

HISTORIC LANDFILL AT GORT, CO. GALWAY

TIER 2 RISK ASSESSMENT

Prepared for: Galway County Council



Comhairle Chontae na Galíimhe
Galway County Council

Date: November 2020

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HISTORIC LANDFILL AT GORT, CO. GALWAY

TIER 2 RISK ASSESSMENT

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Abstract: This report represents the findings of a Tier 2 site investigation carried out at Gort Historic Landfill, Co. Galway and conducted in accordance with the EPA Code of Practice for unregulated landfill sites. The site investigation was undertaken to determine the extent of the historic landfilling at the site.

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EXECUTIVE SUMMARY

Gort Historical Landfill is located in the immediate urban environs of Gort town Co. Galway and the site is currently utilised for rough unorganised grazing. The historic landfill site covers an area of c.2ha located to the west of the L85075 road. The site is bound along its western and northern boundary by the Gort River and the L85075 local road runs along the eastern boundary of the site.

A Tier 2 site investigation and risk assessment was conducted by Fehily Timoney and Company (FT) in accordance with the EPA Code of Practice - Environmental Risk Assessment for Unregulated Waste Disposal Sites for Gort Historic Landfill. The study consisted of a desktop study, site walkover, topographical survey, geophysical survey, intrusive site investigation works and environmental monitoring and analysis of groundwater, surface water, landfill and waste/soil. These works informed the development of the Conceptual Site Model (CSM) and the completion of an environmental risk screening model.

The findings of the site investigation work and geophysical surveying suggest the waste material is deposited in a single infill area within the extent of the landfill and is estimated to be 16,500 m² in area. A volume calculation based on the surveyed surface profiles for the existing ground level and the base of waste as interpreted and preliminary estimates indicate an interred waste volume of 57,750 m³ including fill material placed on top of the landfill.

Analysis of waste samples from the trial pits advanced at the site, when assessed against the waste acceptance criteria indicated that much of the waste material within the site can be classified as inert. This waste classification is considered to reflect the level of biological degradation that has taken place since waste placement commenced. Trial pits confirmed the waste material is near the surface with a minimal soil cover across the site.

Landfill gas monitoring carried out at groundwater monitoring wells BH01, GW01, GW02 and leachate monitoring well LH01 at the site indicates gas concentrations detected are below threshold levels for offsite boreholes and monitoring locations as set by the EPA Landfill Manuals - Landfill Monitoring (2nd Edition), except for the leachate borehole LH01 (located centrally within the waste mass).

Exceedances of chloride and ammoniacal nitrogen were observed in all groundwater samples.

The shallow soil cap is not suitable at preventing rainfall infiltration into the waste body which will continue to contribute to leachate generation. Based on static groundwater level measurements the groundwater table is considered to be located just below or slightly transecting the waste body and may also be contributing to leachate migration from the site.

Analysis of surface water samples from the River Gort indicates no exceedances of guideline limit values. These results indicate the landfill is not having a negative impact on surface water quality.

Based on the results of the Tier 2 site assessment, the site can be classified as a **High-Risk Classification (Class A)**. The main risk identified on the site is the risk posed to the surface water from migration of leachate.



1. INTRODUCTION

1.1 Background

Galway County Council (GCC) appointed Fehily Timoney and Company (FT) to prepare a Tier 2 risk assessment on a historical landfill in Gort, Co. Galway.

Gort Historical Landfill is located in the immediate urban environs of Gort town Co. Galway and the site is currently utilised for rough unorganised grazing. The historic landfill site covers an area of c.2ha located to the west of the L85075 road. The site is bound along its western and northern boundary by the Gort River and the L85075 local road runs along the eastern boundary of the site.

The topography of the site is generally relatively flat, with a gentle slope westward towards the River Gort. The surrounding lands comprise of an urban area to the south and west and agricultural land to the north and east. A hardware/trade store is located at the south/eastern boundary.

Information provided by GCC states that the landfill was established in 1983 and landfilling had ceased in 1993.

Previous remediation measures were noted on the site during the site walkover by an FT engineer. They include constructed embankments at the river side and a leachate collection system (sump), a pumping control system and rising main. It is assumed that the rising main discharges into the local sewer for treatment at Gort Wastewater Treatment Plant. A borrow pit located near the site, adjacent to the local road (L85075) was a source of capping materials. Surface water monitoring was conducted until 2010 at Gort Bridge and at locations downstream of the landfill by Galway Co Co. Water is abstracted upstream of Gort Bridge for the Public Water Supply, c.1km south/south-west and upstream of the historic landfill..

Documents provided by GCC include a reference to the presence of a borrow pit 'located to the right of the local road' that was used as a source of capping materials for the historic landfill. In order to confirm that the landfill deposition did not extend to these lands, this area was included within the Tier 2 site investigation. This included the excavation of 3 no. trial pits, installation of 1 no. groundwater monitoring and sampling of an existing groundwater monitoring well.

A Tier 1 Risk Assessment was previously completed by GCC. Based on the available information, the Tier 1 Assessment determined that the maximum risk score for Gort Landfill was 70%, resulting in a risk classification of **High (Class A)**. The highest score 70% was applied to source-pathway-receptor (SPR) 9, referring to the potential of leachate migration to surface water receptor, i.e. the Gort River. With the exception of SPR1 (risk of leachate to surface water via combined groundwater and surface water pathways) which had a score of 42% (Class B: Moderate) all other risks were calculated to be low (<40%).

A copy of the Tier 1 assessment risk scoring results are included in Appendix 1.



