to construction works commencing and works will be carried out under the terms of the relevant derogation licence this shall include any felling works being undertaken, and works will be timed and conducted in a manner to ensure that no bats are harmed as a result of felling.

BIO CONST 11: Lighting shall not be left switched on overnight within the site during the construction phase. The use of lighting within the site can discourage some bat species from using the site, and attract other species due to higher insect activity, increasing their vulnerability to predators.



#### 7.6.1.7 Mitigation by Prevention

BIO CONST 13: The proposed surface water drainage infrastructure as proposed which includes the use of SuDs measures as well as an attenuation system fed by soakaways shall be implemented on site, therefore preventing impact on the adjacent drainage ditches and the wider aquatic environment, including the European Sites evaluated in the NIS.

#### 7.6.1.8 Mitigation by Reduction

Good site management practices and construction mitigation measures will be implemented as per the CEMP. However, a number of measures are specific for protecting freshwater habitats (drainage ditches) as detailed below:

BIO CONST 14: Construction will follow guidance from Inland Fisheries Ireland (IFI, 2016) for the protection of aquatic habitats. This will include the erection of a geotextile silt fence (or similar barrier) along the western boundary to prevent the ingress of silt to the drainage ditch. Water leaving the site will pass through an appropriately-sized silt trap or settlement pond so that only silt-free run-off will leave the site.

BIO CONST 15: Dangerous substances, such as oils, fuels etc., will be stored in a bunded zone. Emergency contact numbers for the Local Authority Environment Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the site compound. These agencies will be notified immediately in the event of a pollution incident.

BIO CONST 16: Site personnel will be trained in the importance of preventing pollution and the mitigation measures described here to ensure same.

BIO CONST 17: The site manager will be responsible for the implementation of these measures. They will be inspected on at least a daily basis for the duration of works, and a record of these inspections will be maintained.

BIO CONST 18: The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, particular care to minimise impact to retained hedgerows is required, with no felling, removal or trimming undertaken other than where required to facilitate essential access and to ensure health and safety of operatives. Where individual trees are to be retained within the development, protected fencing must be erected.

### 7.6.2 Operational Phase

#### 7.6.2.1 Mitigation by Avoidance / Design

BIO OPER 1: The SUDs strategy as designed shall be implemented on site as it will reduce the impact of the flow of surface water and storm water on the adjacent aquatic environments (drainage ditches).

#### 7.6.2.2 Mitigation by Prevention

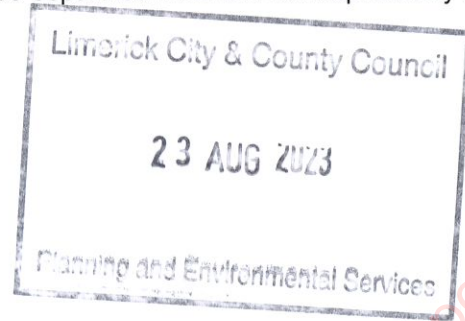
BIO OPER 2: The habitats to be retained outside of the development shall be fenced off from the public so that they remain undisturbed for wildlife. These habitats include the proposed new pond, new and



existing wet grassland and drainage ditches (the latter will be separated from the development by a boundary wall).

#### 7.6.2.3 Mitigation by Reduction

No mitigation proposed.



### 7.7 RESIDUAL EFFECTS

While the construction of high-density housing in a semi-rural setting will significantly alter the environment for local wildlife and reduce the naturalness of habitats in the area, with the implementation of the biodiversity enhancement measures detailed in Section 7.5 and the mitigation measures in Section 7.6, the potential impact of the proposed development on the habitats, flora and fauna in the local area will be reduced markedly.

Considering the requirement for greater housing capacity, the expansion of urban areas is inevitable, making certain impacts unavoidable. The impact of urban expansion on wildlife and natural and semi-natural habitats can be lessened. However, using the types of mitigation measures, ecological enhancements, drainage design, and environmentally responsible wastewater management systems which are incorporated into this development.

At a higher level, the implementation and maintenance of responsible urban planning policies such as green wedges, which benefit both wildlife and human health and wellbeing can also reduce the impacts associated with urbanisation. Within the MS a small green wedge has been proposed south of Phase 5 and together with the hedgerows/treelines to be retained and new hedgerows to be planted, will provide connectivity from within the development to the open countryside and reduce the impact of habitat fragmentation.

Considering these mitigating factors, while also acknowledging the magnitude of the change represented by the alteration of the landscape from a semi-rural to an urban environment, the overall residual impact of the proposed development is considered to be *Permanent but Moderate*.

#### 7.7.1 Construction Phase

Tree felling and other site clearance works will take place outside the season of peak nesting activity in birds, or the area will be surveyed by an ecologist to confirm that no protected fauna are present. As a result, there will be no impact on nesting birds, and no legal offence under the Wildlife Act 1976 (as amended).

#### 7.7.1 Operational Phase

Bat-sensitive lighting techniques will be incorporated into the lighting plan to avoid light-spill in areas that are likely to be used by bats. As a result, there should be no significant change in bat activity within the Site.



## 7.8 MONITORING

### 7.8.1 Construction Phase

Prior to construction water testing should be conducted to provide baseline information on water quality for the two water courses (drainage ditches) adjacent to the overall site.

Suitably qualified personnel will be appointed by the contractor to monitor the construction process and a daily environmental record will be kept of any accidents, leaks or spills and how they were addressed. In addition, the appointed personnel will also monitor the removal of any of the trees and hedgerows and should any nests or bat roosts be identified then work will cease and the ecologist contacted.

Similarly, if any of the Qualifying Interest species for the European Sites should occupy the site during construction (as detailed in the Stage 2 Appropriate Assessment for NIS Report), then works will cease immediately and the relevant authority (NPWS) will be contacted for advice on proceeding.

### 7.8.1 Operational Phase

On completion of the construction phase water monitoring of surface water must be completed to determine any changes to water quality as a result of the construction process.

All onsite environmental record sheets will be collated and an environmental report compiled on completion of the construction phase. This report will be made available to LC&CC.

A qualified ecologist will complete a walkover survey of the development site on completion to ensure that all SuDs measures and landscaping measures have been implemented. A report of this survey will be made available to LC&CC.

Subject to the successful implementation of these measures, it can be concluded that the proposed development will not cause any significant negative impacts on designated sites, habitats, legally protected species, or any other features of ecological importance.

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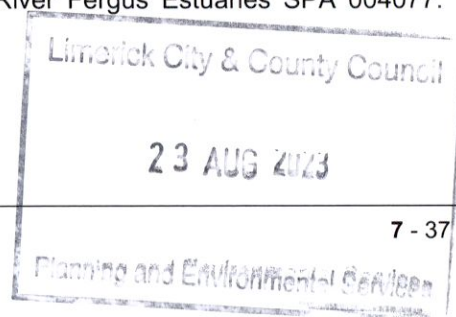
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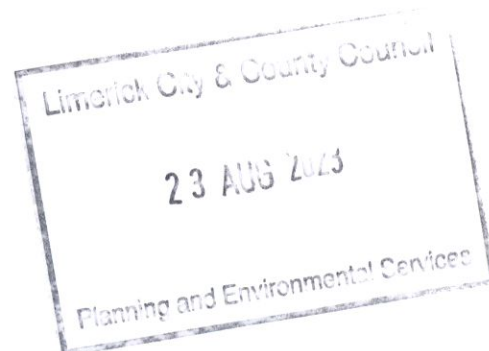
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## CHAPTER EIGHT LAND & SOILS, GEOLOGY AND HYDROGEOLOGY

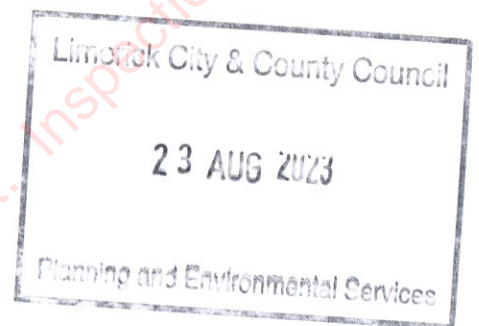
### 8.1 INTRODUCTION

This chapter assesses the impact on the geological environment from the proposed development. The objectives of this chapter are to provide a review of baseline geological conditions across the footprint of the site; assess the potential impact of the proposed development on the underlying soils, geology and hydrogeology, provide appropriate mitigation measures for any identified potential impacts, if deemed necessary and consider any reasonable alternatives. Potential impacts from planned future works are also assessed. This chapter also identifies all potential sources of contamination or environmental liability associated with the site.

### 8.2 ASSESSMENT METHODOLOGY

The assessment was undertaken by undertaking the following:

- A desktop study of soils, subsoils, bedrock and hydrogeology;
- A review of available site investigation data;
- Interpretation of all data and reporting.



The following sources of information were also used in the compilation of this assessment:

- Ordnance Survey of Ireland (OSI) Discovery Series;
- Ordnance survey of Ireland (OSI) online historical maps and aerial photographs;
- GSI On-line Groundwater database;
- Soil Map of Ireland (Second Edition, 1980), national Soil Survey of Ireland, An Foras Talúntais.
- National Parks and Wildlife Service On-line database [www.npws.ie](http://www.npws.ie);
- OPW Hydro-Data (<http://www.opw.ie/hydro-data>);
- Met Eireann - Met.ie – monthly climatological data;
- Limerick City and County Council Online Planning Files and County Development Plan;
- Landslides in Ireland. GSI. Irish Landslides Working Group (2006); and,
- Directory of Active Quarries, Pits and Mines in Ireland (3rd Edition) GSI. 2002;

This chapter was undertaken in accordance with the following:

- Planning & Development (Environmental Impact Assessment) Regulations 2018;
- Guidelines on the Information to be Contained in Environmental Impact Statements, 2022;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018)
- Geology in Environmental Impact Statements a Guide, (IGI, 2002);
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, TII / NRA Document;
- Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013);



- Institute of Geologists Ireland (2002): Geology in Environmental Impact Statements – A Guide;

### 8.3 RECEIVING ENVIRONMENT

The proposed development site (Phase 4) is part of a phased development proposal for a large greenfield area or Masterplan Site (MS). This MS is divided into seven different phases of delivery as detailed in Table 1.1 in Chapter 1.0 Introduction. The overall MS layout which illustrates the indicative layout of the subject site and adjoining lands in the ownership of the applicant is displayed on Figure 1.0 in Chapter 1.0 and full details of the proposed development phases are given in Chapter 2.0.

