

**Homeland Projects Ltd.**

# **Hydrological & Hydrogeological Assessment**

Caheranardrish, Mungret, Co. Limerick



**March 2026**

# Hydrological & Hydrogeological Assessment

Client: Homeland Projects Ltd.

Location: Caheranardrish, Mungret, Co. Limerick

Date: 19<sup>th</sup> March 2026

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## 1. INTRODUCTION

IE Consulting was requested by Homeland Projects Ltd. to undertake a hydrological and hydrogeological study for a proposed Large-scale Residential Development (LRD) at Caheranardrish, Mungret, Co. Limerick.

The study is required to investigate the risk that activities associated with the proposed development, during construction and operation might impact the nearby proposed Natural Heritage Area (pNHA) of Loughmore Turlough.

This report is based on a desk review of available information, a site visit to observe the proposed site setting, and juxtaposition with the Groundwater Dependent Terrestrial Ecosystem (GWDTE) of Loughmore Turlough, and an interpretation of the findings in the context of the potential for impact on the GWDTE.

The proposed development comprises:

- 180 no. residential dwellings as follows: 125 no. houses consisting of 24 no. 4-bed dwellings and 93 no. 3-bed dwellings; 16no. townhouses consisting of 10 no. 3-bed units and 6 no. 2-bed units; 2 no. triplex units each comprising of 2 no. 2-bed units and 1 no. 1-bed unit; and a five-storey apartment building consisting of 13 no. 2-bed units and 17 no. 1-bed units with a crèche with capacity to accommodate 58no. children at ground floor level.
- The provision for car parking, including EV charging points and bicycle parking.
- The provision of private, communal, and public open spaces; internal roads and pathways; pedestrian and cyclist routes; hard and soft landscaping and boundary treatments; waste storage; plant; signage; a new vehicular and pedestrian access onto the Mungret Park Road; public lighting; substations; all associated site development works; and all drainage and foul sewer infrastructure and network works including a pumping station and connections to the existing networks and nature-based suds measures.
- Access to the proposed development via a proposed vehicular and pedestrian access to the existing Mungret Link Road.

## **2. STATEMENT OF AUTHORITY**

IE Consulting is a Water and Environmental Consultancy based in Carlow.

This assessment / report has been prepared and reviewed by qualified professionals specialising in the fields of Hydrogeology, Hydrology, Geotechnics Flood risk, Drainage, wastewater, hydraulic modelling and SuDS design studies. The key staff members involved in this project are:

- Jerome Keohane – BSc, MSc, FCIWEM, MIEI, C.WEM, C. Geol Technical Director with 42 years' experience in ground engineering and hydrogeology.
- Maria Horstmann – BSc, MSc, Geographer, Hydrogeologist, specialised in hydraulic modelling, hydrology, biogeochemistry, hydropedology and ecology.

### 3. DESK STUDY

#### 3.1. Site Location

The proposed development site is located approximately 12 km south-west of Limerick city centre at Caheranardrish, Mungret, Co. Limerick. The site is bounded to the north, west, south, and east by adjacent agricultural lands and to the south-east by the Mungret Community College. It is accessible via the Mungret Park Road and the Mungret Link Road. The total area of the proposed development site is approximately 5.67 hectares.

Located approximately 440m to the south-east of the site is the Loughmore Common Turlough. Due to its significant hydrological and ecological importance within the wider area, the Turlough is given particular consideration throughout this assessment and is included in all figures.

The location of the proposed development site is illustrated below in *Figure 1*.

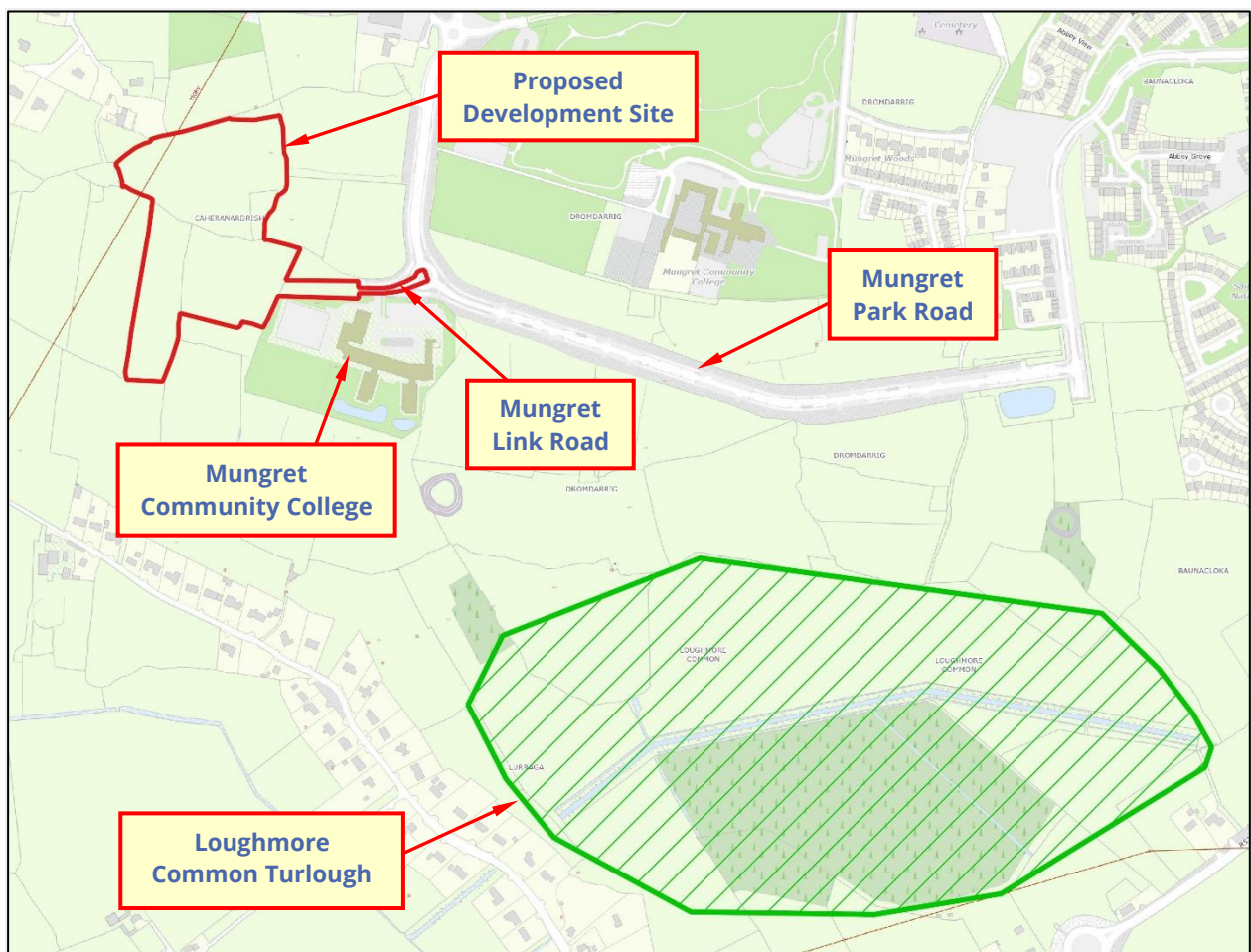


**Figure 1 – Site Location**

## 3.2. Topography

LiDAR data for the area was procured to inform the study.

The topography of the proposed development site is generally undulating and uneven, with a local high point located in the central northern part of the site and a saddle depression situated in the centre, immediately to the south of the high point. Existing ground elevations range from approximately 18.3 m OD in the northern part to approximately 13.7 m OD along the south-western boundary of the site. The proposed development site slopes from the local high point towards the boundaries of the site at an average gradient of approximately 1.3 % (1 in 75).

The topography of the proposed development site and the environs is illustrated below in *Figure 2*.

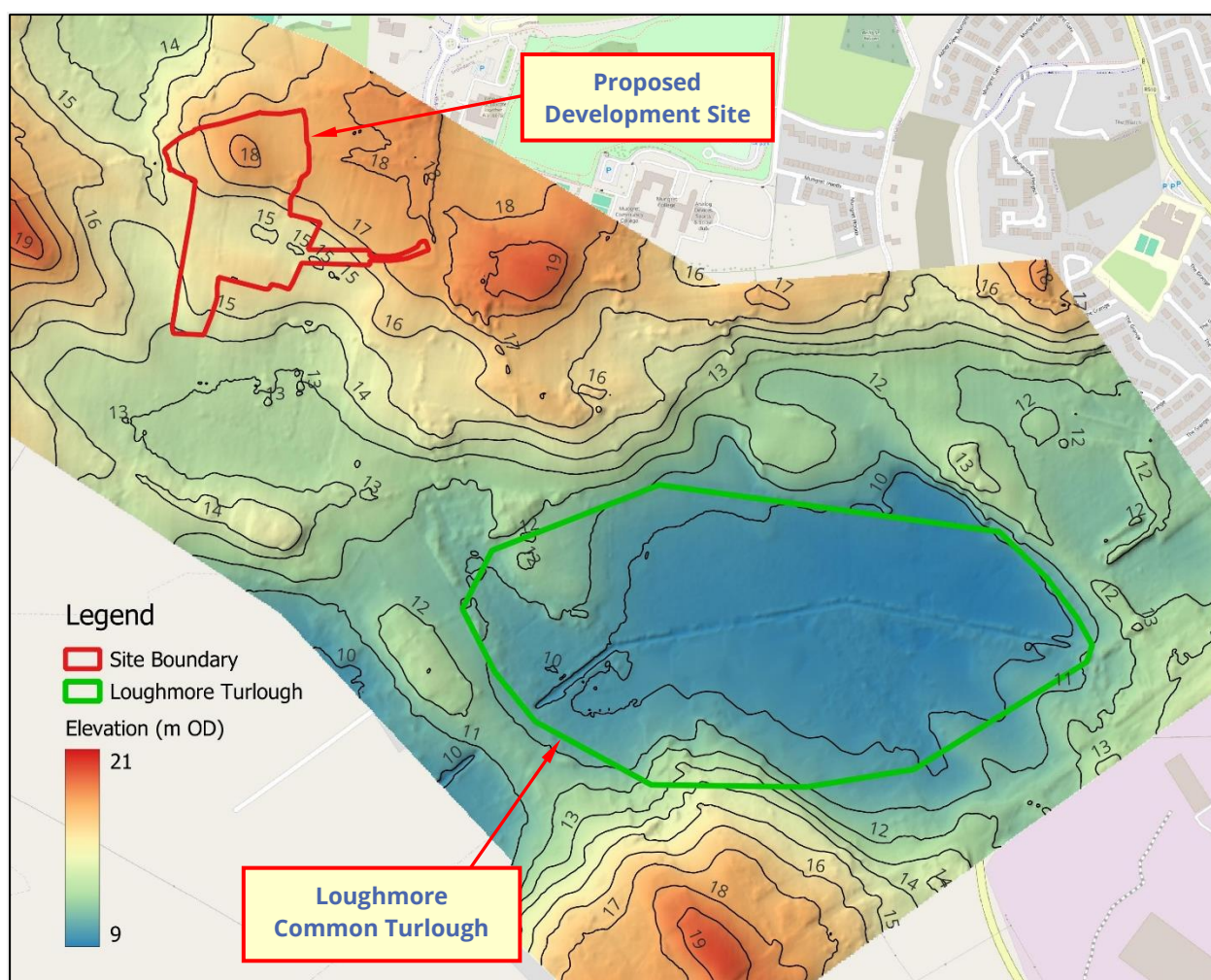


**Figure 2 – Site Topography**

### 3.3. Local Hydrology, Landuse & Existing Drainage

On the day of site survey and inspection (15<sup>th</sup> January 2026) the proposed development site appeared to be well-drained and free from any standing water. It was noted that soil infiltration tests had been conducted across the site, and site observations on the day confirmed the relative infiltration rates.