1.2 Scope of Works

FT's scope of work was to undertake a Tier 2 assessment of the site in accordance with the EPA Code of Practice (CoP) 2007: *Environmental Risk Assessment for Unregulated Waste Disposal Sites*. This approach required the completion of the following:

- Desk Study
- Topographical survey
- Geophysical and surveying to estimate extents and depths of waste
- Intrusive Site Investigation
- Groundwater and Surface Water Sampling
- Environmental Risk Assessment (ERA)
- Development of a conceptual site model (CSM)

As part of the initial desk study, a review of available information was undertaken. This was followed-up with a site walkover by FT personnel. The desk study and site walkover were used to determine the locations for the intrusive site investigation. The site walkover checklist and accompanying photolog are included in Appendix 2 to this report.

Minerex were appointed by FT to undertake a geophysical survey of the site. Geophysical surveying included Electro Conductivity, Electro Resistivity and Seismic Refraction surveying methods.

The geophysical survey report is included in Appendix 3 to this document.

The purpose of the geophysical study was to attempt to define the vertical and lateral extents of any waste body. Trial pits were excavated to provide a preliminary assessment of the volume, extent and type of waste infilled at the site. The geophysical survey also aided in determining suitable locations for intrusive site investigation.

FT appointed Causeway Geotech Limited (CGL) to conduct the intrusive site investigation which included the installation of 2 no. groundwater monitoring wells an 1 no. leachate monitoring well , 11 no. trial pit excavations, waste/made ground sampling, chemical and geotechnical analysis.

A geotechnical report is included in Appendix 4 to this document.

Laboratory analysis of waste, surface water and groundwater samples were conducted to assess and quantify any potential or ongoing environmental impacts. Results of waste sampling are included in Appendix G of Causeway Geotechnical Report (Appendix 4 of this report) with laboratory analytical reports for surface water and groundwater presented in Appendix 5.

The information gathered from the desk study, intrusive site investigation and geophysical survey were used to inform the development of the CSM and the Environmental Risk Assessment (ERA). This report presents the findings of the assessment.



2. DESK STUDY

2.1 Introduction

The desk study included the review of the following literature sources and websites:

- Geological Survey of Ireland, Groundwater Web Mapping: www.gsi.ie
- Environmental Protection Agency Maps: <http://gis.epa.ie/Envision>
- National Parks and Wildlife Service Map Viewer: www.npws.ie
- DoHPLG/EPA/Local Authority maps: www.catchments.ie
- BS 5930: 1999, Code of Practice for Site Investigations
- BS 10175: 2000, Investigation of Potentially Contaminated Sites – Code of Practice
- EPA - Assessing and Developing Natural Background Levels for Chemical Parameters in Irish Groundwater (2017)

A desktop review of available documentation for the site was conducted followed by a site walkover on the 25th of May 2020.

2.2 Desk Study

This section of the report presents the findings of the desk study.

2.2.1 Site Description and On-Site Conditions

The overall site covers an area of c.2 ha comprising an area located to the west of the L85075 road. The site is bound to the west and north by the River Gort with the L85075 road located along its eastern boundary. The site is in the ownership of GCC.

The site can be accessed via the Station Road. There are no dwellings located within the site however residential units are present within 200m of the site boundary, in Gort town. A commercial area is located immediately south of the site on the eastern side of the L85075.

The topography of the site is generally relatively flat, with a gentle slope southward towards River Gort. The surroundings are composed of an urban area to the south and west and agricultural lands to the north and east. A hardware store is located at the south eastern boundary of the site.

Remedial works have previously been carried out at the site including the installation of groundwater monitoring wells. An existing groundwater monitoring well, identified as BH01 was retained and will be monitoring as part of this Tier 2 site investigation. The site walkover also confirmed the presence of a leachate collection system including a small pump station, an access manhole (MH01) to the leachate collection system is also present and will be monitored as part of the Tier 2 site investigation.

The location of the site is shown in Figure 2-1.



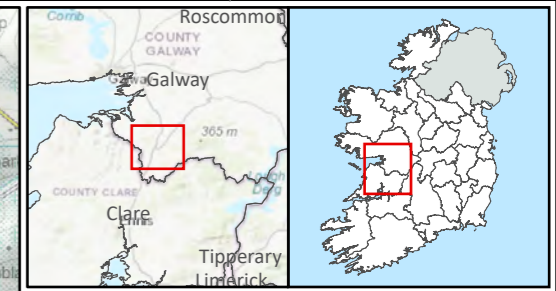
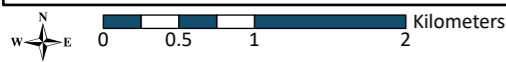
2.2.2 Previous Studies

A Tier 1 Risk Assessment was previously completed by GCC (see Appendix 1 for risk scoring). The Tier 1 assessment comprised the following:

- Identification of contaminant sources, pathways of contaminant migration and potential receptors which may be vulnerable if exposed to those contaminants; i.e. the identification of Source- Pathway-Receptor (SPR) linkages; and
- The prioritisation of sites and SPR linkages based on their perceived risk.

Based on the available information, the Tier 1 Assessment determined that the maximum risk score for Gort Landfill was 70%, resulting in a risk classification of **High (Class A)**.