The study area takes a holistic approach and examines the wider MS area whilst focusing on any areas of significance within the proposed Phase 4 development site.

#### 8.3.1 Topography

The overall site has a high point of +18.00m AOD (Malin Head) in the north east corner. From here the land falls away to the southeast, south and west. The ground profile falls to a low point of +5.00m AOD (Malin Head) along the southern boundary of the site. The land has typical gradients of 2.3% to the southeast, 2.9% to the south and 7.7% to the west.



Figure 8.1 Site Topographical Survey



**8.3.2 Bedrock**

GSI geological mapping indicates that the major rock unit group in the wider area is the undifferentiated limestone of Carboniferous (Visean) Age. Two rock outcrops have been identified in geological mapping within the site. These are identified as being of the same undifferentiated limestone of Carboniferous (Visean) Age. No karst features have been mapped in the area. The closest karst feature is approx. 6km to the south.

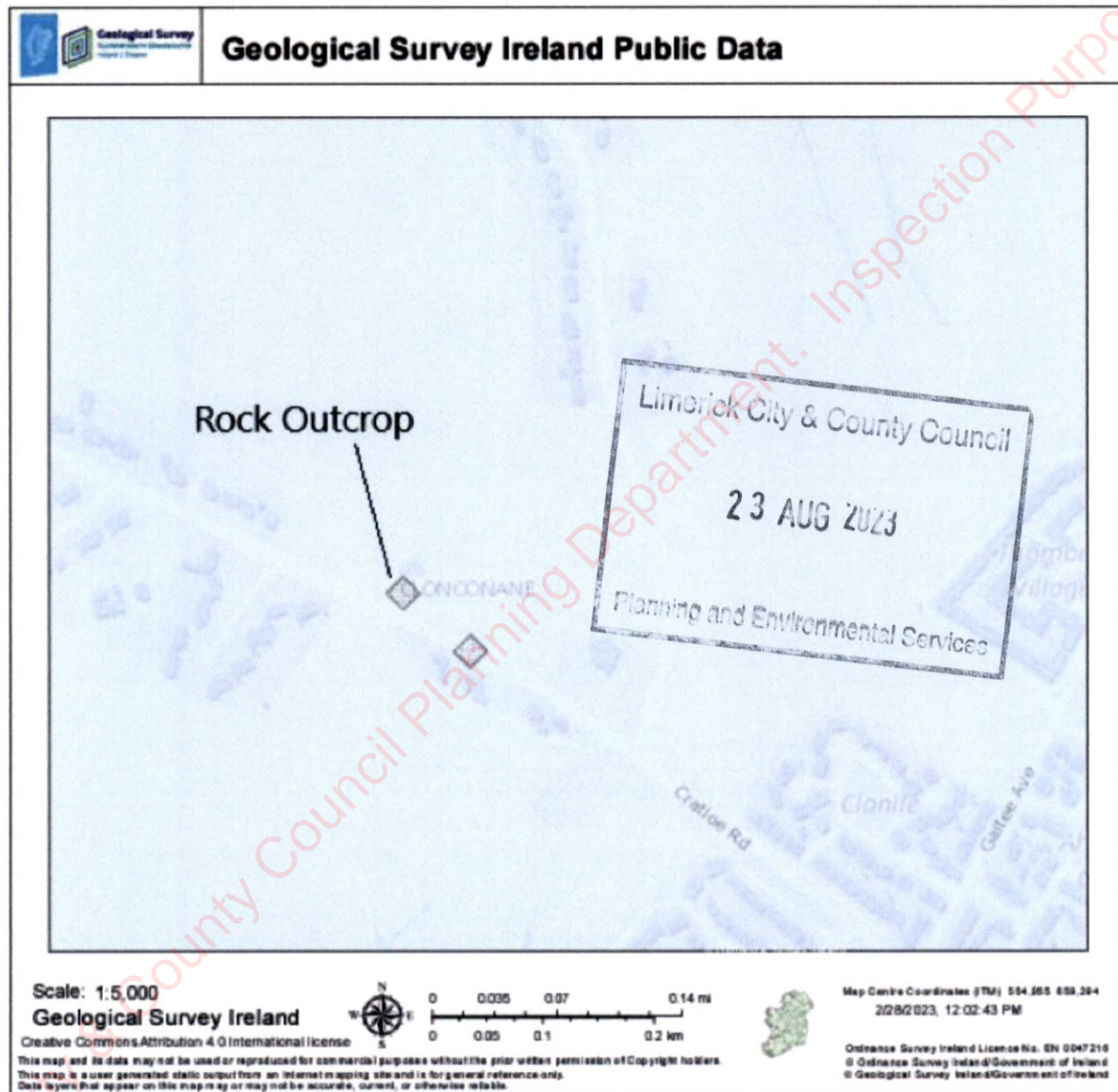


Figure 8.2 Bedrock Geology 100k [GSI Online Mapping]

**8.3.3 Soils and Subsoils**

GSI geological mapping shows that a significant portion of the site is located above a bedrock outcrop. The periphery of the site and surrounding areas are underlain by glacial till derived from limestones. An underlying layer of estuarine silts and clays encroaches on the southern boundary of the site.



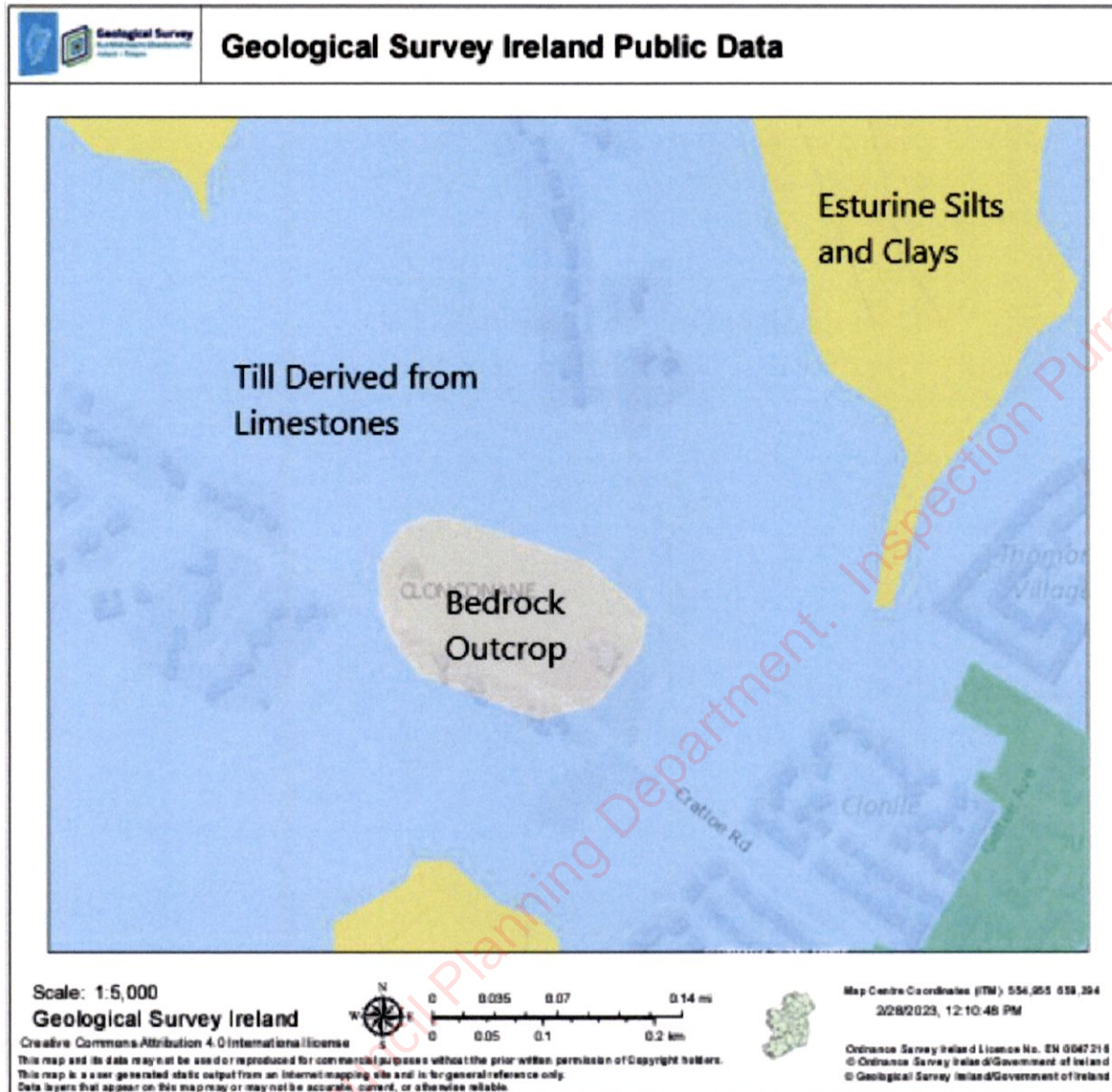
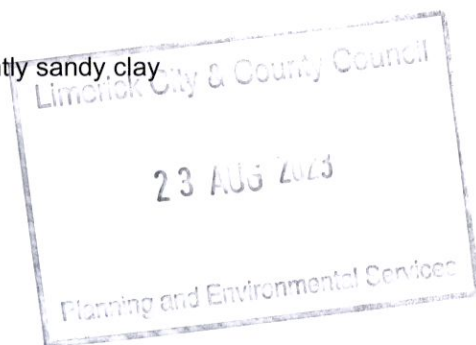


Figure 8.3 Quaternary Sediment [GSI Online Mapping]