The infiltration tests were conducted by OSL-Butler in trial pits excavated to approximately 2m depth. The infiltration values were determined in accordance with BRE 365 and indicated  $f$  values in the range  $2 \times 10^{-5}$  m/s to  $8 \times 10^{-6}$  m/s, which demonstrate suitable ground for infiltration. The results are discussed in more detail in the Engineering Services Report-OSL-Butler 2025.

Important hydrological features in the vicinity of the proposed development site include the River Shannon and its tributaries, including the Ballincurra River, to the north and north-east of the site; Mungret Quarry, which is dewatered, the Barnakyle River to the west and the Loughmore Common Turlough with the Loughmore Canal south east of the site, as illustrated in *Figure 3* below.

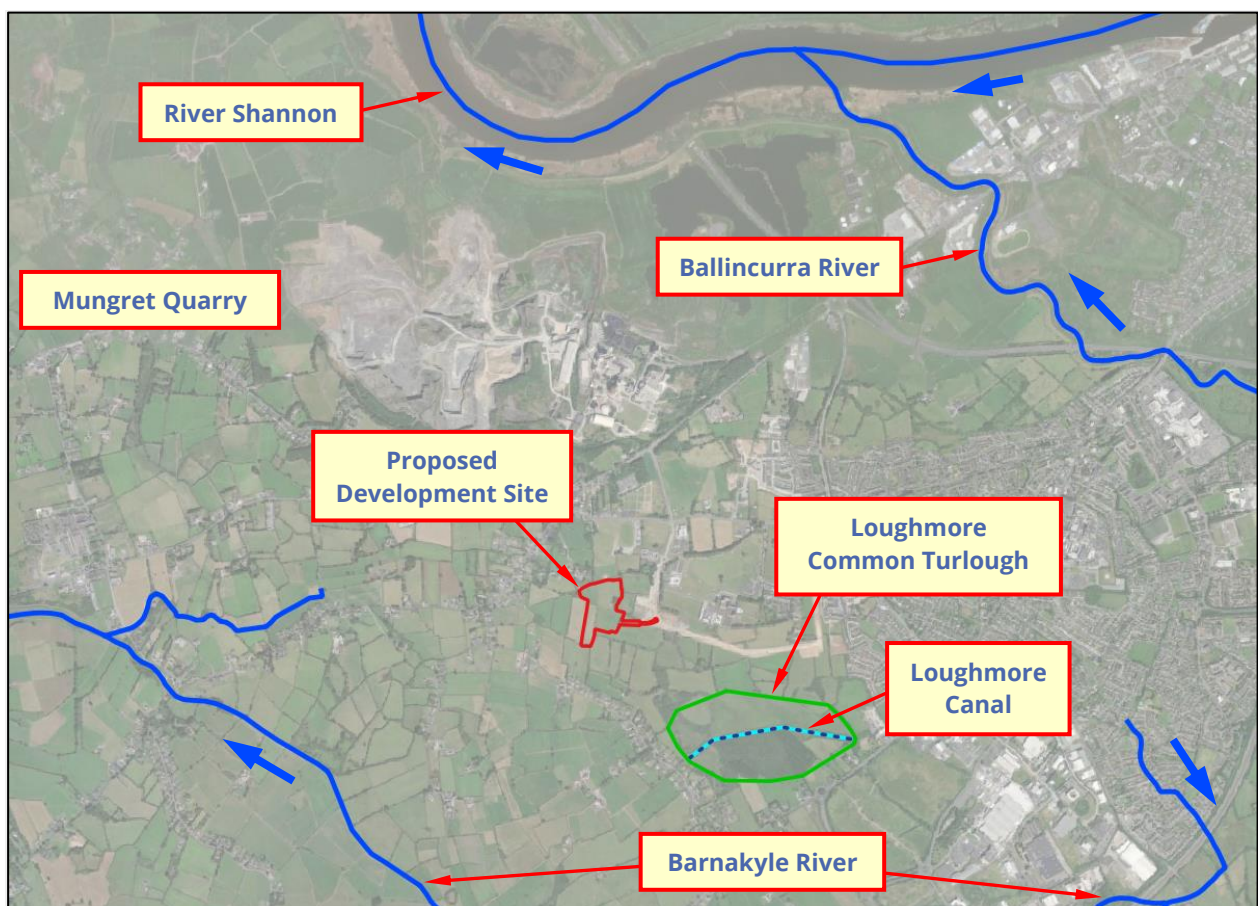


**Figure 3 – Local Hydrology**

An assessment of the existing landuse in the vicinity of the proposed development site indicates a predominantly rural area with some urbanised areas to the east (Raheen, suburb of Limerick) and to the north (Mungret village). Further to the north lies a cement factory with a quarry, which is owned by Irish Cement Ltd. The quarry is operating below sea-level facilitated by active dewatering, which will have created a cone of depression with groundwater flow to the north towards the quarry.

The Raheen Business Park in the south-east of the proposed development site comprises a series of commercial and industrial units.

### 3.3.1. River Shannon

The most significant hydrological feature in the vicinity of the proposed development site is the River Shannon which is located approximately 2.3 km beyond the northern boundary of the site. At this location the River Shannon generally flows in an east to west direction. The proposed development site is indicated within the catchment of the main River Shannon.

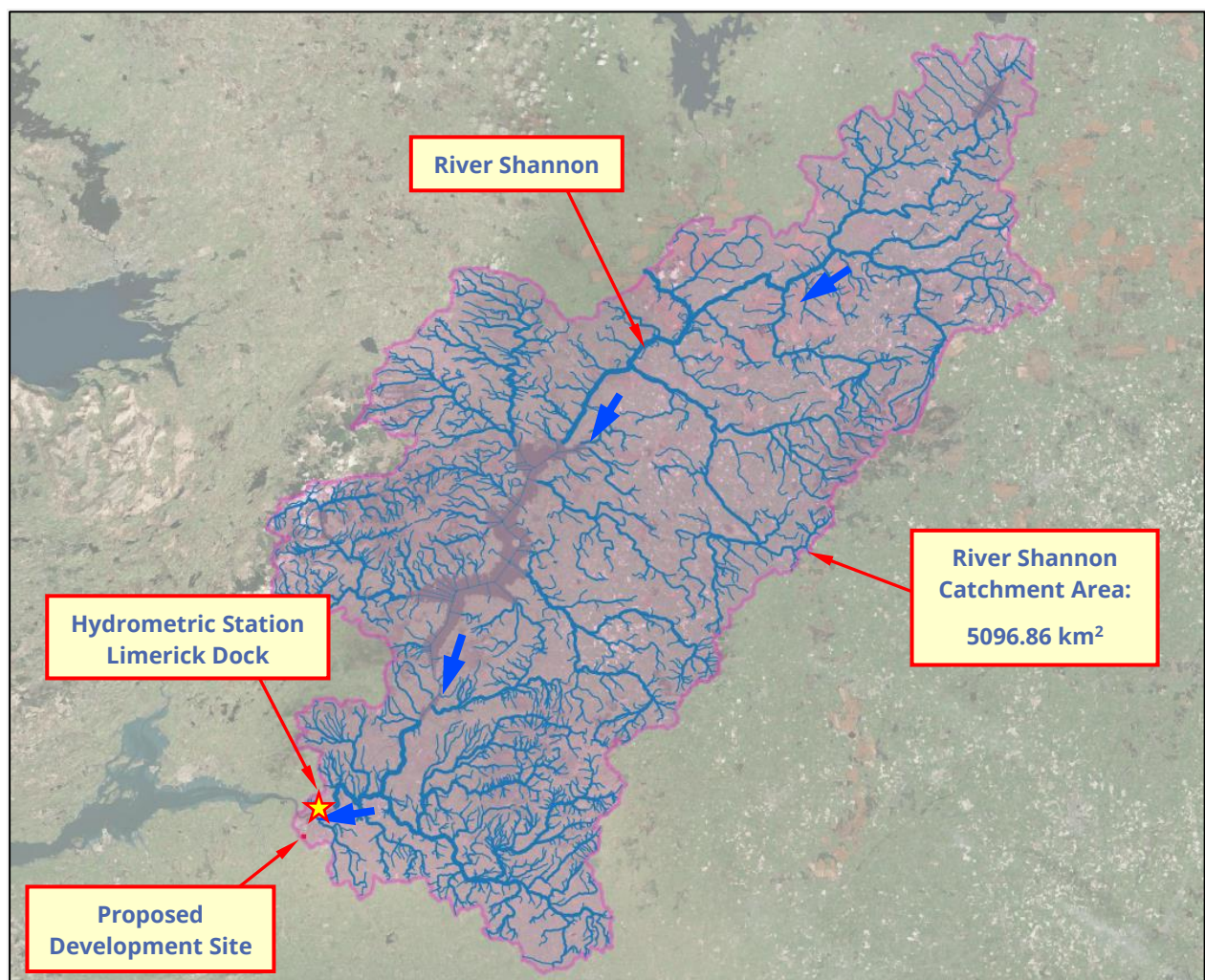


Figure 4 – River Shannon Catchment Area

Utilising the OPW FSU web portal and purchased topography, the catchment area of the River Shannon, to a point downstream of the proposed development site, was delineated and found to be approximately 5096.86 km<sup>2</sup> as illustrated in *Figure 4* above. With a catchment of this size, it can be assumed that flow rates are considerably high and that the River Shannon will receive groundwater as baseflow and will control local groundwater levels. Water levels at the nearby upstream OPW hydrometric gauging station Limerick Dock (station number: 24063) show a tidal influence with daily fluctuations in water levels of several meters.<sup>1</sup> The flow rates of the River Shannon are not measured at this station.

### 3.3.2. Loughmore Common Turlough

The closest hydrological feature in the vicinity of the proposed development site is the Loughmore Common Turlough which is located approximately 440m to the south-east of the site, as illustrated in *Figure 5* below.