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Site Boundary

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TITLE:	Site Location
PROJECT:	Gort Historic Landfill ERA
FIGURE NO:	2.1
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2.2.3 Topography

The site covers an area of c.2ha and is located at the edge of the town of Gort with the River Gort flowing along the western and northern boundaries of the site. Topography of the site and surrounding environment is characterised by land gently sloping towards the River Gort. Ground surface elevations at the site decrease from a peak of 22.45 mAOD (above ordnance datum) to east of the site to a height of 18 mAOD at the bank of the River Gort to the north/north-west and 19.4 mAOD at the western boundary. The site also slopes to the east from the peak of 22.45 mAOD to 19-20 mAOD along the adjacent road.

2.2.4 Geology

Drift/Quaternary Geology

Quaternary sediments at the site comprise a combination of tills derived from limestones (western area) and bedrock outcrop or subcrop (eastern area). Alluvium deposits are also shown to be present along River Gort. Drift/quaternary geology is shown in Figure 2-2.

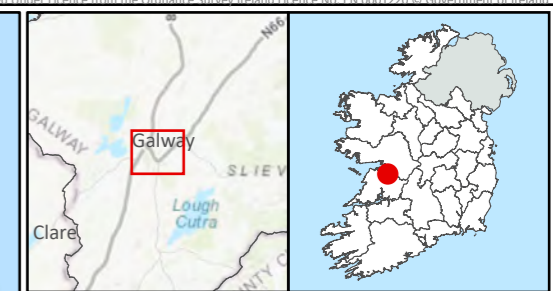
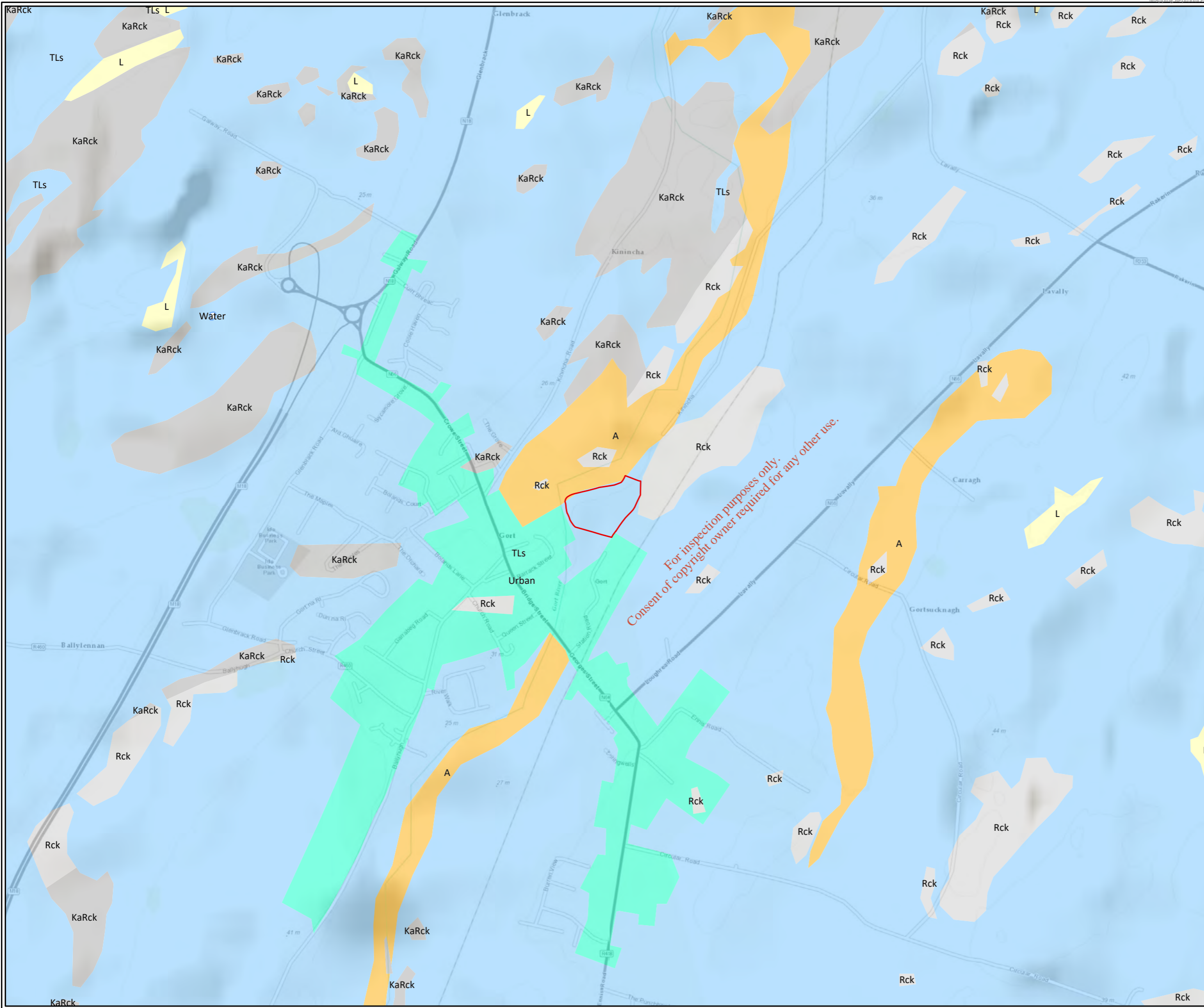
Solid or Bedrock Geology

The bedrock beneath the site comprises two different formations, Waulsortian Limestones (CDWAUL) and Ballysteen Formation (CDBALL). Further to the north, west and south of the site is the Tubber Formation.

GSI mapping also indicates the presence of bedrock outcrop within the wider area. A significant number of bedrock outcrops and karstified bedrock outcrops are also shown along the banks of the River Gort. Bedrock geology mapping is presented in Figure 2-3.