### 8.3.4 Site Investigation

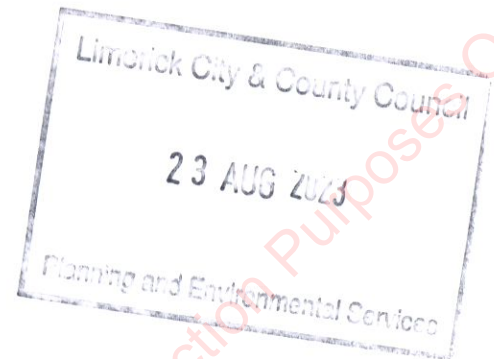
Historic site investigation is available from a large civil engineering project which ran through the area being assessed in this EIAR. The SI pertinent to this site was reviewed in detail below;

- BH01/RC01
  - 300mm – Topsoil
  - 400mm - Dark brown, slightly gravelly slightly sandy clay
  - 3400mm to end of BH – Strong limestone
  - No groundwater encountered
- TP01
  - 550mm – Topsoil
  - Obstruction at 0.55m depth
- TP02
  - 550mm – Silt with many boulders





- Obstruction at 0.55m depth
- TP03
  - 200mm – Topsoil
  - 1100mm - Slightly gravelly sandy clay
  - 600mm - Sandy gravelly silt with some cobbles
  - Obstruction at 1.9m depth
- TP04
  - 225mm – Topsoil
  - 1050mm - Slightly sandy gravelly silt
  - Obstruction at 1.3m depth
- DP01
  - Refusal at 1300mm
- DP02
  - Refusal at 800mm



A generalised summary of ground conditions based on available site investigation is as follows;

- Topsoil 225mm to 550mm thick
- Clay 400mm to 1100mm thick
- Silt 550mm to 1050mm thick
- Limestone rock at 400mm to 1900mm deep

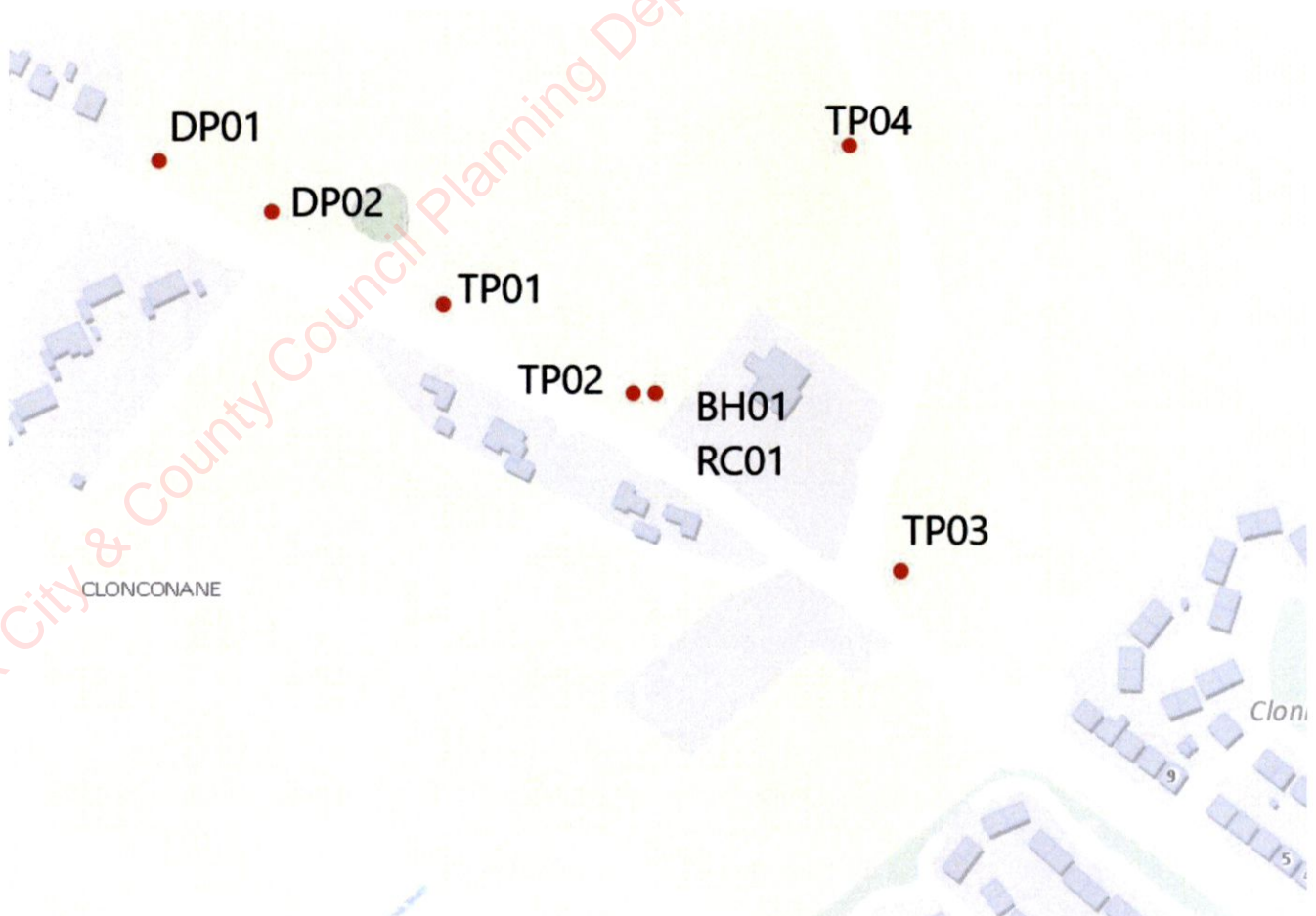


Figure 8.4 Historic SI La



8.3.5 Wells

There is one well identified on GIS records within 1km of the site. This well is located to the southeast at a distance of approx. 450m. The well is likely to be drilled to depths which penetrate the underlying limestone bedrock. The depth of the well is recorded at 6m.

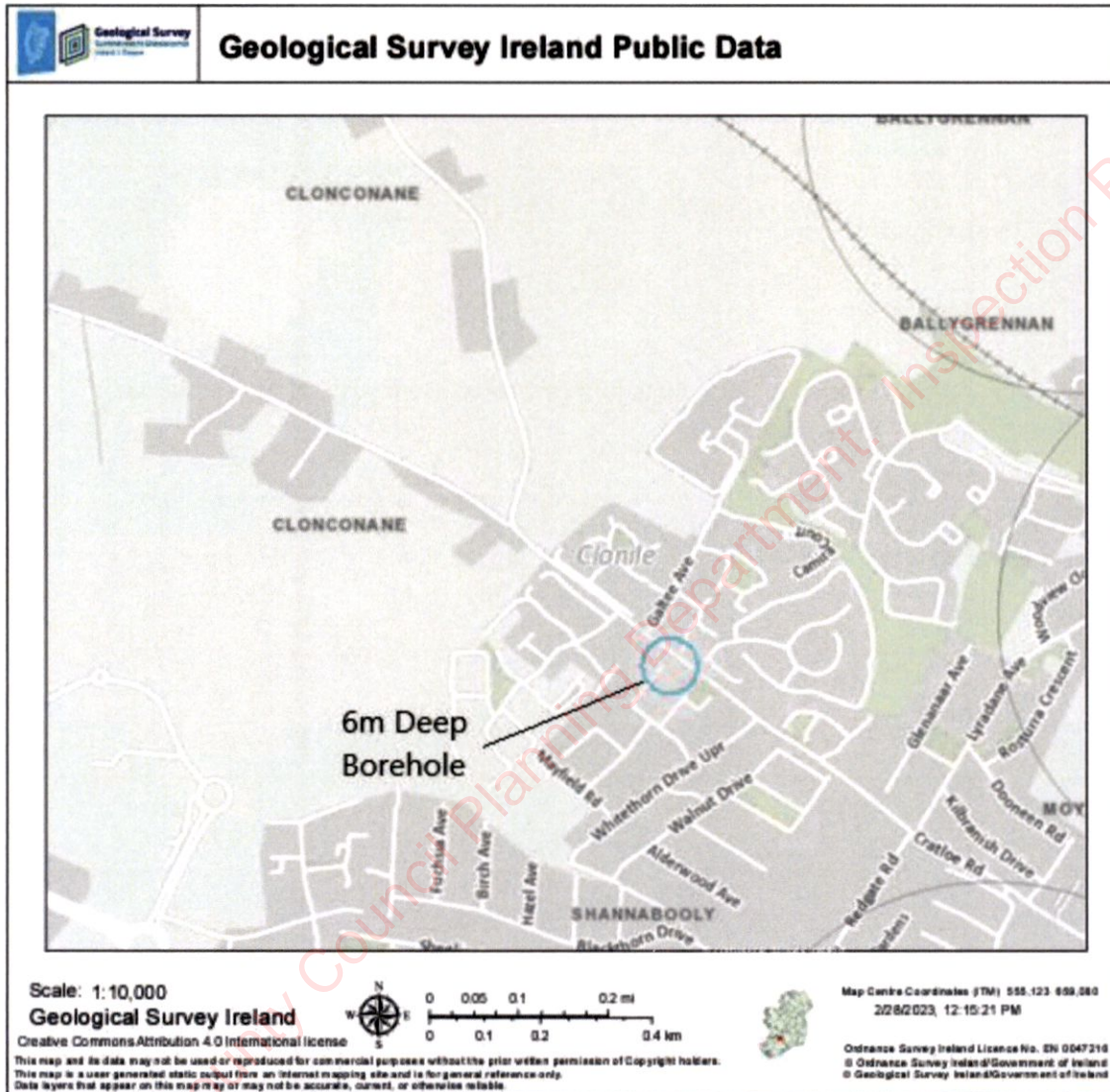
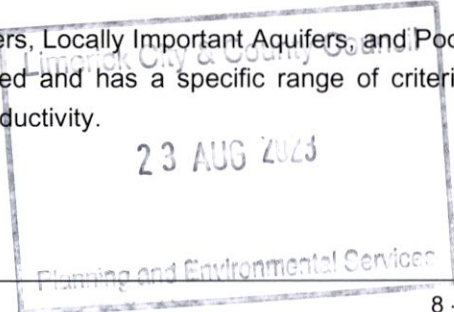


Figure 8.5 Groundwater Wells and Springs Mapping [GSI Online Mapping]

8.3.5 Aquifer Classification

The Geological Survey of Ireland has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource into the National Draft Bedrock Aquifer Map.