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<sup>1</sup> <https://waterlevel.ie/hydro-data/#/overview/Waterlevel/station/197286/Limerick%20Dock/stationInfo>

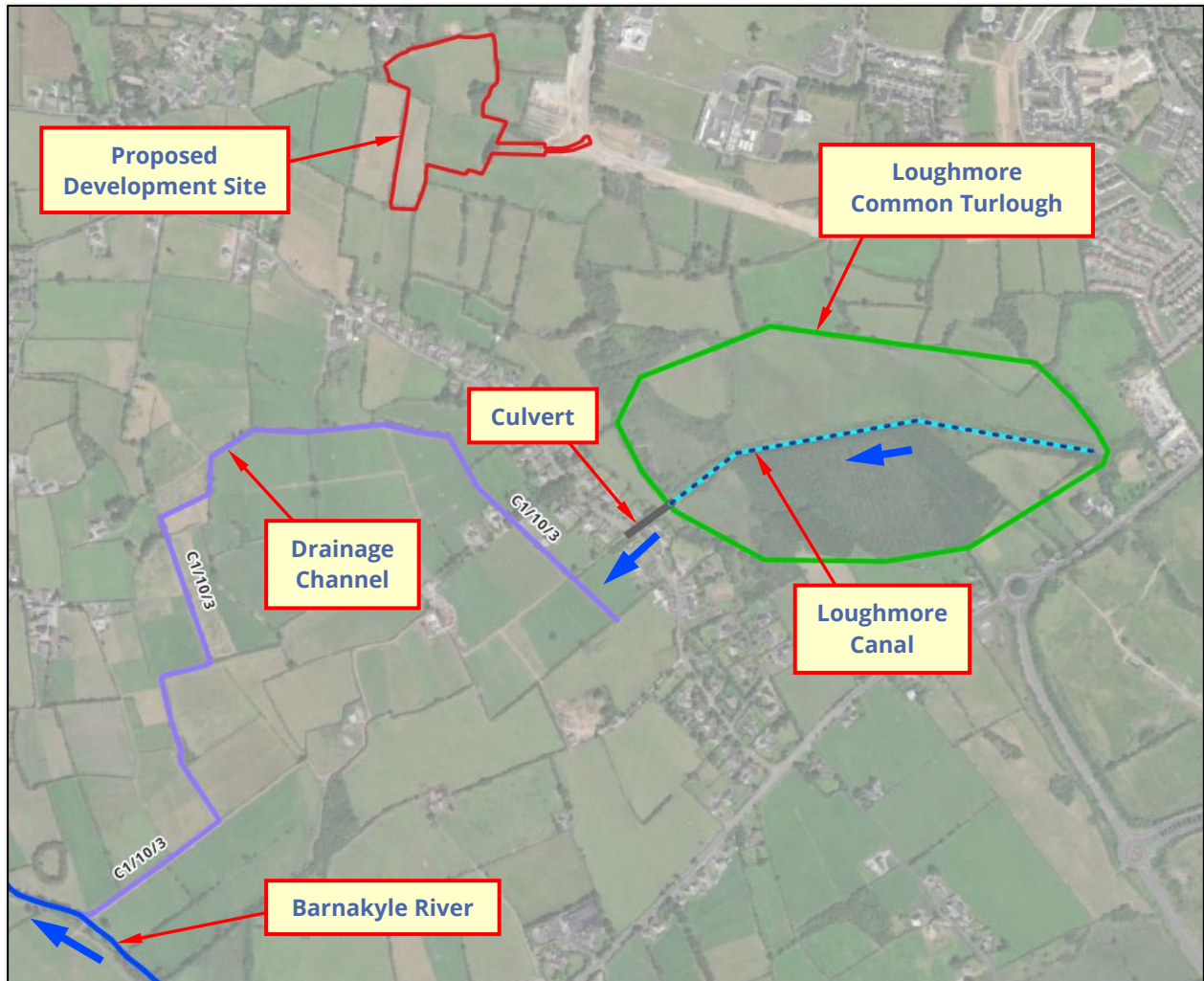


**Figure 5 – Loughmore Common Turlough**

A turlough is a Karst feature that is commonly found in limestone landscapes in western Ireland. Turloughs are intermittent waterbodies that occur in topographic depressions and recharge because of high rainfall and accordingly high groundwater tables. These ephemeral lakes often form during the winter months and can then dry up during drier periods in the summer. Due to their complex interaction between groundwater and surface water, turloughs have unique hydrological and ecological characteristics and are very sensitive to local changes of the water cycle and to pollution.<sup>2</sup>

The Loughmore Common Turlough is a proposed Natural Heritage Area (pNHA).

Previous studies have identified karst springs, which feed groundwater into the turlough, during high watertable periods.

<sup>2</sup> Waldren, S. (2015): Turlough Hydrology Ecology and Conservation.

Utilising the OPW FSU web portal and purchased topographic LiDAR data, the local topographic setting of Loughmore Common Turlough was reviewed to identify potential contributing surface water flow paths.

Based on this assessment, the contributing surface runoff area to the Turlough is estimated to be relatively small, with an estimated extent of approximately 1.5 km<sup>2</sup>. *Figure 6a* and *Figure 6b* present the site topography with indicative surface runoff directions, highlighting that there is a possibility of surface water drainage from the southern portion of the undeveloped proposed development site towards the Loughmore Common Turlough (about 0.1% of the total catchment). However, the quantity of overland flow from this area will be small and will possibly be intercepted along the flowpaths, before reaching the Turlough.

The modifications to drainage patterns will not negatively impact surface water quantity to the wetland, and will safeguard the turlough, from any accidental spillages, that might occur during the operational period of the development.

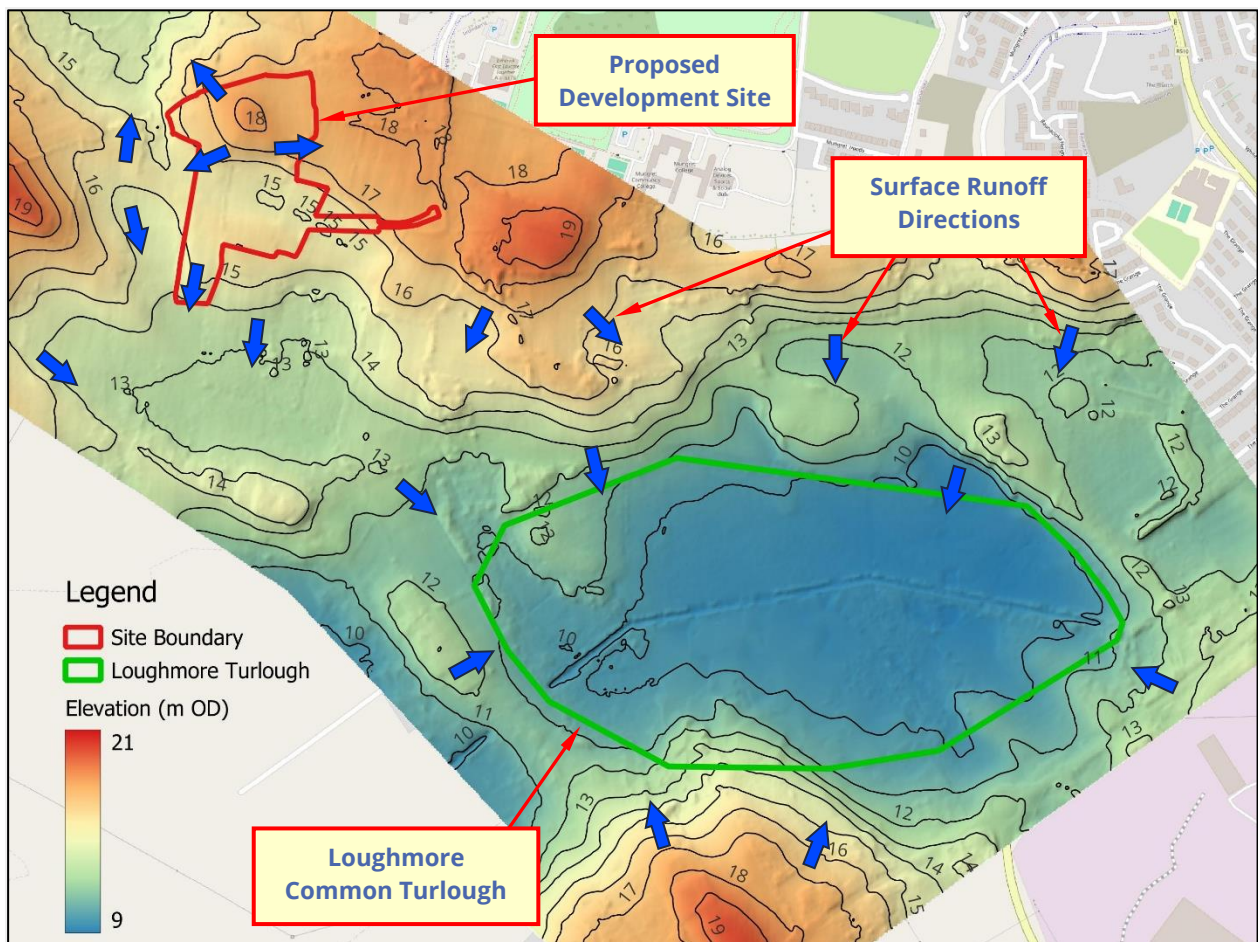


**Figure 6a – Loughmore Common Turlough Contributing Surface Runoff Area**

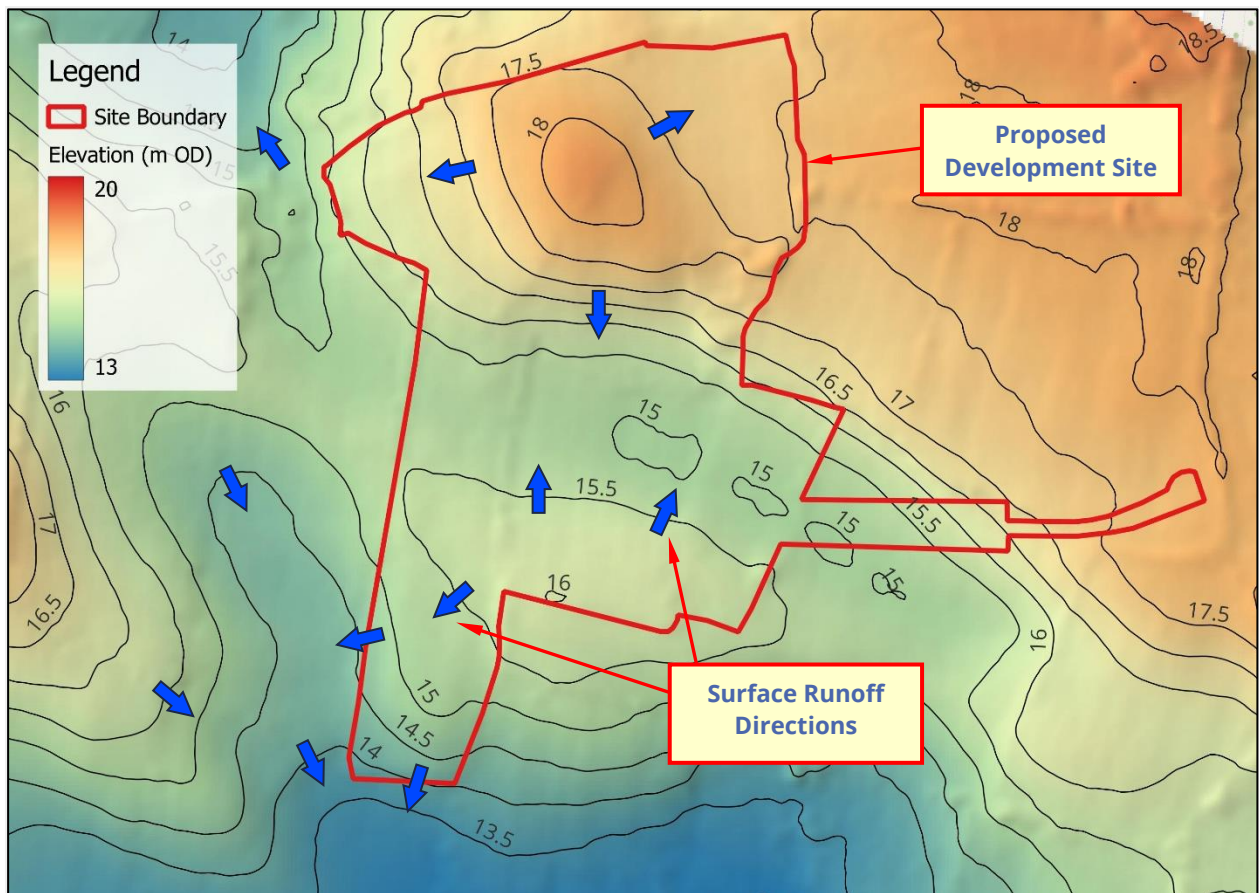


**Figure 6b – Site Topography & Indicative Surface Runoff Directions**

The turlough is crossed from east to west by the Loughmore Canal. The Loughmore Canal is a man-made drainage feature discharging into a drainage channel (reference: C1/10/3) and agricultural lands to the west via a long concrete triple-cell box culvert, as illustrated in *Figure 7* below. The Loughmore Canal receives run-off from some adjacent housing and commercial developments.