Bedrock was encountered at 2.80m (19.38 mAOD) and 1.0m (22.55 mAOD) BGL during the installation of boreholes GW01 and GW02 as referenced in the CGL borehole logs, Appendix 4.

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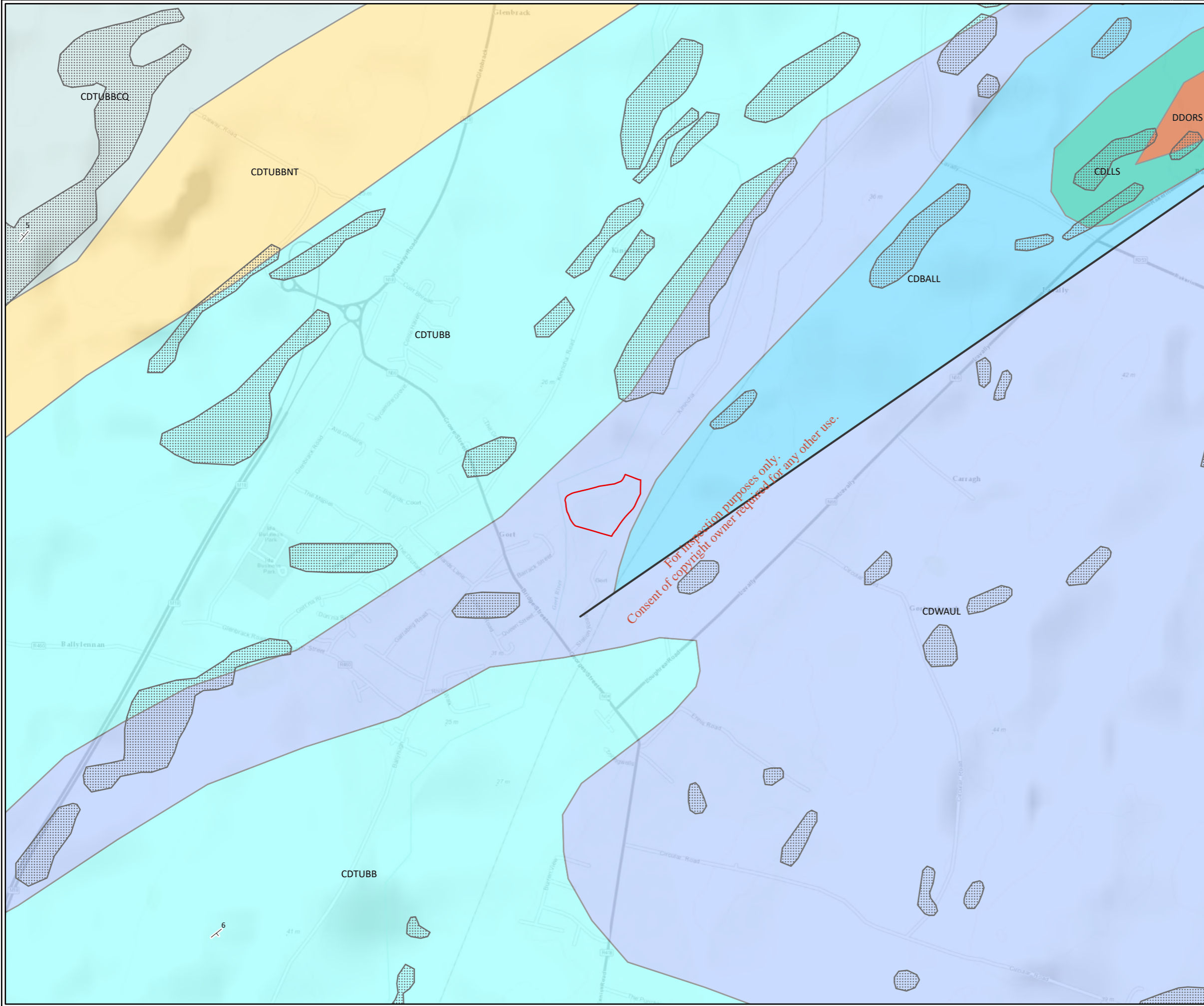


- Site Boundary
- Quaternary Sediments**
- A, Alluvium
- KaRck, Kartsified bedrock outcrop or subcrop
- L, Lacustrine sediments
- Rck, Bedrock outcrop or subcrop
- TLS, Till derived from limestones
- Urban
- Water

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TITLE:	Quaternary Geology		
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- Site Boundary
- Strike and dip of bedding, way up unknown
- Fault
- Bedrock Outcrop
- Bedrock Geology**
- Ballysteen Formation
- Lower Limestone Shale
- Tubber Formation
- Castlequarter Member
- Newtown Member
- Waulsortian Limestones
- Old Red Sandstone (undifferentiated)

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2.2.5 Hydrogeology

An examination of the national bedrock aquifer mapping shows that the bedrock aquifer beneath site is classified as a ‘Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones’. The bedrock aquifer mapping is presented in Figure 2-4.

There are no karst landforms recorded within the site boundary, however less than 100m west of the site the underlying groundwater aquifer is classified as being a ‘Regionally Important Aquifer - Karstified (conduit)’.

Historical mapping (1888-1913 and 1837-1842) for the area shows no springs within the site boundary or near the site. As the site is located at the edge of an urban area there is a lower risk of unregistered private wells being in the vicinity of the site with the most likely source of drinking being via public mains supply.