The three main classifications are Regionally Important Aquifers, Locally Important Aquifers, and Poor Aquifers. Each of these types of aquifer is further subdivided and has a specific range of criteria associated with it, such as the transmissivity (m<sup>2</sup>/day) and productivity.





The development lands are located in an aquifer classified as “Lm”: (A Locally Important Aquifer which is generally moderately productive) and both made ground given the previous use as a gold course and areas of moderate permeability subsoil overlain by well drained soil

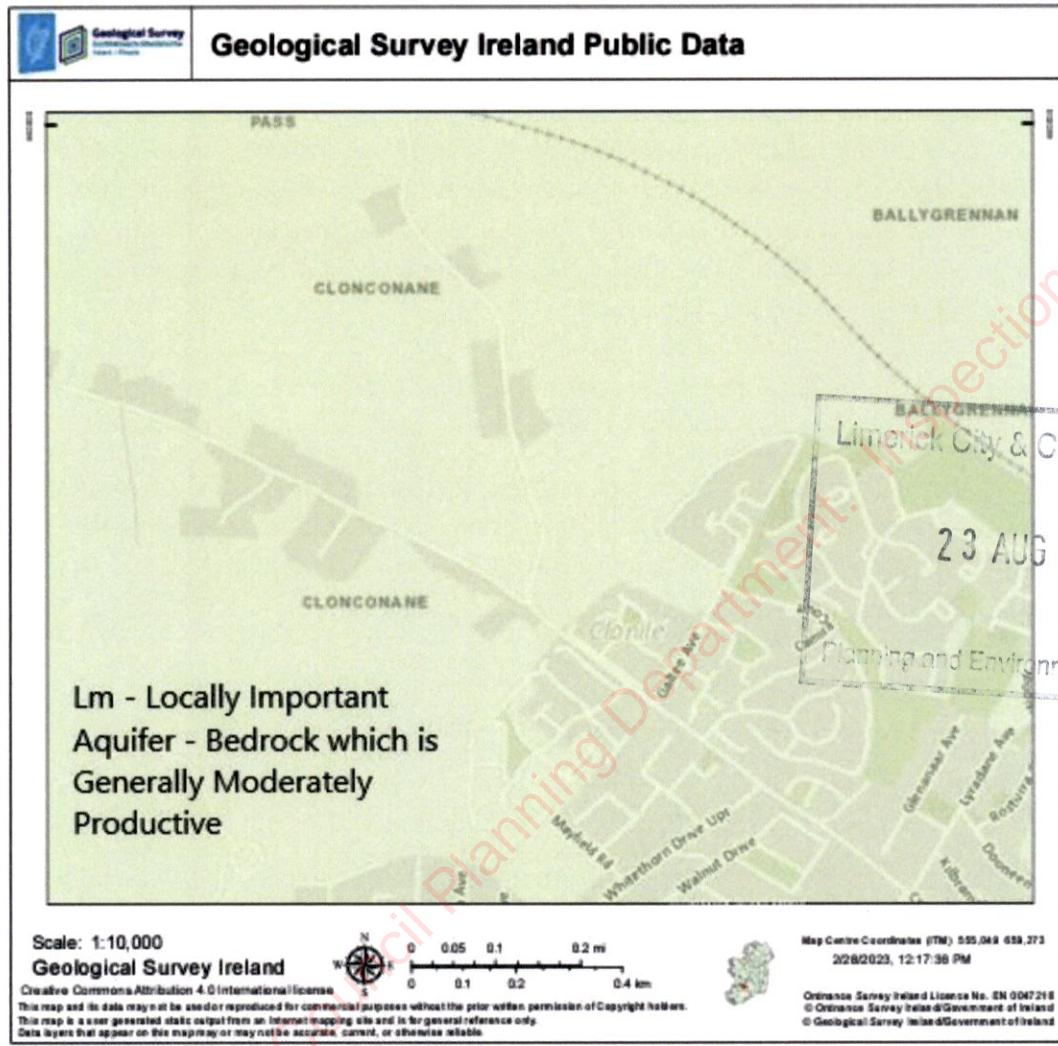


Figure 8.6 Groundwater Resources (Aquifers)

The Ground Water Body (GWB) is recharged from rainwater percolating through the topsoil and subsoil deposits and directly to the aquifer via outcrop. Regionally, there is no subsoil thickness data currently available to assess this GWB. There is outcropping rock and rock close to surface across the GWB, particularly in the east. The main discharges are to the streams and rivers crossing the GWB, and to the River Shannon that forms the western and southern boundaries of the GWB.

Groundwater levels are generally shallow ranging from near ground level near streams and rivers, up to around 5-15 mbgl away from surface water bodies, depending upon ground elevation. The water table will generally follow the topography. Local groundwater flow will be from the higher ground between surface water bodies to the rivers and streams, where it discharges. Regional groundwater flow directions are generally westwards and southwards to the Shannon, and oblique to the E-W flowing major river within the GWB. Groundwater flow path lengths are on the order of 500–1500m over the bulk of the GWB. In discharge zones, flow paths will be much shorter, at around 100–300m



Groundwater sustains flows in the gaining rivers and streams crossing the GWB. Groundwater will flow into the NHA Inner River Shannon as direct baseflow, and via baseflow to the Crompaun River which flows into the Shannon

### 8.3.5 Aquifer Vulnerability

The GSI classify aquifer vulnerability as the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The vulnerability of groundwater depends on the ability of contaminants to migrate to the underlying aquifer which is dependant predominantly on the permeability and thickness of the subsoils overlying the groundwater body and the types of recharge source (i.e. diffuse or point source) – see table below. Under the GSI groundwater vulnerability classification scheme the mapped vulnerability at a location applies to the shallowest groundwater target (i.e. aquifer) at the location.

Aquifer vulnerability is largely dependent on overburden thickness and the inherent permeability of the bedrock. If bedrock is near or exposed at the surface the groundwater classification will be extreme.

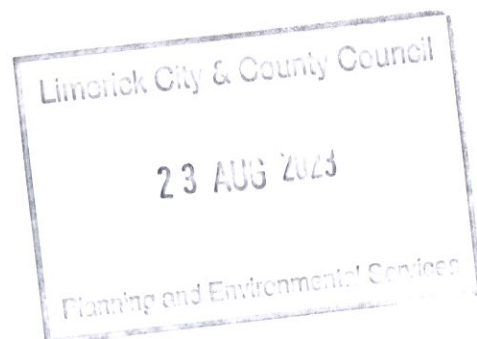
A detailed description of the groundwater vulnerability categories can be found in the Groundwater Protection Schemes document (DELG/EPA/GSI, 1999) and in the draft GSI Guidelines for Assessment and Mapping of Groundwater Vulnerability to Contamination (Fitzsimons et al, 2003).

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
<b>Extreme (E)</b>	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
<b>High (H)</b>	> 3.0m	3.0 - 10.0m	3.0 - 5.0m	> 3.0m	N/A
<b>Moderate (M)</b>	N/A	> 10.0m	5.0 - 10.0m	N/A	N/A
<b>Low (L)</b>	N/A	N/A	> 10.0m	N/A	N/A

Notes: (1) N/A = not applicable.  
 (2) Precise permeability values cannot be given at present.  
 (3) Release point of contaminants is assumed to be 1-2 m below ground surface.

Figure 8.7 Aquifer Vulnerability Rating

Groundwater vulnerability data provided by GIS mapping shows the area to have a moderate to high vulnerability classification. The area of high vulnerability coincides with the bedrock outcrop.