The canal is unlined and so is expected to be in hydraulic continuity with the wider Loughmore Common Turlough. This means that waters in the wider turlough area may also drain towards the canal, thus impacting the quantity of water in the turlough feature.

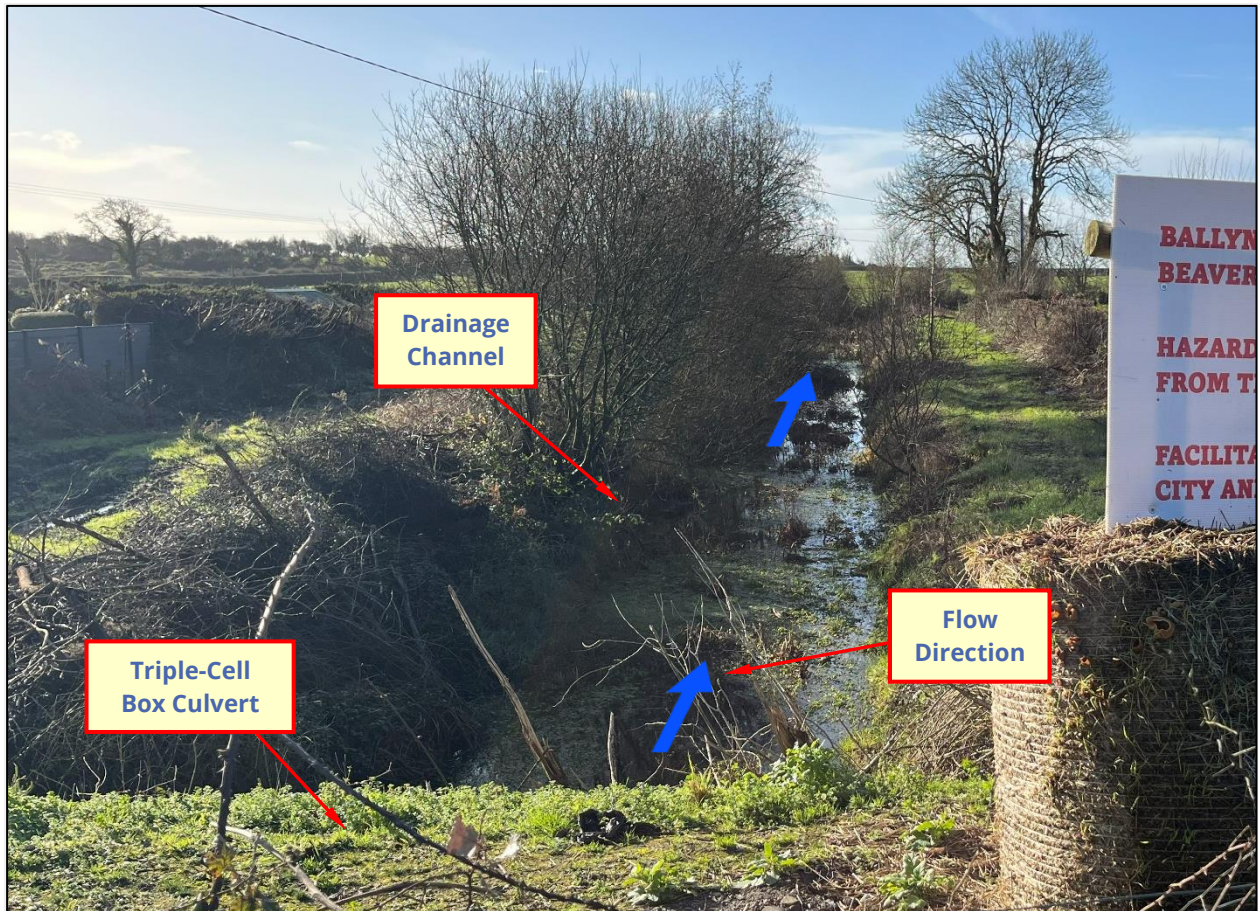


**Figure 7 – Location of Culvert**

The drainage channel is directly connected to the Barnakyle River, which discharges further downstream into the River Shannon.

There will be no direct discharge from the proposed development site to the Loughmore Canal. Currently there may be some run-off from a small portion of the southern section of the site from in the direction of the Turlough. Development of the site will intercept 60% of the current run-off on whole the site and divert it towards infiltration.

### 3.4. Soils

The national datasets on soils produced by the Environmental Protection Agency (EPA) and the Geological Survey of Ireland (GSI) were consulted to assess the type, distribution and extent of soil layers in the vicinity of the proposed development site.

*Figure 8* below illustrates the mapped soil types for the general area of the site.

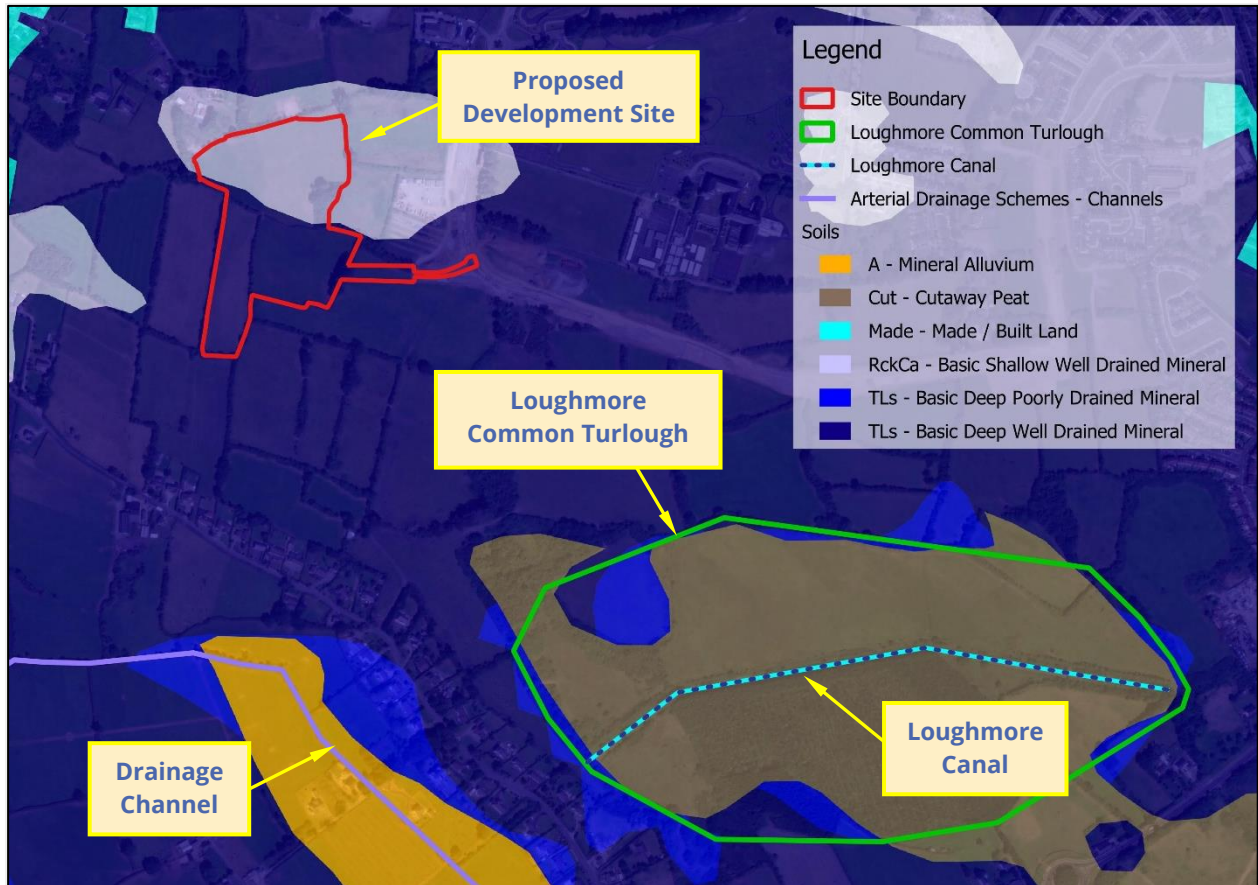


**Figure 8 – Soils**

The mapping indicates that the proposed development site is underlain by basic deep well drained mineral soils (dark blue) in the south and shows exposed bedrock at the surface (purple) in the north of the site.

The mapping indicates that Loughmore Common Turlough is almost entirely underlain by cutaway peat (brown) and smaller areas of basic deep poorly drained mineral soils (blue) and basic deep well drained mineral soils (dark blue). Peat soils are organic soils formed under high water saturation conditions, where the rate of organic matter accumulation exceeds the rate of decomposition. As a result, peat soils are characterised by a very high organic matter content, high porosity (high water storage capacity), and low oxygen availability. Consequently, peat soils and subsoils often support shallow or perched water tables and respond rapidly to rainfall events once saturated.<sup>3</sup> Cutaway peat indicates a history of peat extraction. This will have modified the original character of the site, as will the growth of forestry on the site.

<sup>3</sup> Price, J. S., McCarter, C. P. R. & Quinton, W. L. (2023): Groundwater in Peat and Peatlands.

The wider area surrounding the proposed development site is dominated by well drained mineral soils, with limited occurrences of alluvium soils (orange) and man-made ground (light blue). Mineral soils are soil types in which mineral particles (sand, silt, and clay derived from the weathered rock underneath) dominate, as opposed to peat soils, which are organic in origin.

### 3.5. Subsoils

The national datasets on subsoils produced by the Environmental Protection Agency (EPA) and the Geological Survey of Ireland (GSI) were consulted to assess the type, distribution and extent of subsoil layers in the vicinity of the proposed development site.

Figure 9 below illustrates the mapped subsoil types for the general area of the site.