Table 2.1 below presents the details of the registered boreholes and springs within 1km of the site. It is noted that all wells listed below have location accuracies of 1 – 2km and may be located outside of the 1km radius.

Table 2.1: Borehole and Spring Descriptions near the Project Site

BH/Spring	Yield class	Yield (m ³ /day)	Use	Depth (m)	Depth to Rock confidence (m)	Distance from site (km)	Date
1419NWW015	-	-	Public supply (Co Co)	-	-	1	1899

The GSI mapping showing approximate locations of known wells and springs is included in Figure 2-5.

There are no Groundwater Drinking Water Protection Areas within the site, however the River Gort is part of the Coole Zone of Contribution (ZOC) Group Scheme Preliminary Source Protection Area, the abstraction point is located upstream of Gort Bridge and the site. The primary zone of contribution (ZOC) relating to groundwater is located approximately 1.12 km north of the site at its closest point. Other groundwater protection zones are listed in Table 2.2.

Table 2.2: Groundwater Drinking Water Protection Areas near the Project Site

Groundwater Protection Zone	Distance from site (km)
Ballyaneen Rankerin	1.8
Lydacan Area 2	3.2
Tierneevin	3.7
Peterswell Castledaly	6.1



The groundwater body (GWB) underlying the site is the Caherglassaun Turlough GWB, a poorly productive bedrock aquifer.

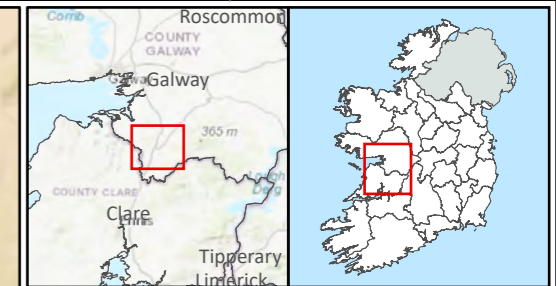
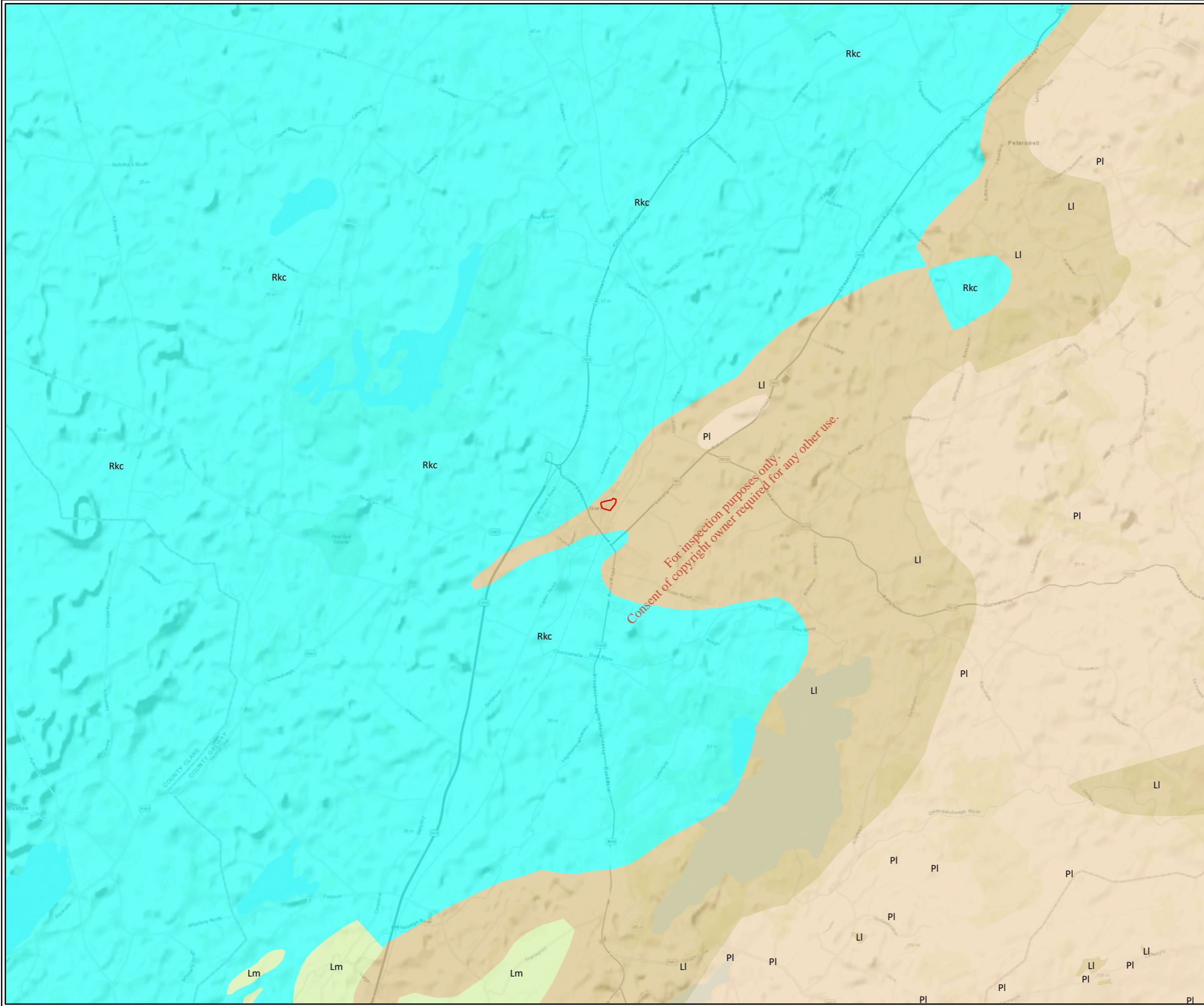
The most recent (2013-2018) Water Framework Directive quality status for the GWB is 'Poor'. The WFD risk to groundwater quality was most recently classified as 'At Risk'.