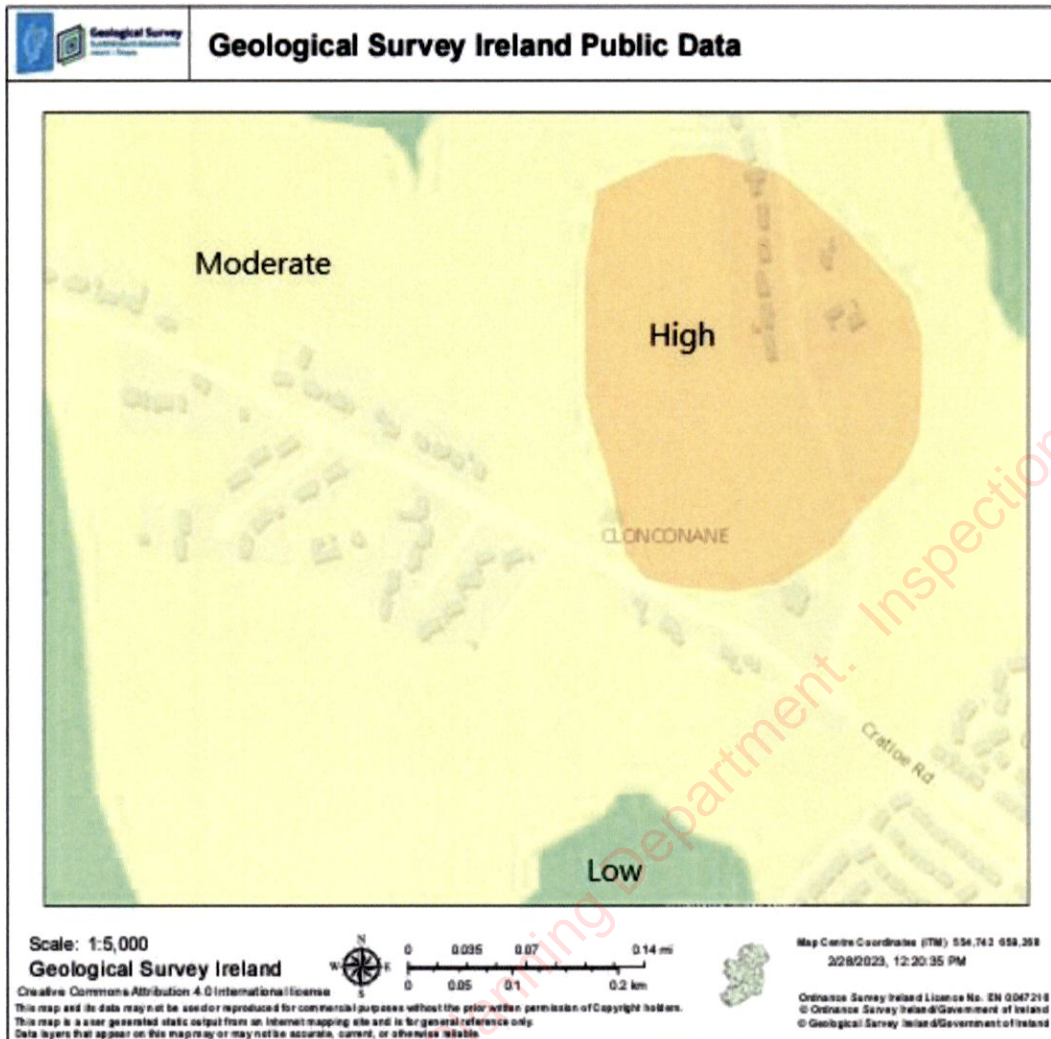


Figure 8.8 Groundwater Vulnerability [GSI Online Mapping]

A review of the subsoil thickness indicates depth to bedrock is generally expected in the range of between 3m and over 10 metres below the land surface. However, as discussed previously bedrock outcropping is to be expected.

**8.3.5 Water Framework Directive Groundwater Status**

The Water Framework Directive (WFD) classification scheme for water quality includes two status classes: good and poor. The assignment of the status class depends on the ecological and chemical status of the groundwater body.

The underlying groundwater body is the Limerick City Northwest groundwater body (GWB). The relevant European codes is IE\_SH\_G\_140. The groundwater status in this area has been assigned “good” status (Ground Waterbody WFD Status 2016-2021).

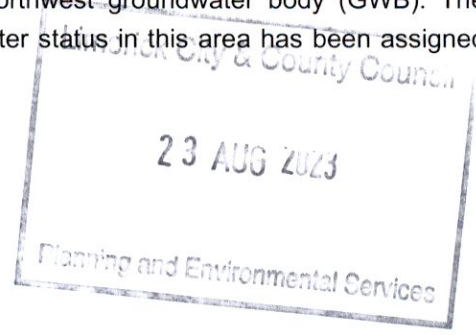






Figure 8.9 Ground Waterbody WFD Status [EPA Online Mapping]

**8.3.6 Contamination**

EPA online mapping has no recorded waste disposal or contaminated sites located in proximity to the proposed site.

According to the EPA database there are no reported contaminated soil or groundwater issues present at this site.

**8.3.7 Designated Protected Areas**

The site is not within or directly adjacent to any protected areas. At its nearest point the site is approx. 1.5km North East of the River Shannon and River Fergus Estuaries SPA, the Lower River Shannon SAC and the Fergus Estuary and Inner Shannon, North Shore Proposed NHA.

The Cromptau River lies to the West of the site and this runs into the above mention designated protected areas.

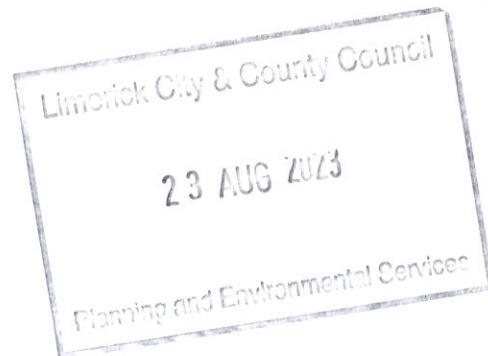


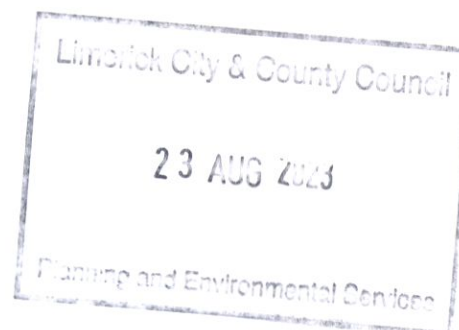




Figure 8.10 Designated Protected Area – [EPA Online Mapping]

### 8.3.8 Areas of Geological Heritage Importance

GSI mapping shows there is no recorded geological heritage sites in close proximity to the study area. The nearest geological heritage sites are located in Mungret, approximately 10 km to the west. This is a Visean Shelf Limestone Quarry. It is currently classified as a County Geological Site. Adjacent to this site is a road cut excavated through limestone bedrock on the N18 route east of the Limerick Tunnel which is also classified as a County Geological Site.





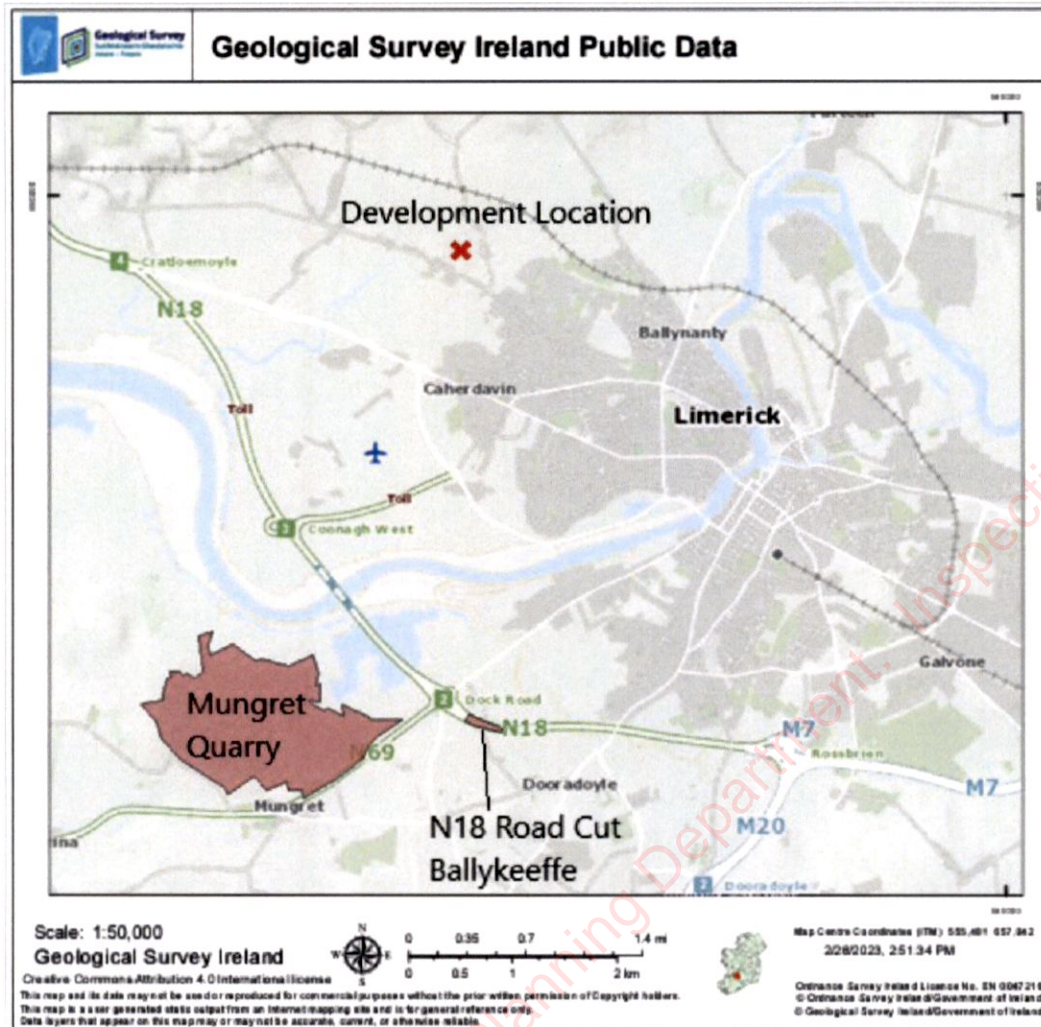


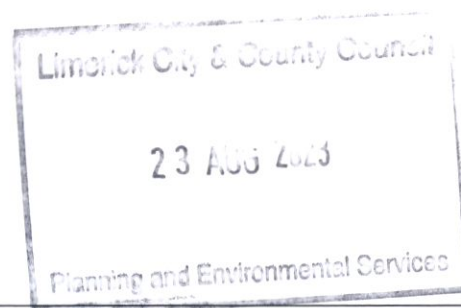
Figure 8.11 Areas of Geological Importance – [GSI Online Mapping]

### 8.3.9 Radon

EPA radon mapping (pre May 2022) shows a prediction of the number of homes in a given grid square that exceed the national Reference Level. Grid squares in which the predicted percentage of homes is 10% or greater are called High Radon Areas.

Between one and five per cent of the homes in this 10km grid square are estimated to be above the Reference Level

The EPA has issued specific guidelines with respect to underground residential and commercial developments. In relation to the proposed development, following construction the risk of radon impact is considered to be negligible.





### 8.3.10 Quarries

There are no quarries in the close vicinity of the study area. The nearest quarry is the Bobby O'Connell and Sons Ltd. Crushed Rock Operation at Ardnacrusha approx. 5km to the north of the study area.