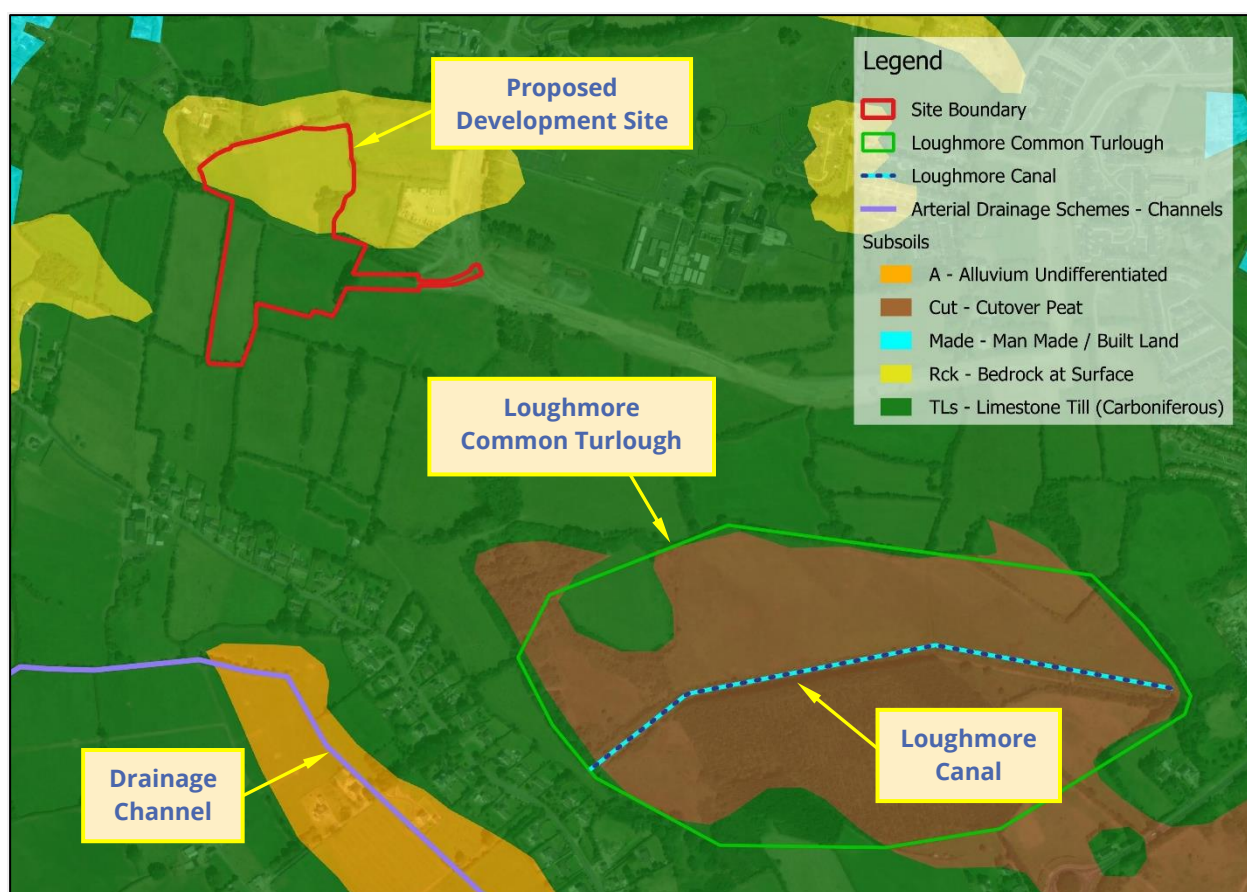


**Figure 9 – Subsoils**

The mapping indicates that the proposed development site is underlain by limestone tills (green) in the south and shows exposed bedrock at the surface (yellow) in the north of the proposed development site. Limestone tills are glacial deposits derived from Carboniferous limestone bedrock. These tills typically show a mixed matrix of fine and coarse materials and are generally associated

with limited drainage when compared to more permeable granular deposits. Their presence in the wider area indicates that subsurface conditions are likely to be characterised by moderate permeability. Small areas of exposed bedrock indicate locations where subsoil cover is thin or absent. The mapping indicates that Loughmore Common Turlough is almost entirely underlain by cutover peat (brown). There may however be a thin layer of till underlying the peat.

The wider area surrounding the proposed development site is dominated by limestone tills, with limited occurrences of alluvium subsoils (orange) and man-made ground (light blue).

### 3.6. Geology

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, extent and age of bedrock geology in the vicinity of the proposed development site.

Figure 10 below illustrates the mapped bedrock geology for the general area of the site.

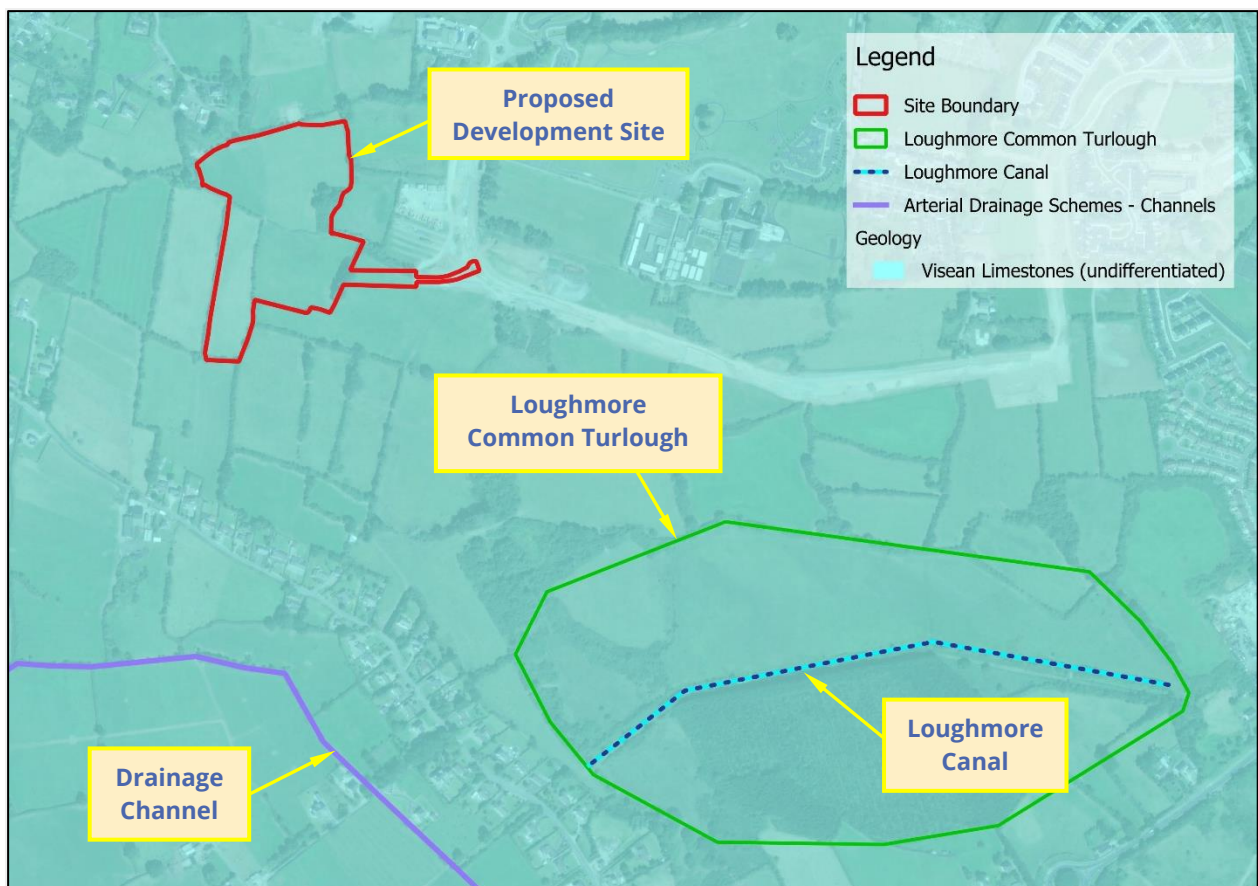


**Figure 10 – Geology**

The mapping indicates that all bedrock units in the area are of Carboniferous age (approximately 359–299 million years ago), more specifically assigned to the Mississippian (Early Carboniferous). During that period, much of Ireland was covered by shallow tropical seas, resulting in the deposition of fossil-rich limestone. The proposed development site and Loughmore Common Turlough is entirely underlain by Viséan undifferentiated limestones (light blue).

### 3.7. Baseline Groundwater Conditions

#### 3.7.1. Bedrock Aquifer

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, distribution and extent of bedrock aquifers in the vicinity of the proposed development site.

Figure 11 below illustrates the mapped bedrock aquifer for the general area of the site.

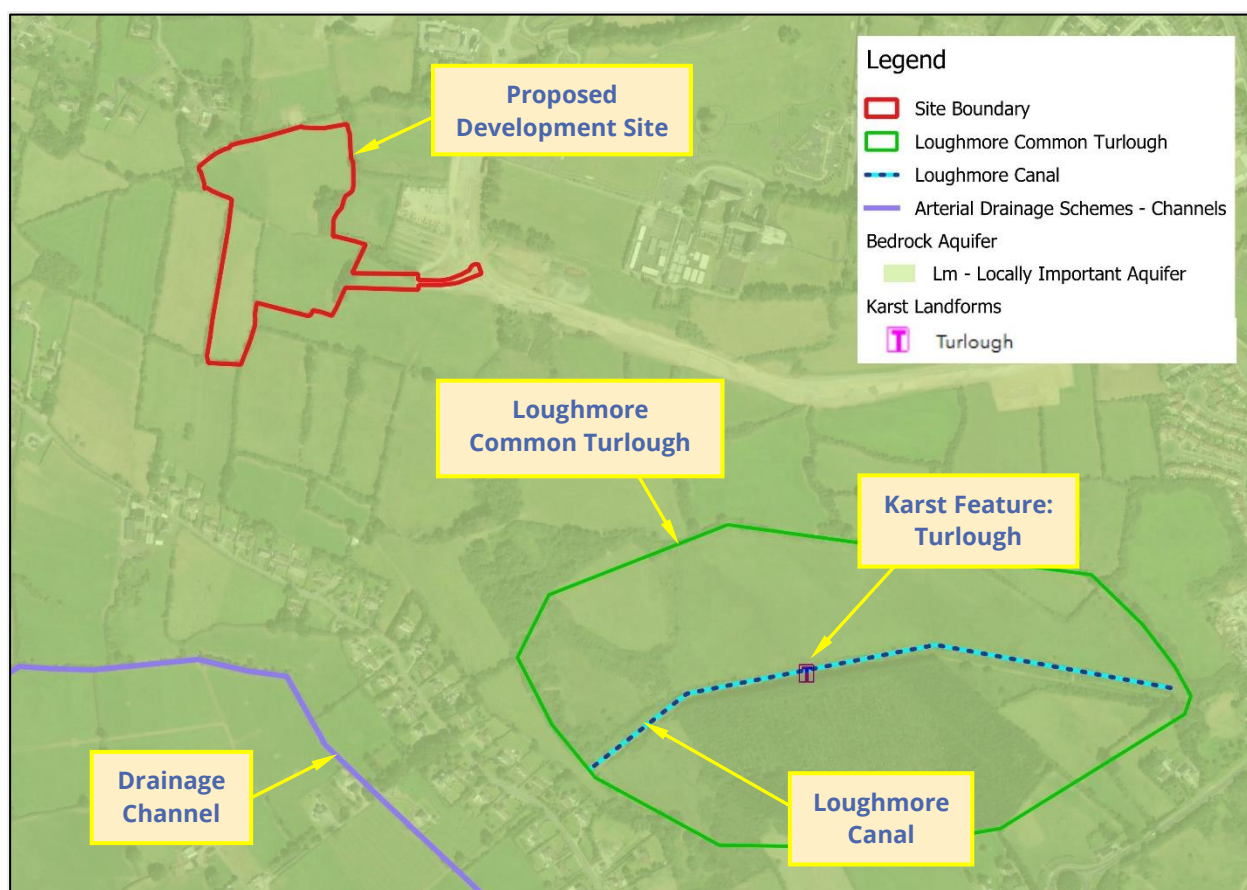


Figure 11 – Bedrock Aquifer

The entire area is underlain by a Locally Important **Lm** Aquifer, classified by the GSI as a bedrock which is “generally moderately productive”. Groundwater flow within this limestone aquifer occurs predominantly through fractures, joints, and locally developed karst features within the limestone bedrock.

Previous studies have identified karst features within the Turlough, which may act as springs during high water table periods and may act as sinks during low water table periods.

The general absence of other mapped karst features is related to the cover of subsoil over the bedrock. However, the epi-karst or original bedrock surface would have been typically uneven with depressions created by karst dissolution.

### 3.7.2. Subsoil Permeability

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, distribution and extent of subsoil permeability in the vicinity of the proposed development site.

Figure 12 below illustrates the mapped subsoil permeability for the general area of the site.