The Peterswell Castledaly and Ballyaneen_Rankerin group schemes source protection zones and portions of the Lydacan Area 2 and Tierneevin group schemes source protection zones are also located within the Caherglassaun Turlough GWB. However, based on review of topographical and hydrological mapping it is likely that the Peterswell Castledaly and Ballyaneen_Rankerin drinking water supplies are located upgradient of the landfill. A hydrogeological connection and groundwater pathway from the site may exist between the Coole ZOC and Lydacan Area group scheme.

There are no recorded groundwater dependent ecosystems within the site.

Groundwater recharge varies within the site. Owing to the variation in geology, the recharge co-efficient values developed by GSI vary from 60% to 85%, yielding groundwater aquifer recharge rates of 431 to 611 mm/yea when applying an effective rainfall rate of 719 mm/yr.

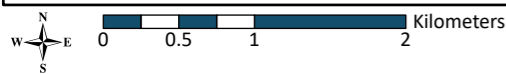
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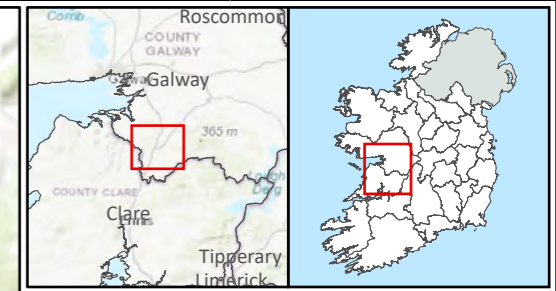
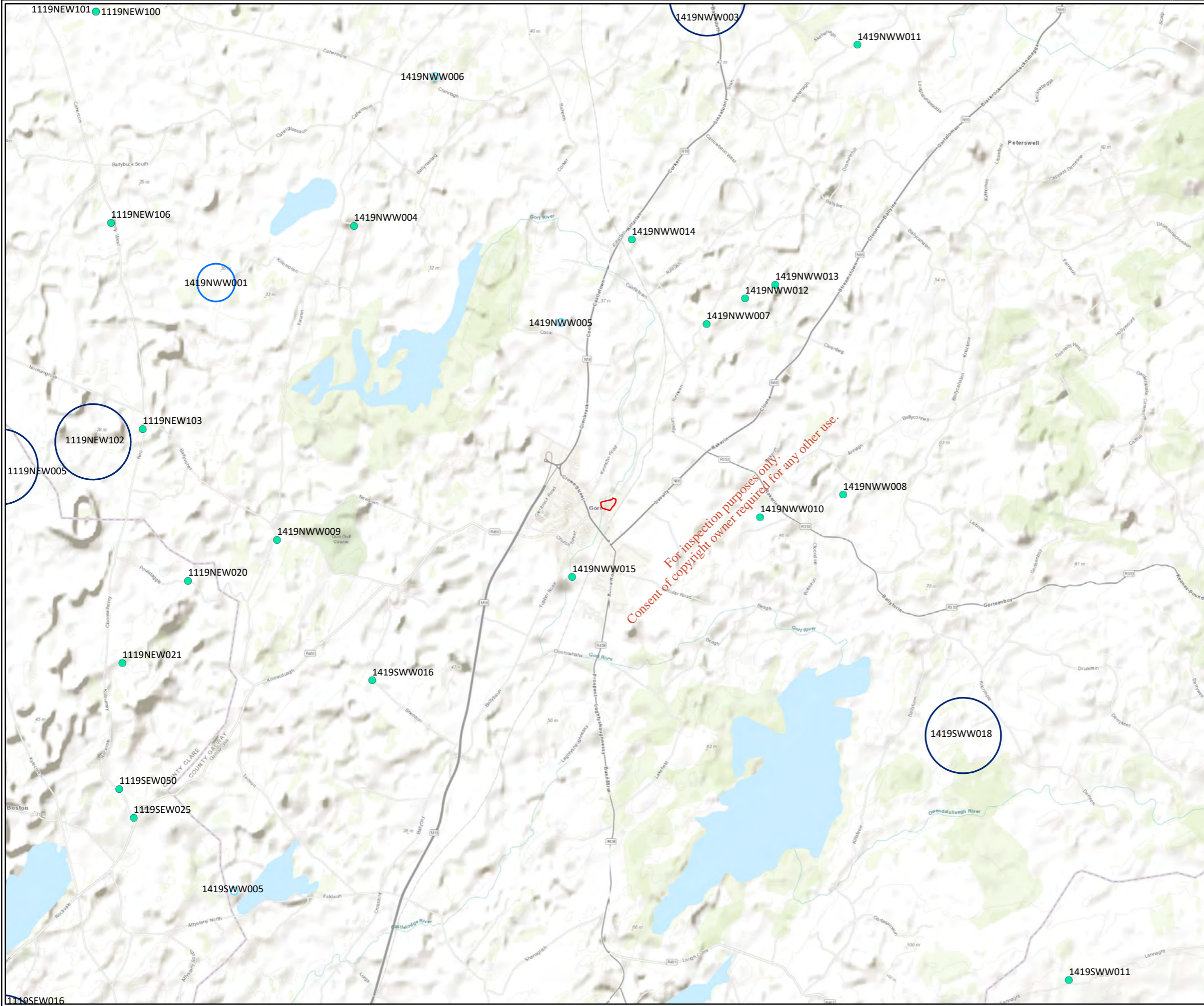