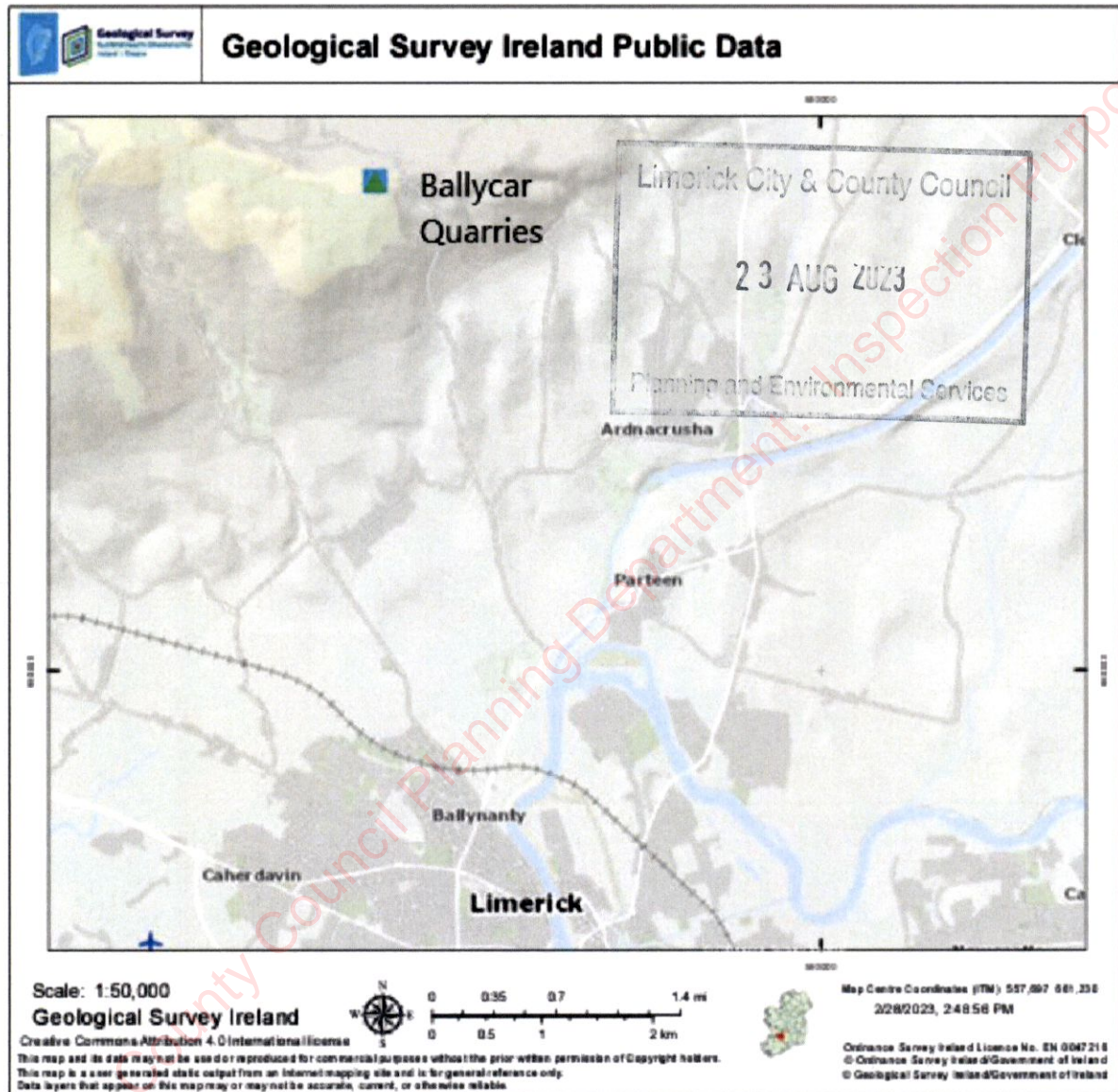


Figure 8.12 Active Quarries [GSI Online Mapping]

### 8.3.11 Potential Sources of Waste and Contamination

Potential sources of buried waste or contamination were identified and assessed. This report reviewed historical maps and historical activities that reportedly occurred across the site and identified a number of areas requiring further investigation/consideration. These included the following:

There is a historic quarry located within the lands. This was identified on the OSI 6" last edition map (1829-1841) and 25" map (1897-1913). The location of the quarry correlates with the historical SI which places rock at a shallow depth (TP02 suspected rock at 550mm deep, BH/RC01 rock confirmed at 400mm deep). The quarry does not show up on all historic maps, nor do any of the historical aerial



imagery show any suggestion of quarrying activity at this location. Based on this it can be assumed that the extent of quarrying activity was limited and unlikely to have resulted in large voids that required infilling.

Historic mapping has also shown a pump located within the development. There is no remnant of this well on site. If not appropriately sealed or backfilled, this well may provide a preferential vertical pathway of possible contaminants within the shallow subsoils to the underlying sand and should be appropriately identified and assessed during any redevelopment activities. There is also the potential for the backfilled material to contain contaminants.

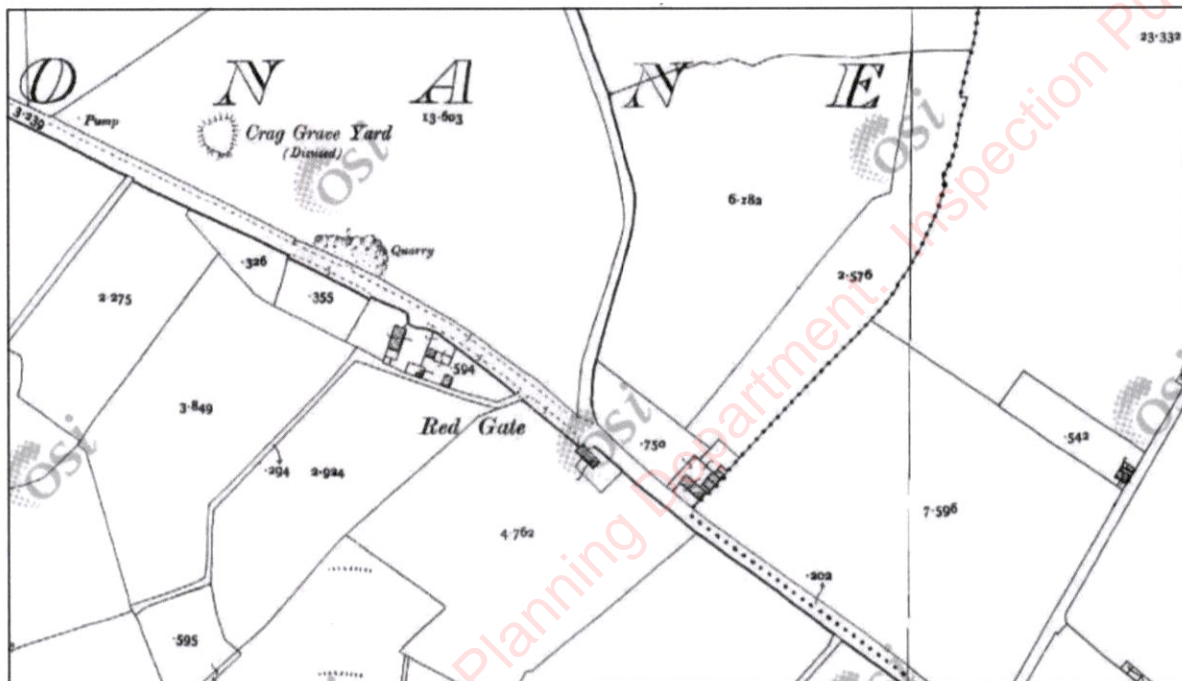


Figure 8.13 Historic Mapping [OSI Online Mapping – Licence CYAL50253692]

Historic aerial imagery of the site show an existing golf course extending across the entire development area. The development of this lands into a golf course may have involved digging pits for sand bunkers and filling grounds to suite golf course geometries. If any regrading was carried out this would typically not extend into subsoils, except for sand bunkers which would be localised pits. These lands have been subsequently farmed and as such the bunkers and greenways have been ploughed / infilled. Materials imported for the golf course would be limited to sand.

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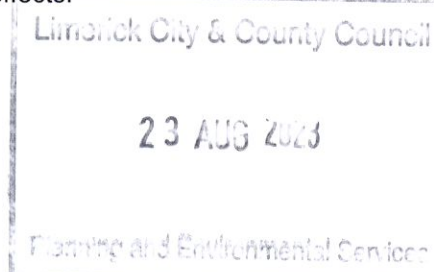


Figure 8.14 Historic Aerial Imagery [OSI Online Mapping – Licence CYAL50253692]

#### 8.4 DESCRIPTION OF EFFECTS

Seven different 'Delivery Phases' of development, as detailed in Chapter 1.0, are proposed to effectively deliver the overall indicative masterplan. This application relates to Phase 4 (54 no. units) as detailed in Chapter 1.0 and 2.0 of this EIAR. Whilst seven different phases are proposed at this point in time, the reality is that some of the phases could be fast-tracked such that two phases advance in construction together. This, however, is very much dependent on market conditions and the specific requirements of contractors. In any case, should different phases cumulatively progress together, the overall impacts are unlikely to be different.

In order to ensure an effective and conclusive environmental assessment consistent with best practise, the assessment of potential effects on the environment also examines the collective cumulative effects of the overall development if all seven development phases, as detailed in Chapter 1.0, were implemented. The examination of the 'all phase' development scenario is consistent with best practice in order to examine a 'worst-case' scenario of the project effects.