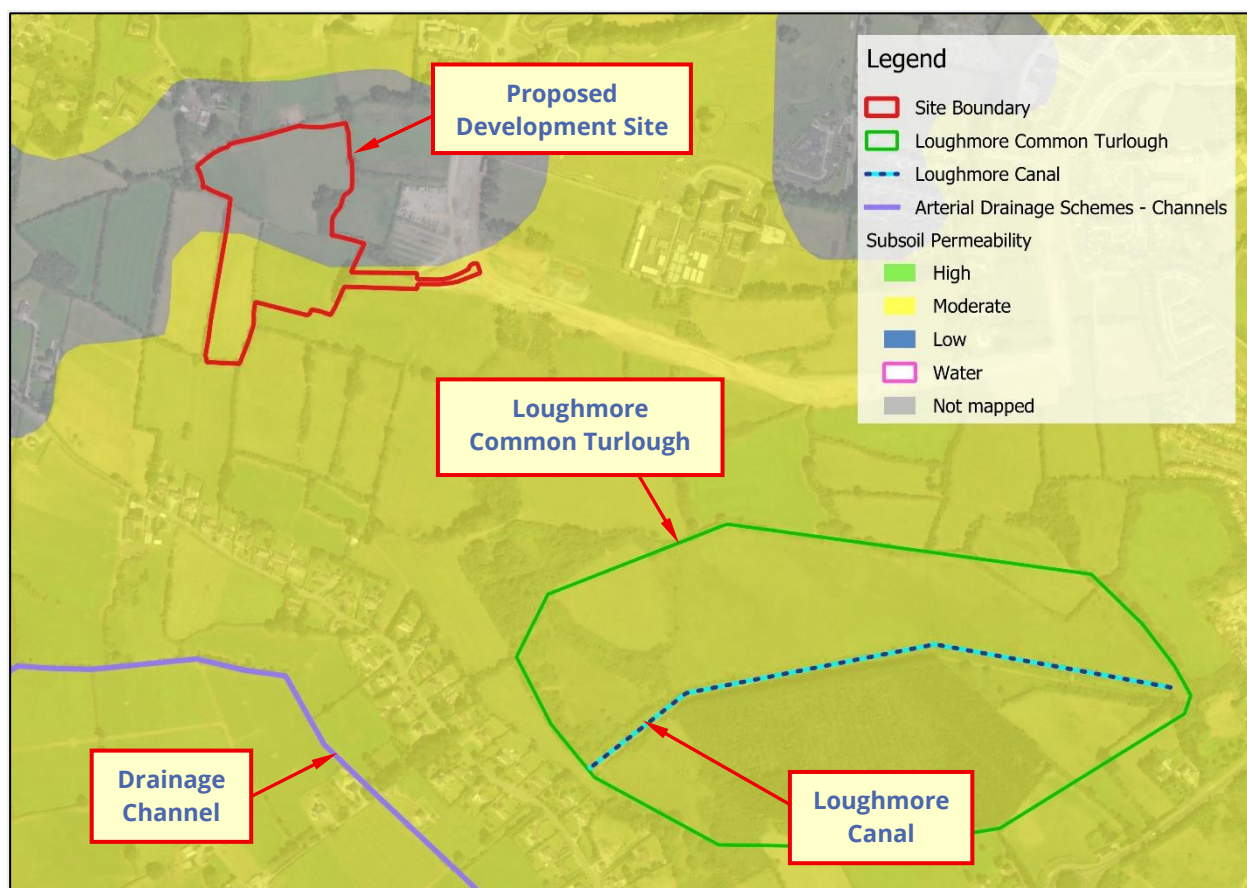


**Figure 12 – Subsoil Permeability**

The mapping indicates that the subsoil permeability in the south of the proposed development site, of Loughmore Common Turlough and of the wider area is **moderate** (yellow). The north of the site is not mapped (grey).

### 3.7.3. Groundwater Recharge

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the amount of groundwater recharge in the vicinity of the proposed development site.

Figure 13 below illustrates the mapped groundwater recharge for the general area of the site.

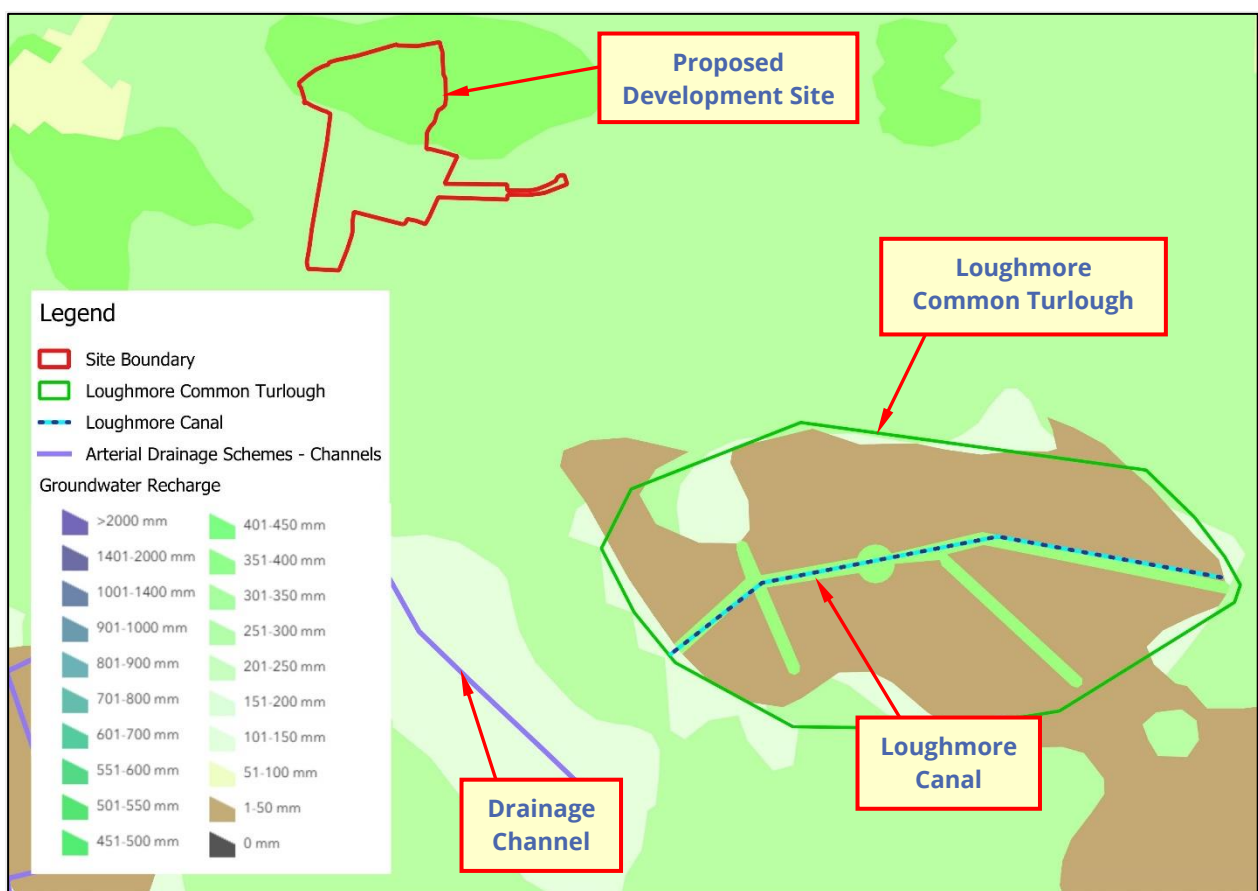


**Figure 13 – Groundwater Recharge**

The mapping indicates a high spatial variability in groundwater recharge across the area.

Average annual recharge rates are generally moderate, ranging from approximately 401–450 mm/yr in the northern part of the proposed development site to 251–300 mm/yr in the southern part. The effective rainfall at this location, defined as the proportion of total rainfall available for infiltration after evapotranspiration losses, is estimated at 488.9 mm/yr. Variations in groundwater recharge across the site are primarily controlled by different recharge coefficients, which are approximately

85% in the northern part of the proposed development site and 60% in the southern part. These coefficients determine the proportion of effective rainfall that contributes to groundwater recharge and explain the observed differences in average annual recharge rates between the northern and southern areas of the site. The GSI mapping further indicates that soils at the site are classified as well drained, which is consistent with the moderate recharge potential identified for the area.

The area of cutaway peat around Loughmore Common Turlough shows lower average annual recharge rates, which are generally moderate, in the range of approximately 1–50 mm/yr. Effective rainfall at this location is estimated at 454.8 mm/yr. However, the recharge coefficient is relatively low, at approximately 10%, explaining the reduced average annual recharge rates. The GSI mapping further indicates that soils at Loughmore Common Turlough are classified as poorly drained. This reflects the presence of peat and seasonally waterlogged surface conditions associated with the Turlough system, where groundwater levels frequently rise to or above ground level.

### 3.7.4. Groundwater Flow Direction

The main groundwater flow direction will be from south to north towards the River Shannon. The active dewatering in Mungret Quarry will create an increased groundwater gradient, which means that the groundwater velocity to the north, will be greater. The site is shown on Figure 14 below showing the locations of Loughmore Turlough, the groundwater flow direction and the Quarry. As can be seen the site is downgradient of the Turlough and upgradient of the quarry, meaning there will be no groundwater flow from the proposed development site to the south.



**Figure 14 – Groundwater Flow direction**

### 3.7.5. Groundwater Vulnerability

The national dataset on geology produced by the Geological Survey of Ireland (GSI) was consulted to assess the type, distribution and extent of groundwater vulnerability in the vicinity of the proposed development site.

Figure below illustrates the mapped groundwater vulnerability for the general area of the site.

The mapping shows that areas of bedrock outcrop in the northern part of the proposed development site as well as the channel of the Loughmore Canal are classified as having Extreme Groundwater Vulnerability, reflecting the absence or very limited thickness of protective subsoil cover in these locations. The remaining part of the proposed development site, together with Loughmore Common Turlough and the surrounding area, is classified as having High Groundwater Vulnerability, which suggests 3-5 m of subsoil over rock. This relatively thin subsoil layer provides only limited attenuation of potential contaminants.