- Site Boundary
- Bedrock Aquifers**
- LI: Locally Important Aquifer - Bedrock Mod Productive Locally
- Lm: Locally Important Aquifer - Bedrock Generally Mod Productive
- PI: Poor Aquifer Bedrock Generally Unproductive Except Locally
- Rkc: Regionally Important Aquifer - Karstified (conduit)

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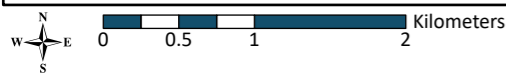




- Site Boundary
- Wells and Springs (10-50m Accuracy)
- Wells and Springs (50-100m Accuracy)
- Wells and Springs (100-200m Accuracy)
- Wells and Springs (200-500m Accuracy)
- Wells and Springs (500m-1km Accuracy)

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2.2.6 Groundwater Vulnerability

Groundwater vulnerability, as defined by the GSI, is the term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.

The factors used in assessing groundwater vulnerability include subsoil type and thickness and recharge type as indicated in Table 2.3. The GSI procedure whereby groundwater protection is assessed is outlined in the EPA-GSI publication *Groundwater Protection Schemes* (DELG/EPA/GSI, 1999).

The GSI Online mapping data set identifies the vulnerability of groundwater to contamination within the site area is classified as being primarily as ‘rock at or near the surface (X)’ and as ‘extreme (E)’. The groundwater vulnerability mapping is presented in Figure 2-6.

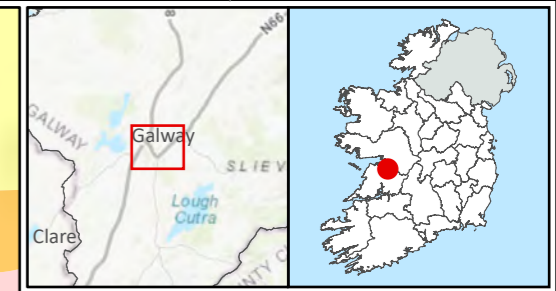
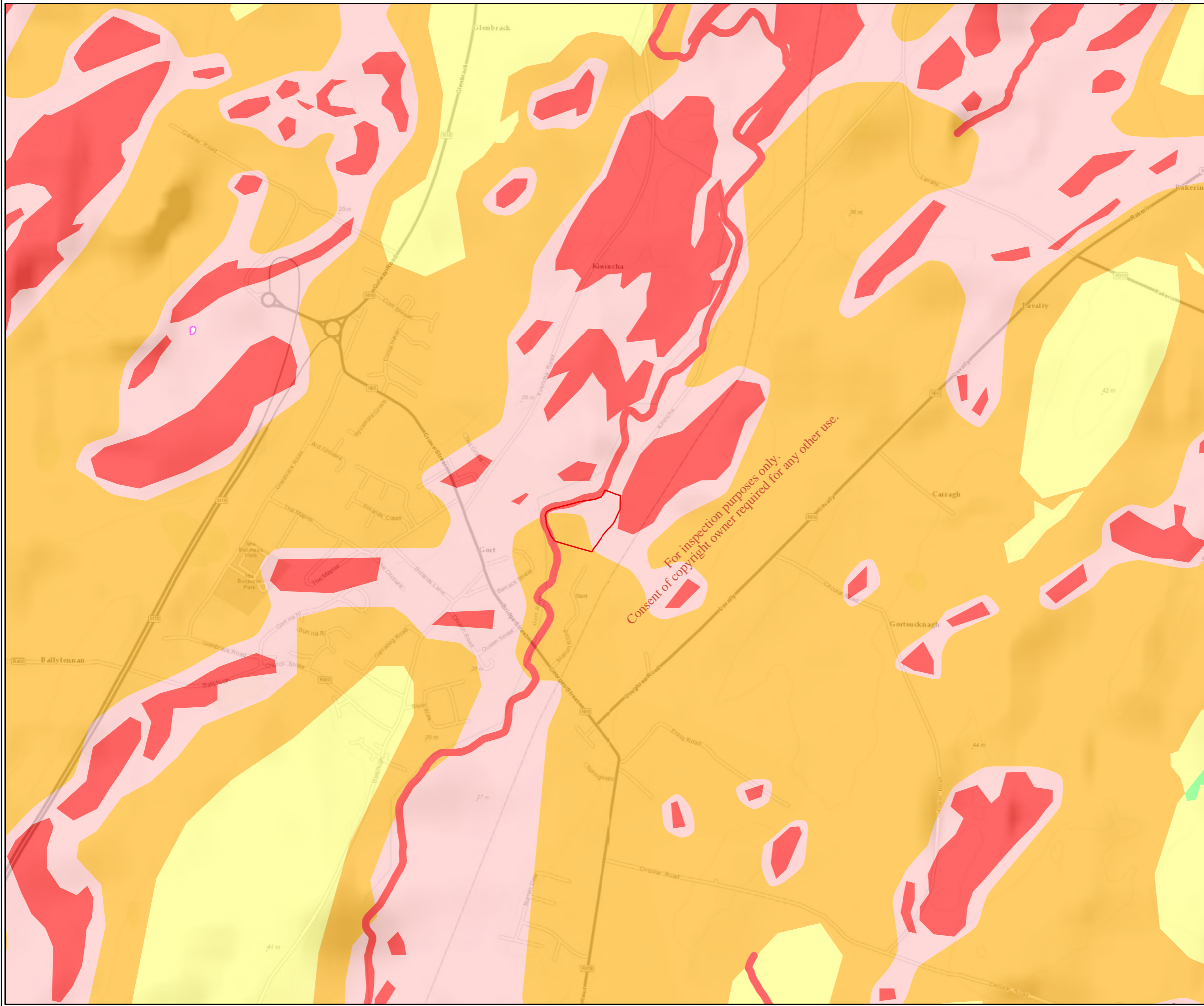
Table 2.3: GSI Guidelines – Aquifer Vulnerability Mapping