## 8.4.1 Construction Effects

No.	Construction Activity	Attribute	Character of Likely Impact
1.	Excavation Works	Bedrock	Within the development lands bedrock has been identified at shallow depths. This is particularly true along the route of the Old Cratloe Road where depths were confirmed by available site investigation information and a bedrock outcrop is identified within GSI mapping. In order to achieve finished levels and foundation depths, bedrock removal will be required. Therefore, groundworks will likely have an impact on the top of the bedrock within localised sections of the site especially where cut is required to achieve finished levels. The proposed development ie. house levels, road levels, drainage, etc. will naturally follow the existing contours. This will limit in so far as possible the extent of groundworks and bedrock excavation required.
		Site Subsoils	Extensive stripping and wide-scale excavation of soils and sub-soils to prepare and construct the development are proposed. Excavated soils suitable for re-use will be stockpiled on-site and used for backfilling or drainage purposes. This will reduce the total volume of imported material being brought onto site. It is anticipated that the impact on soils arising from the construction phase will be short-term and slight.  It is noted that the site would have been subject to regrading works during the construction of the golf course and subsequent farming practices.
		Groundwater	The removal of topsoil and localised excavations across the site will potentially increase the vulnerability of the underlying groundwater aquifer especially given the high level of bedrock present within the site which will be exposed during construction cut and fill works.
2.	Excavation Works leading to soil erosion	Site Subsoils	Earthworks and the removal of topsoil would expose subsoil layers to the effects of weathering and may result in the erosion of soil, particularly in times of adverse weather conditions.
3.	Construction works	Geomorphology	It is considered that the proposed construction works would have minor effects on the geomorphology of the area, as the development would not materially change the local slopes and topography.
4.	Fuel storage/usage on site Fuel storage/usage on site	Subsoils Future Site Users	Accidental spillage of contaminants during construction works may cause short to long term, moderate to significant impacts to subsoils and to future site users if not stored and used in an environmentally safe manner. This could have an impact on groundwater in particular due to the groundwater vulnerability status.
		Groundwater	
5.	Construction Traffic	Subsoils Future Site Users	There may be a risk of soil and groundwater pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles. This could
		Groundwater	



No.	Construction Activity	Attribute	Character of Likely Impact
			have an impact on groundwater in particular due to the groundwater vulnerability status.
6.	Contaminated land/buried waste undetected	Subsoils	Based on historic mapping there is evidence that some sections may comprise of made ground material, eg. Gold sand bunkers and quarry. Asbestos and other contaminants within the existing filled material must be considered a possibility however unlikely.
		Groundwater	Disturbance and release of potential pollutants within the subsurface during site works. This could have an impact on groundwater in particular due to the groundwater vulnerability status.
7.	Contaminated Infill	Subsoils Future Site Users	The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access roads may pose a risk to the surrounding subsoils and/or to future site user and may pose a risk to groundwater in particular due to the groundwater vulnerability status.
		Ground Water	The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access roads
8.	Waste Arisings	Subsoils	Waste material generated from construction activities may require disposal off-site if not suitable for reuse on site. Temporary storage on site may be required and impacts to exposed subsoils and groundwater from possible contaminated direct runoff during rainfall events may occur
		Groundwater	
9.	Vandalism	Subsoils Future Site Users	Pollution due to vandalism of stores or plant poses a risk to subsoils and groundwater, groundwater in particular due to the groundwater vulnerability status, and to future site users.
		Groundwater	
10.	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Subsoils	Road surface runoff and poorly designed drainage system being channelled to subsoils before infiltrating to groundwater can result in contamination of the surrounding subsoils.
		Groundwater	
11.	Concrete Wash Water	Groundwater	It is not anticipate that significant concrete wash water will be generated on site. However, inappropriate disposal or uncontrolled runoff of wash water from concrete trucks or wash down facilities has the potential to impact on the quality of the underlying aquifer.

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No.	Construction Activity	Attribute	Character of Likely Impact
12.	Excavation Dewatering Works	Groundwater	Given the high level of bedrock anticipated, the development site works and excavation proposals may intersect the underlying aquifer during the construction phase. Localised dewatering for local groundwater flow from is to be anticipated

#### 8.4.2 Operational Effects

No.	Activity	Attribute	Character of Potential Impact
1	Hydrocarbon laden surface water runoff from roads, car parks and general hardstanding	Subsoils Ground Water	Road surface runoff and poorly designed drainage system being channelled to subsoils before infiltrating to groundwater can result in contamination of the surrounding subsoils and groundwater.
2	Reduction in groundwater replenishment.	Groundwater	The total site area will be developed. There is significant green areas which will continue to percolate rainwater into the ground. Surface water drainage will be based on the principles of SUD's which promotes infiltration of groundwater into the soil without compromise of the underlying aquifer.

### 8.5 LIKELIHOOD OF SIGNIFICANT EFFECTS

#### 8.5.4 'Do-Nothing' Effects

If the proposed development did not proceed, based on existing site investigation data to-date, there would be no impact on the underlying soils or hydrogeology. It is envisaged that the land use would remain unchanged as a greenfield site for agricultural use.

#### 8.5.1 Construction Effects

No.	Construction Activity	Attribute	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
1.	Excavation Works	Bedrock	Medium	Small Adverse	Slight
2.	Excavation Works	Site Subsoils	Medium	Moderate Adverse	Moderate
3.	Excavation Works	Ground Water	Medium	Moderate Adverse	Moderate

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No.	Construction Activity	Attribute	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
4.	Excavation Works leading to soil erosion	Site Subsoils	Medium	Small Adverse	Slight
5.	Construction works	Geomorphology	Medium	Small Adverse	Slight
6.	Fuel storage/usage on site	Subsoils Future Site Users	Medium	Small Adverse	Slight
7.	Fuel storage/usage on site	Groundwater	Medium	Small Adverse	Slight
8.	Construction Traffic	Subsoils Future Site Users	Medium	Small Adverse	Slight
9.	Construction Traffic	Groundwater	Medium	Small Adverse	Slight
10.	Contaminated land/buried waste undetected	Subsoils	Medium	Small Adverse	Slight
11.	Contaminated land/buried waste undetected	Groundwater	Medium	Small Adverse	Slight
12.	Contaminated Infill	Subsoils Future Site Users	Medium	Moderate Adverse	Moderate
13.	Contaminated Infill	Groundwater	Medium	Moderate Adverse	Moderate
14.	Waste Arisings	Subsoils	Medium	Moderate Adverse	Moderate
15.	Waste Arisings	Groundwater	Medium	Moderate Adverse	Moderate
16.	Vandalism	Subsoils Future Site Users	Medium	Small Adverse	Slight
17.	Vandalism	Groundwater	Medium	Small Adverse	Slight
18.	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Subsoils	Medium	Small Adverse	Slight

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No.	Construction Activity	Attribute	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
19.	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Groundwater	Medium	Small Adverse	Slight
20.	Concrete Wash Water	Groundwater	Medium	Small Adverse	Slight
21.	Excavation Dewatering Works	Groundwater	Medium	Moderate Adverse	Moderate

### 8.5.2 Operational Effects

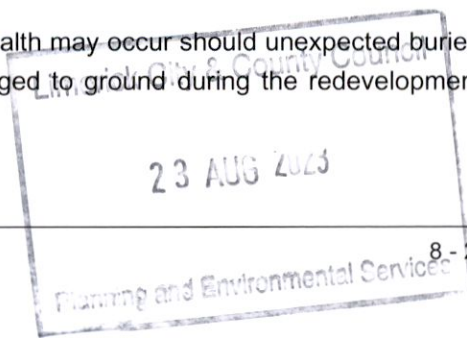
No.	Activity	Attribute	Importance of Attribute	Magnitude of Potential Impact	Significance of Potential Impact
1	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Subsoils	Medium	Small Adverse	Slight
2		Groundwater	Medium	Small Adverse	Slight
2	Reduction in groundwater replenishment	Groundwater	Medium	Small Adverse	Slight

### 8.5.3 Cumulative Effects

The proposed development comprises a phase of the overall development of the applicant's landholding at this location. An examination of the potential for other projects to contribute cumulatively to the impacts from the proposed development was undertaken during the preparation of this EIAR. The cumulative assessment has regard to the entirety of the masterplan site.

Given the scale of the proposed development and the capacity of the surrounding environment to accommodate a development of this nature and size, it is considered that the overall cumulative Masterplan development will have a slight and long term impact on the underlying land, soil, geology and hydrogeology, through the construction of additional buildings, infrastructure and hardstanding required for the development.

Potential impacts on subsoils, water sources and human health may occur should unexpected buried waste or contaminated material be encountered or discharged to ground during the redevelopment





works. However, provided sufficient mitigation measures are in place, as required under this EIAR, the overall impact on the site and regional geology will be slight to imperceptible.

The proposed development does need to be considered in conjunction with the works currently underway, delivering the proposed Coonagh to Knockalisheen Distributor Project. This infrastructure project secured consent from An Bord Pleanála in 2021 and was subject to the preparation of an EIAR and Environmental Impact Assessment. This new infrastructure will provide greater connectivity to existing services and facilities in the area.

## 8.6 REMEDIAL & MITIGATION MEASURES

### 8.6.1 Construction Phase

#### 8.6.1.1 Mitigation by Avoidance / Design

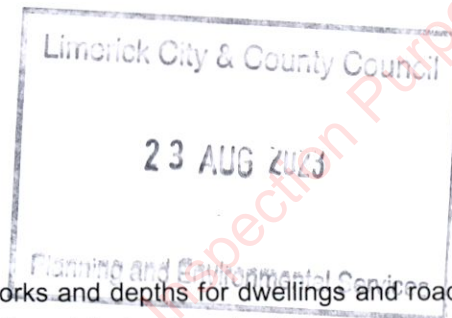
L & S CONST 1: Where feasible, the extent of excavation works and depths for dwellings and roads shall be limited through design to minimise disturbance of the original soil, subsoil formations and bedrock and to retain soil structure. This will also help to reduce the volumes of backfill and material to be removed off-site.

L & S CONST 2: Asbestos and other contaminants within any filled material must be considered a possibility. This should be investigated prior to the commencement of development works and suitable mitigation measures (including special environmental and human health contingency plans and procedures, following best-practice guidance) for the unexpected discovery of contaminated land or illegally deposited waste materials shall be developed and implemented as part of a detailed risk assessment under the direction of a contaminated land consultant / hydrogeologist.

L & S CONST 3: Detailed plans to deal with the possibility of encountering contaminated land / materials during construction shall be developed and included within an overall Construction Environmental Management Plan (CEMP) to be approved in advance of the commencement of development works by Limerick City and County Council. In the event that contamination is encountered, the approved plans shall be adhered to at all times by relevant contractors and subcontractors.