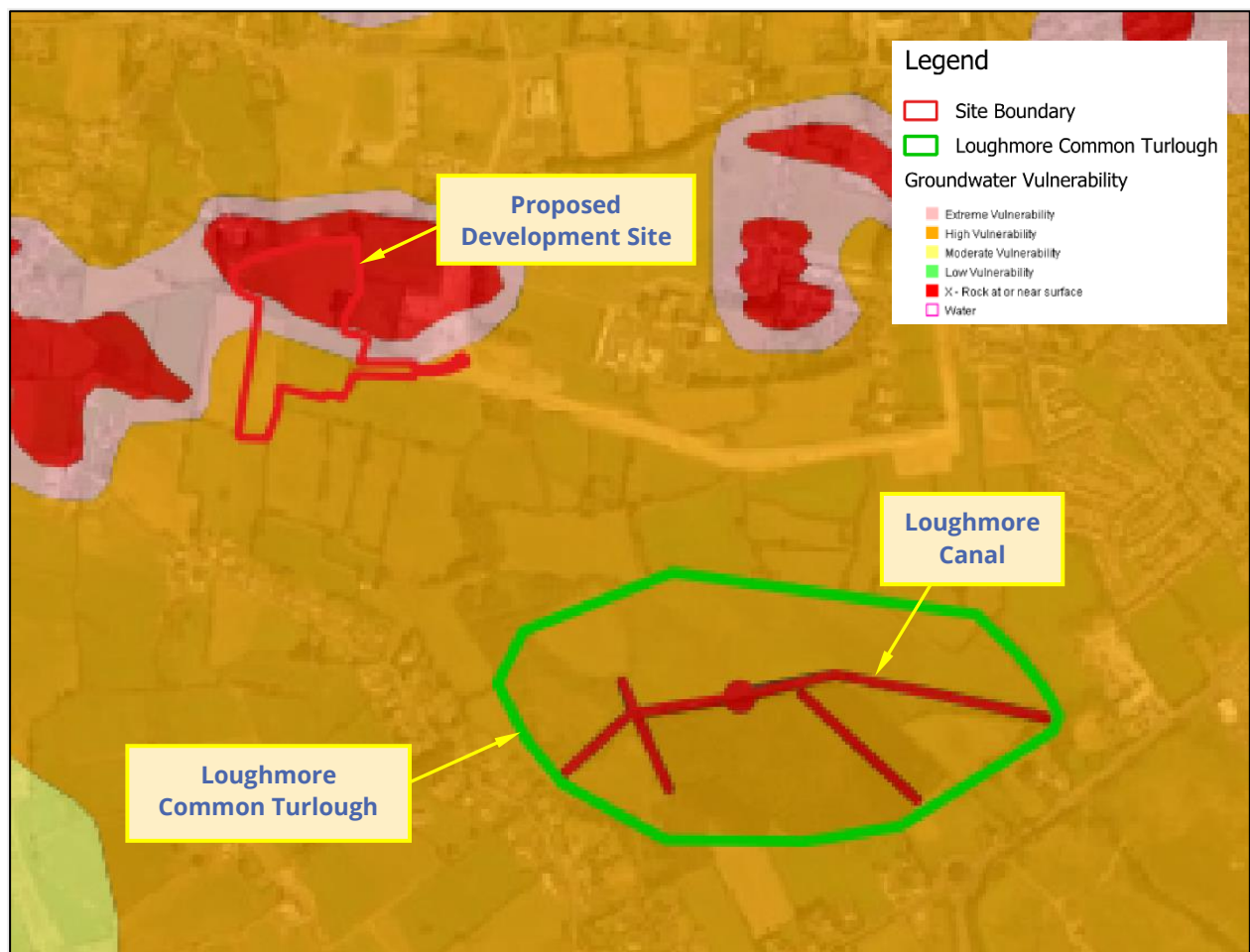


**Figure 15 – Groundwater Vulnerability**

The groundwater vulnerability highlights the sensitivity of the underlying limestone aquifer to surface-derived inputs. In particular, the presence of high to extreme vulnerability indicates that groundwater levels are likely to respond rapidly to sustained rainfall events and that seasonal fluctuations in groundwater levels can be expected. These characteristics are consistent with the hydrogeological setting of a karst-influenced limestone aquifer and are particularly relevant for the functioning of Loughmore Common Turlough, which is strongly controlled by groundwater level variations.

#### 3.7.6. Turlough Hydrogeology

In addition to a component of surface water run-off from surrounding areas, the Turlough is a groundwater dependent terrestrial water environment.

The Turlough is in an area of low topography, that may have been created by collapse of an existing karst topography due to dissolution as discussed above. The peat developed in the ephemeral waterlogged fen conditions.

The base of the feature is close to the water table. During dry months, the base of the Turlough will sit above the watertable. However, in the winter because of rejected recharge into the aquifer the watertable will rise above the base of the turlough, creating a lake feature.

An approximate zone of contribution from the groundwater aquifer to the Turlough is shown in *Figure* below. There will be no groundwater recharge from the site to the turlough.

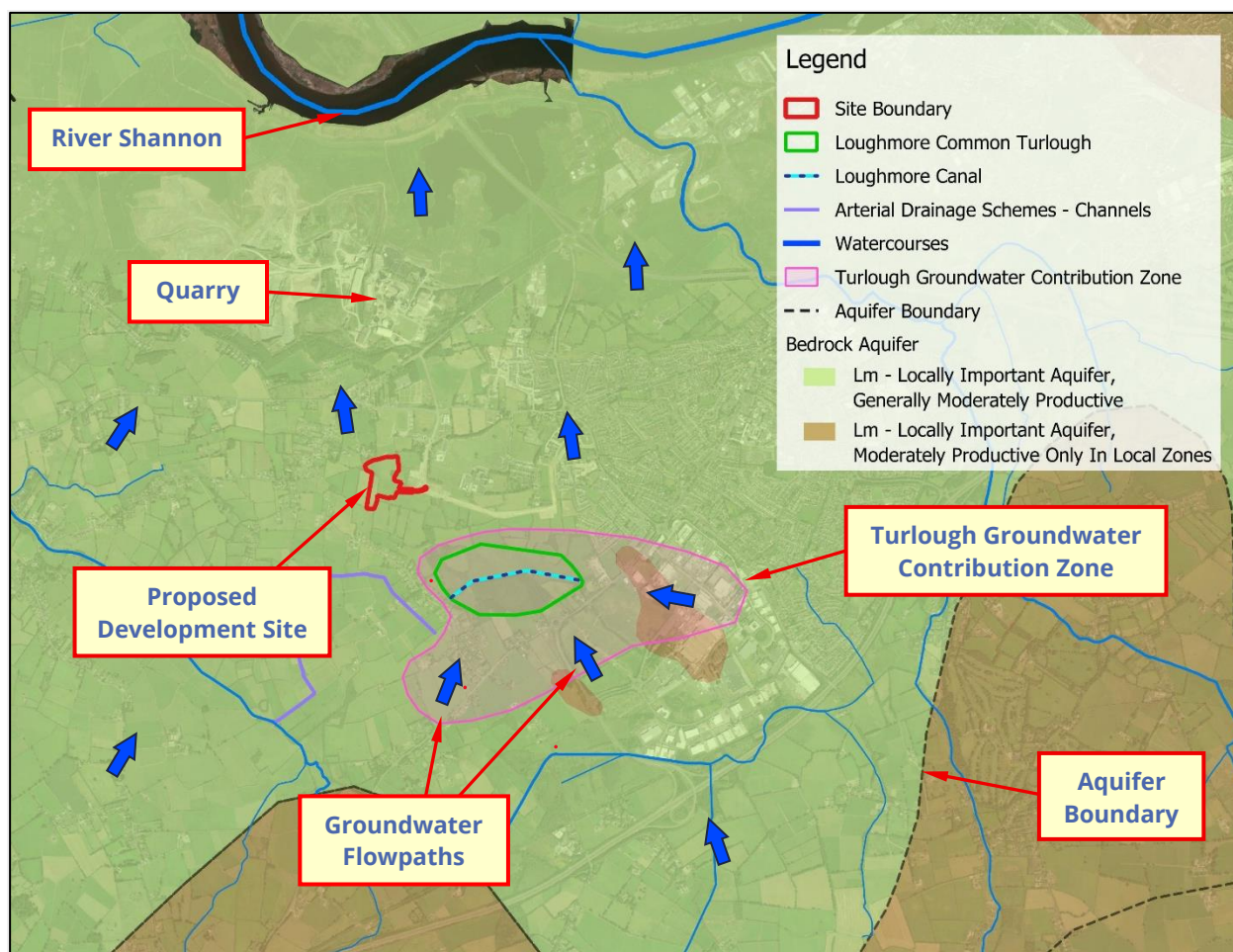


**Figure 16 – Groundwater Contribution Zone to Turlough**

The area is constrained by topography to the west, south and east, and by the down gradient distance to the north. Groundwater will flow to the North in the general direction of the Shannon, but flowpaths maybe curtailed by dewatering in Mungret Quarry.

## **4. ASSESSMENT OF POTENTIAL SOURCES OF CONTAMINATION ON THE PROPOSED DEVELOPMENT SITE**

### **4.1. Construction related Activities**

If planning is approved, construction of the development will proceed.

The construction activities will be subject to an approved CEMP, which will include the safe environmental management of excavated soils, run-off arising during construction, and the safe management of hydrocarbons and other products used as part of the construction process. Once the CEMP is adhered to, there will be no risk to the Loughmore Common Turlough.

### **4.2. Wastewater**

Once the development is completed the key issues will be the management of foul and storm water.

Regarding the foul sewer, the full design details are provided in the accompanying Engineering Report.

The following is a summary:

It is proposed that this development will be serviced internally by 150 mm and 225 mm diameter foul sewers and will include the provision of services connections, inspection chambers etc. throughout the site.

Due to the topography of the site and invert levels of the existing foul sewer infrastructure mentioned above, it is not possible to connect to the existing infrastructure by means of gravity. It is thus proposed to include a foul sewer pump station within the development to lift foul sewerage through pumping to the existing foul sewer on the LIHAF road.

The proposed foul sewer pumping station has been designed in accordance with Uisce Éireann's Code of Practice for Wastewater Infrastructure. The design incorporates dual submersible pumps operating on a duty/standby arrangement, with ductile iron pipework to IS EN 598. Adequate emergency storage has been provided in line with development scale, together with odour and septicity control measures.

A dedicated metered power supply, automated controls, and provision for telemetry/remote monitoring have been included, alongside appropriate alarm and call-out systems. Safe vehicular access for maintenance, tanker removal of wet well contents, and lifting/handling equipment have been integrated. Flood risk, site security, fencing, and odour setback requirements have also been

addressed to ensure the pumping station is fit for purpose and fully compliant with Uisce Éireann standards.

Foul sewers have been designed in accordance with the Uisce Éireann 'Standard Details for Wastewater infrastructure' and 'Code of Practice for Wastewater Infrastructure'. In addition, foul sewers have been designed to the Building Regulations 1997, as amended, (referred to within as 'the Building Regulations') and specifically in accordance with the principles and methods set out in EN 752:2008 and DOE 'Recommendations for Site Development Works' (1998).

Foul sewer shall be constructed to comply with the requirements of the Building Regulations 1997 in accordance with the recommendations contained in the Technical Guidance Documents, Section H (revised 2005) and the Uisce Éireann Code of Practice and Standard Details for Wastewater Infrastructure.

The wastewater will effectively be fully contained with the foul sewer network, with adequate safeguards to eliminate the risk of release of any deleterious material to the environment.

The foul water system is being constructed to a high standard and there will be no significant risk to Loughmore Common Turlough from the proposed wastewater management because there will be no release of contaminants.

### 4.3. Stormwater Management

The design details for the stormwater management are provided in the Engineering Services Report submitted as part of this application. In summary:

Site tests have confirmed that there is infiltration capacity in the ground. In accordance with SuDS principles, this property will be utilised as part of the stormwater management approach.

A standalone storm sewer network will also be provided, to take any flows more than the infiltration capacity. As illustrated in *Figure* below<sup>4</sup>, the flows through the storm network will run to a pumping station within the development in order to lift surface water through pumping to the existing surface water sewer. The proposed surface water sewer pumping station has been designed in accordance with Uisce Éireann's Code of Practice for Wastewater Infrastructure. The design incorporates dual submersible pumps operating on a duty/standby arrangement, with ductile iron pipework to IS EN 598. Adequate emergency storage has been provided in line with development scale, together with odour and septicity control measures. A dedicated metered power supply, automated controls, and

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<sup>4</sup> OSL Butler Consulting Engineers (2025): Engineering Services Report, 24051-OSL-00-RP-C-0002.

provision for telemetry/remote monitoring have been included, alongside appropriate alarm and call-out. From here it is proposed to service the proposed development by means of a connection to the existing 300 mm diameter surface water pipe located within the Mungret Link Road to the southeast of the subject site.