L & S CONST 4: Monitoring prior to, during and post construction works of groundwater quality shall be undertaken to ensure minimum disturbance of water quality in the general vicinity of the site. During the construction phase, the monitoring programme shall include daily checks, weekly inspections and monthly audits to ensure compliance with the Construction and Demolition Waste Management Plan (CDWMP) and the CEMP. This shall be undertaken in consultation with Limerick City and County Council

L & S CONST 5: All waste containers (including all ancillary equipment such as vent pipes and refueling hoses) shall be stored within a secondary containment system (e.g. a bund for static tanks or a drip tray for mobile stores and drums). The bunds shall be capable of storing 110% of the tank capacity. Where more than one tank is stored, the bund shall be capable of holding 110% of the largest tank or 25% of the aggregate capacity (whichever is greater). Drip trays used for drum storage shall be capable of holding at least 25% of the drum capacity. Where more than one drum is stored the drip tray shall be





capable of holding 25% of the aggregate capacity of the drums stored. Spill kits shall be kept in these areas in the event of spillages.

L & S CONST 6: All imported soils and stones shall be sourced from a licenced / permitted facility with suitable documentation to confirm the material is inert and fit for purpose.

#### 6.6.1.2 Mitigation by Prevention

L & S CONST 7: Suitable runoff and sediment control measures shall be designed and implemented prior to and during construction activities. These control measures depend upon weather conditions, site characteristics and construction activities and will ensure protection to the underlying subsoils and groundwater aquifer.

L & S CONST 8: Waste fuels and materials shall be stored in designated areas that are isolated from surface water drains or open waters (e.g. excavations). Skips shall be closed or covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. Hazardous wastes such as waste oil, chemicals and preservatives, shall be stored in sealed containers and kept separate from other waste materials while awaiting collection by a registered waste carrier. Fueling, lubrication and storage areas and site offices shall not be located within 25m of drainage ditches, surface waters or open excavations. Fuel Interceptor tanks shall be installed on the site to treat any runoff.

L & S CONST 9: All construction vehicles, plant and machinery shall be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected. Precautions shall be taken to avoid spillages, including:

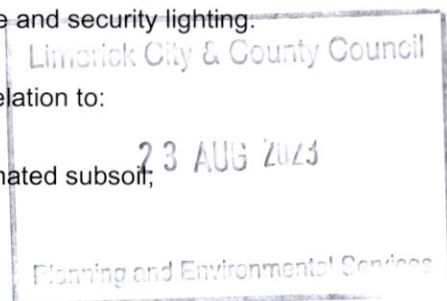
- Supervision of deliveries and refuelling activities;
- Use of secondary containment e.g. bunds around oil storage tanks;
- Use of drip trays around mobile plant; and
- Designating and using specific impermeable refuelling areas isolated from surface water drains.

L & S CONST 10: All potentially hazardous materials shall be securely stored on site.

L & S CONST 11: Adequate security measures shall be installed on the construction site. Early assessment of sensitivities and risks will assist in the design of the site layout and security measures required. Security measures shall include secure fencing, secure site access, securing plant and equipment, secure storage of materials, sufficient warning signage and security lighting.

L & S CONST 12: The construction phase shall be monitored in relation to:

- Prevention of oil and diesel spillages;
- Adequate runoff control of potential stockpiles of contaminated subsoil;
- Protection of topsoil stockpiled for re-use;
- cleanliness of the adjoining road network.



L & S CONST 13: Soils shall be reused on site where possible. Chemical analysis will be carried out to assess whether the backfill material is inert or presents a risk to human and / or environmental receptors. Suitable soil disposal routes and waste soil receiving facilities shall be determined and incorporated into the Construction & Demolition Waste Management Plan (C&DWMP) for the works.



L & S CONST 14: Excavated materials shall be visually assessed for signs of contamination. Should material appear to be contaminated or potentially contaminated, samples shall be analysed by an appropriate testing laboratory. Contaminated material shall be treated in accordance with the Waste Management Regulations. All excess fill and material considered unacceptable for reuse on site in terms of the residual risk posed to human health and to the environment shall be appropriately disposed of in accordance with the Waste Management Regulations.

#### 8.6.1.3 Mitigation by Reduction

L & S CONST 15: Surplus subsoil arisings caused by excavations for foundations, roads and drainage shall be minimised and where necessary, stockpiled and taken off-site to a licensed landfill facility. Any topsoil that is removed shall be used for re-grading at a later stage.

L & S CONST 16: Top-soiling and landscaping of the works shall be undertaken as soon as finished levels are achieved, in order to reduce weathering and erosion and to retain soil properties. Existing topsoil shall be retained on site to be used for the proposed development

L & S CONST 17: Reusable excavated gravels, sands or rock shall be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material.

L & S CONST 18: Wheel wash facilities shall be provided close to the site entrance to reduce the deposition of mud, soils and other substances on the surrounding road network.

#### 8.6.2 Operational Phase

##### 8.6.2.1 Mitigation by Avoidance / Design

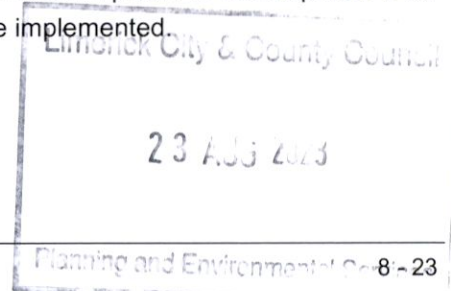
L & S OPER 1: An appropriately designed drainage system has been incorporated into the design of the proposed development. The system has been designed in accordance with the Greater Dublin Strategic Drainage Study (GSDSDS), the CIRIA SUDS Manual 2015 and Recommendations for Site Development Works for Housing Areas published by the Department of the Environment and Local Government. It involves ensuring that suitable protection measures of runoff infiltration to ground including permeable paving, gullies and catch pits, lined attenuation structures and oil-water interceptors are provided. The design takes into consideration the groundwater vulnerability rating and all surface water SUDS features within 1m of the bedrock will be wrapped with impermeable geotextile to prevent potentially contaminated water entering the aquifer.

##### 8.6.2.2 Mitigation by Prevention

No mitigation measures are considered necessary during the operational phase of development if all mitigation measures listed within Section 8.6.1 of this Chapter are implemented.

##### 8.6.2.3 Mitigation by Reduction

No mitigation measures are considered necessary during the operational phase of development if all mitigation measures listed within Section 8.6.1 of this Chapter are implemented.





**8.7 RESIDUAL EFFECTS****8.7.1 Construction Phase**

No.	Construction Activity	Attribute	Significance of Potential Impact Prior to Mitigation	Significance of Potential Impact with Mitigation
1.	Excavation Works	Bedrock	Slight	Imperceptible
2.	Excavation Works	Site Subsoils	Moderate	Slight
3.	Excavation Works	Ground Water	Moderate	Slight
4.	Excavation Works leading to soil erosion	Site Subsoils	Slight	Imperceptible
5.	Construction works	Geomorphology	Slight	Imperceptible
6.	Fuel storage/usage on site	Subsoils Future Site Users	Slight	Imperceptible
7.	Fuel storage/usage on site	Groundwater	Slight	Imperceptible
8.	Construction Traffic	Subsoils Future Site Users	Slight	Imperceptible
9.	Construction Traffic	Groundwater	Slight	Imperceptible
10.	Contaminated land/buried waste undetected	Subsoils	Slight	Imperceptible
11.	Contaminated land/buried waste undetected	Groundwater	Slight	Imperceptible
12.	Contaminated Infill	Subsoils Future Site Users	Moderate	Slight
13.	Contaminated Infill	Groundwater	Moderate	Slight
14.	Waste Arisings	Subsoils	Moderate	Slight
15.	Waste Arisings	Groundwater	Moderate	Slight

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No.	Construction Activity	Attribute	Significance of Potential Impact Prior to Mitigation	Significance of Potential Impact with Mitigation
16.	Vandalism	Subsoils Future Site Users	Slight	Imperceptible
17.	Vandalism	Groundwater	Slight	Imperceptible
18.	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Subsoils	Slight	Imperceptible
19.	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Groundwater	Slight	Imperceptible
20.	Concrete Wash Water	Groundwater	Slight	Imperceptible
21.	Excavation Dewatering Works	Groundwater	Moderate	Slight

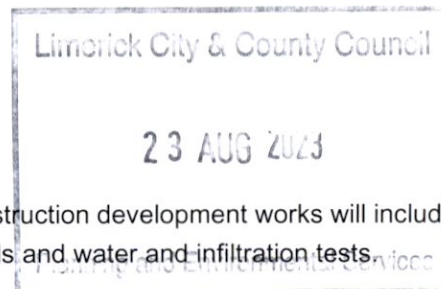
### 8.7.1 Operational Phase

No.	Operational Activity	Attribute	Significance of Potential Impact Prior to Mitigation	Significance of Potential Impact with Mitigation
1	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Subsoils	Slight	Slight
2		Groundwater	Slight	Slight
2	Reduction in groundwater replenishment	Groundwater	Slight	Slight

## 8.8 MONITORING

### 8.8.1 Construction Phase

Site investigations to be undertaken as part of the pre-construction development works will include trail holes, boreholes, core holes, contamination testing of spoils and water and infiltration tests.





Soil removed during the construction phase is to be monitored to maximise potential for re-use on site. Monitoring of any hazardous material stored on-site will form part of the proposed Construction & Waste Management Plan. A dust management/monitoring programme should be implemented during the construction phase of the development. The quantities of topsoil and subsoil removed off site will be recorded.

### 8.8.1 Operational Phase

The ongoing monitoring and maintenance of surface water treatment features such as petrol interceptors, gullies, and catch pit manholes

## 8.9 REFERENCES

TII Design Manual for Roads and Bridges

Radon Map of Ireland - <http://www.epa.ie/radiation/radonmap/>

Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 2009, EC DG XI Environment, Nuclear Safety & Civil Protection Ref: NE80328/D1/3

Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002),

Geology in Environmental Impact Statements a Guide, (IGI, 2002),

Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA Document.

Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013),

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