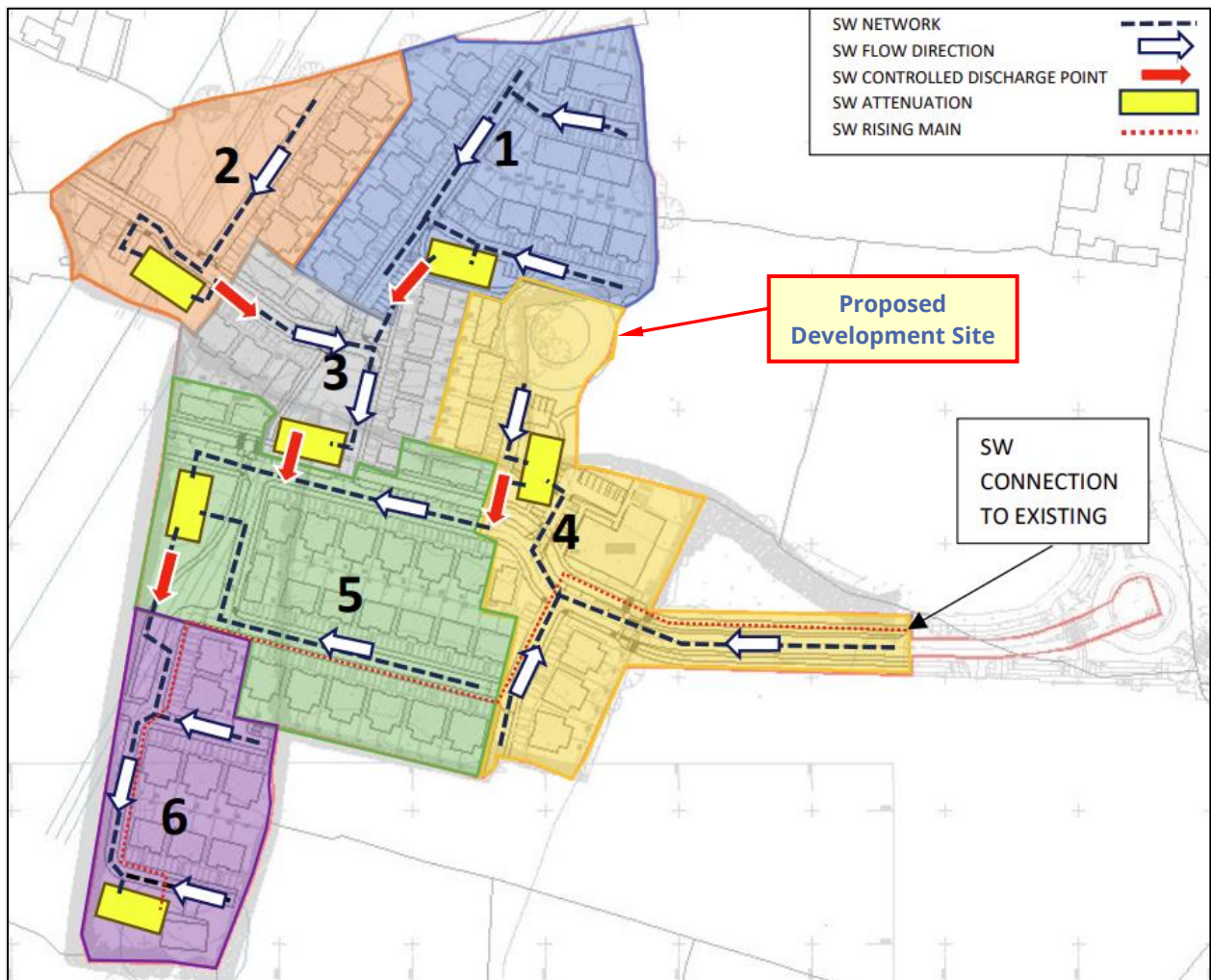


**Figure 17 – Surface Water Network and Sub-catchments of the Proposed Development Site**

It is understood that there is a discharge of stormwater to ground further north of the Mungret Link Road. This water will percolate to ground, and will move north in accordance with the groundwater gradient, which in turn will be accentuated by pumping in the Quarry,

Similarly, any infiltration on the site, will enter the watertable, and move northwards towards the River Shannon.

There will be no risk to the Loughmore Common Turlough, because it is to the south and upgradient of the site, and groundwater flow will be to the north.

## 5. HYDROLOGICAL ASSESSMENT

The hydrological assessment considers the existing surface and groundwater water regime of the proposed development site and the wider area, with particular focus on the hydrological and hydrogeological functioning of Loughmore Common Turlough.

The proposed development site and the surrounding area are located within the wider catchment of the River Shannon. While the River Shannon exerts a significant influence on regional groundwater conditions, it is sufficiently distant from the site that it does not directly influence local surface water processes. At a local scale, surface water hydrology is controlled primarily by the site topography, soil conditions and surface water drainage pathways.

A review of the topographic data indicates that there is a possibility of surface water runoff from the existing undeveloped site towards Loughmore Common Turlough. However, the contributing surface runoff area is relatively small (about 0.1 % of the total catchment area) and does not represent a significant hydrological input to the Turlough system. Modification of this flow, as part of the proposed development, will not significantly impact recharge to the Turlough.

As part of the proposed development, the topography of the site will be altered, and the hydrology of the site will be altered. The proposed development incorporates a comprehensive surface water management strategy based on Sustainable Urban Drainage Systems (SuDS) including permeable paving, swales, tree pits, cellular attenuation, detention basins and other nature-based solutions. These measures are designed to attenuate surface water runoff close to source, promoting infiltration, evaporation and temporary storage, and thereby reducing both runoff rates and volumes, also improving water quality and biodiversity.

The capacity of infiltration will be supplemented by collection in a storm network, attenuation and treatment using by-pass separators, and collection in a pump sump, which will deliver stormwater to the public storm sewer system.

The Groundwater recharge area for the Turlough will be mainly from the south, with a lesser contribution from the east and west. There will be no groundwater contribution from the north (including the proposed development site), due to the natural gradient being towards the Shannon, which will be accentuated by the active dewatering of the quarry.

Groundwater beneath the site is expected to be at approximately 10m O.D, which will be at least 4m below ground level at the lowest point. This means that groundwater levels will not interfere with infiltration, even with winter groundwater levels.

These measures are designed to ensure that post-development surface water runoff rates and volumes do not exceed existing hydrological conditions. The implementation of on-site attenuation and treatment function, will mean that under normal conditions the existing surface water regime will be maintained, allowing infiltration up to the infiltration capacity of the site. Extreme events will be managed by the storm sewer network, with a pumped discharge out of the catchment.

There will be no adverse effect on the hydrological functioning of Loughmore Common Turlough because of this proposed development.

## 6. HYDROGEOLOGICAL ASSESSMENT

The hydrogeological assessment considers groundwater conditions at the proposed development site and within the wider area, with particular emphasis on groundwater flow directions and their relevance to the functioning of Loughmore Common Turlough.

The proposed development site is underlain by Carboniferous limestone bedrock, which forms a locally important aquifer. Groundwater flow within this aquifer is primarily controlled by fractures and hydraulic gradients rather than local topography.

At a regional scale, groundwater flow is directed towards the River Shannon, which represents the principal groundwater discharge zone in the area. The River Shannon, together with the large-scale quarry operated by Irish Cement Ltd. to the north of the site, exerts a strong hydraulic control on groundwater levels. The quarry, which extends to elevations of approximately -27 m OD, is likely to act as a localised groundwater sink, further reinforcing groundwater flow towards the north.

Loughmore Common Turlough responds to seasonal fluctuations in groundwater levels. During periods of high rainfall, groundwater levels rise and exceed ground level within the Turlough depression, resulting in seasonal flooding. During drier periods, groundwater levels decline, and water drains from the turlough via swallow holes and karst conduits, causing the turlough to partially or fully dry out.

Infiltration from the proposed surface water attenuation measures will recharge the underlying limestone aquifer. However, due to the regional groundwater gradient towards the River Shannon and the influence of the nearby quarry, infiltrated water is expected to migrate northwards rather than towards Loughmore Common Turlough.

A conceptual hydrogeological model, as shown in *Figure*, has been developed to illustrate the relationship between the proposed development site, Loughmore Common Turlough, the quarry, and the River Shannon.

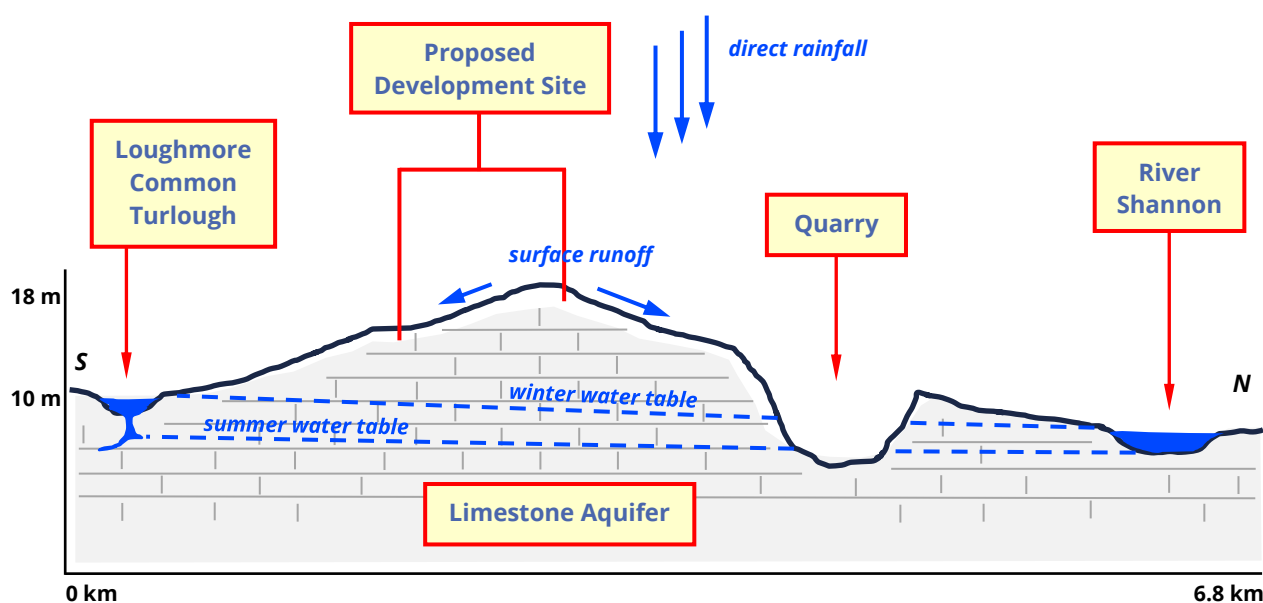


**Figure18 – Conceptual Hydrogeological Model**

The conceptual model demonstrates that groundwater flows beneath the site consistently discharge towards the River Shannon under both winter high groundwater levels and summer low groundwater levels.

On this basis, the proposed development will not adversely affect groundwater flow patterns supporting the hydrological functioning of Loughmore Common Turlough.

## 7. CONCLUSIONS

The baseline hydrological conditions of Loughmore Common Turlough and the surrounding environs have been established.

Loughmore Turlough exists because of its low topography, which lies close to the annual fluctuations of the water table in the underlying Limestone Aquifer. It will receive groundwater recharge primarily from south-east and west of the Turlough. It also receives some surface water recharge from surrounding higher topography.

A small proportion of the proposed development site, in its existing state, at the extreme southern end, may generate some surface water run-off to the Turlough. Surface water management, associated with the proposed development, will however reduce, any direct run-off to the south from this small area. As this is a small area, removed from the wetland, it will not negatively impact the water quantity to the turlough.

Instead, infiltration of stormwater will be encouraged, and where the infiltration capacity is exceeded, stormwater will be attenuated and collected in a sump to be pumped northwards towards the public stormwater system and discharged through a large soakaway.

The infiltrated stormwater on the site, and that pumped to the existing stormwater network on the LIHAF road and thereafter discharged via a large soakaway to the north of the LIHAF road, will infiltrate vertically to the watertable, and then move northwards with the groundwater gradient towards the River Shannon.

Active dewatering in the Mungret Quarry to the north of the site, will modify groundwater flow paths, and will accelerate flow towards the quarry.

There will therefore be no significant effect on water recharge to the Turlough from the proposed development.

Potential sources of contamination, that might affect the water quality in the Turlough, will be effectively managed by the CEMP during construction and by the sealed and contained wastewater network, which will pump wastewater to the public foul sewer to the north.

These measures together with no groundwater flow from the proposed development site to the turlough and the insignificant risk of run-off from the site reaching the Turlough will therefore ensure that water quality in the Turlough will remain unaffected by the proposed development.