Vulnerability Rating	Hydrogeological Conditions		
	<i>Subsoil Permeability (Type) and Thickness</i>		
	High Permeability (Shallow Bedrock)	Moderate Permeability (e.g. Sandy soil)	Low Permeability (e.g. Clayey subsoil, clay, peat)
Extreme (E)	0 - 3.0 m	0 - 3.0 m	0 - 3.0 m
High (H)	>3.0 m	3.0 -10.0 m	3.0 - 5.0 m
Moderate (M)	N/A	>10.0 m	5.0 - 10.0 m
Low (L)	N/A	N/A	>10 m

Notes:

N/A = Not Applicable

Precise permeability values cannot be given at present



Site Boundary

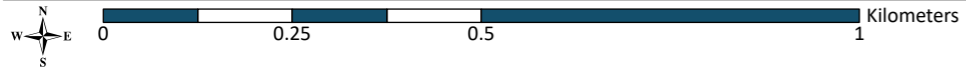
Groundwater Vulnerability

- Site Boundary
- E - Extreme
- H - High
- M - Moderate
- L - Low
- Water
- X - Rock Near Surface or Karst

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TITLE:	Groundwater Vulnerability		
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2.2.7 Hydrology

The site is located within the Galway Bay South East catchment (Hydrometric Area: 29), Cannahowna_SC_010 sub-catchment and Cannahowna_010 sub-basin. The River Gort (EPA River Section Name: Cannahowna_010), which forms the northern and western boundary of the site, is the most significant water feature near the site. The River Gort flows in a northerly direction discharging in the Castletown River (Kilchreest_010) before eventually discharging to the Atlantic, at Kinvarra Bay, north-west of Gort Town. There is therefore a direct connection to the River Gort. Surface water discharge from the site is primarily from overland surface run-off.

Surface water quality monitoring was historically conducted at Gort Bridge, c. 320m upstream of the site by GCC, and is the nearest EPA surface water monitoring station to the site. Downstream at c.760m is EPA monitoring station (ID: RS29C010200 - at Old Mill North of Gort).

The most recent biological Q-Rating for surface water quality at Gort Bridge (2018) was Q4, 'Good' status while the most recent (2018) biological (Q-rating) downstream of the site was Q3, Poor. A review of information provided by the EPA shows that the downstream monitoring station (RS29C010200) is located downstream of the Gort wastewater treatment plant (WWTP) discharge point on the Gort River. Discharges from the WWTP have the potential to negatively impact water quality and conditions downstream of the discharge point.

The river and catchment mapping are presented in Figure 2-7.

2.2.8 Ecology

The site is not located within any Natural Heritage Area (NHA), proposed NHA (pNHA), Special Area of Conservation (SAC) or Special Protection Area (SPA). The nearest protected site is the Coole-Garryland Complex SAC and pNHA (Site Code: 000252) which is located c.1.1 km north-west of the site at its closest point and the Coole-Garryland SPA (Site Code:004107) located c. 1.5 km at its closest point.

There does not appear to be any direct pathway or linkage between the site and these protected areas.

There is a Special Area of Conservation and Proposed Natural Heritage Area, East Burren Complex (Site Code: 001926), located c. 3 km south-west from the site.

Another protected site in relative proximity to the site is the Lough Cutra SAC, pNHA (Site Code: 000299) and SAC (Site Code: 004056), located around c.3.3 km to the south-east of the site.

There are no other protected sites in the vicinity of the site or any sites that could be considered at risk.

The ecology protected areas mapping is presented in Figure 2-8.

2.2.9 Existing Geological Heritage

There are no records of geological heritage within the site boundary.



The nearest record of a geological heritage site is approximately 1.2m north-west of the site boundary identified as the Coole-Garryland Complex. This site is described as *‘a very large complex of turloughs, risings and sinks in the Gort lowlands’*.

Another Geological Heritage site; the Beagh Sink - Pollduagh System, is located c.1.9 km south from the site. Beagh Sink - Pollduagh System is described as *“Sequence of genetically linked karstic features along the course of the Beagh River between its initial sink and its final resurgence from Pollduagh cave as the Gort River”*.

The geological heritage mapping is presented in Figure 2-9.

2.2.10 Existing Geotechnical Stability

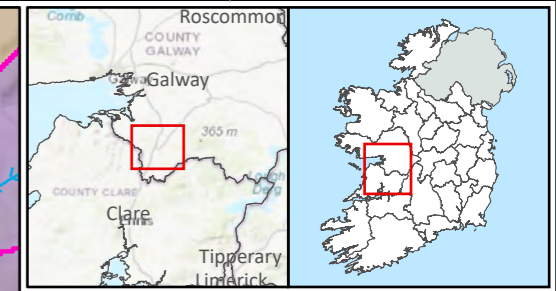
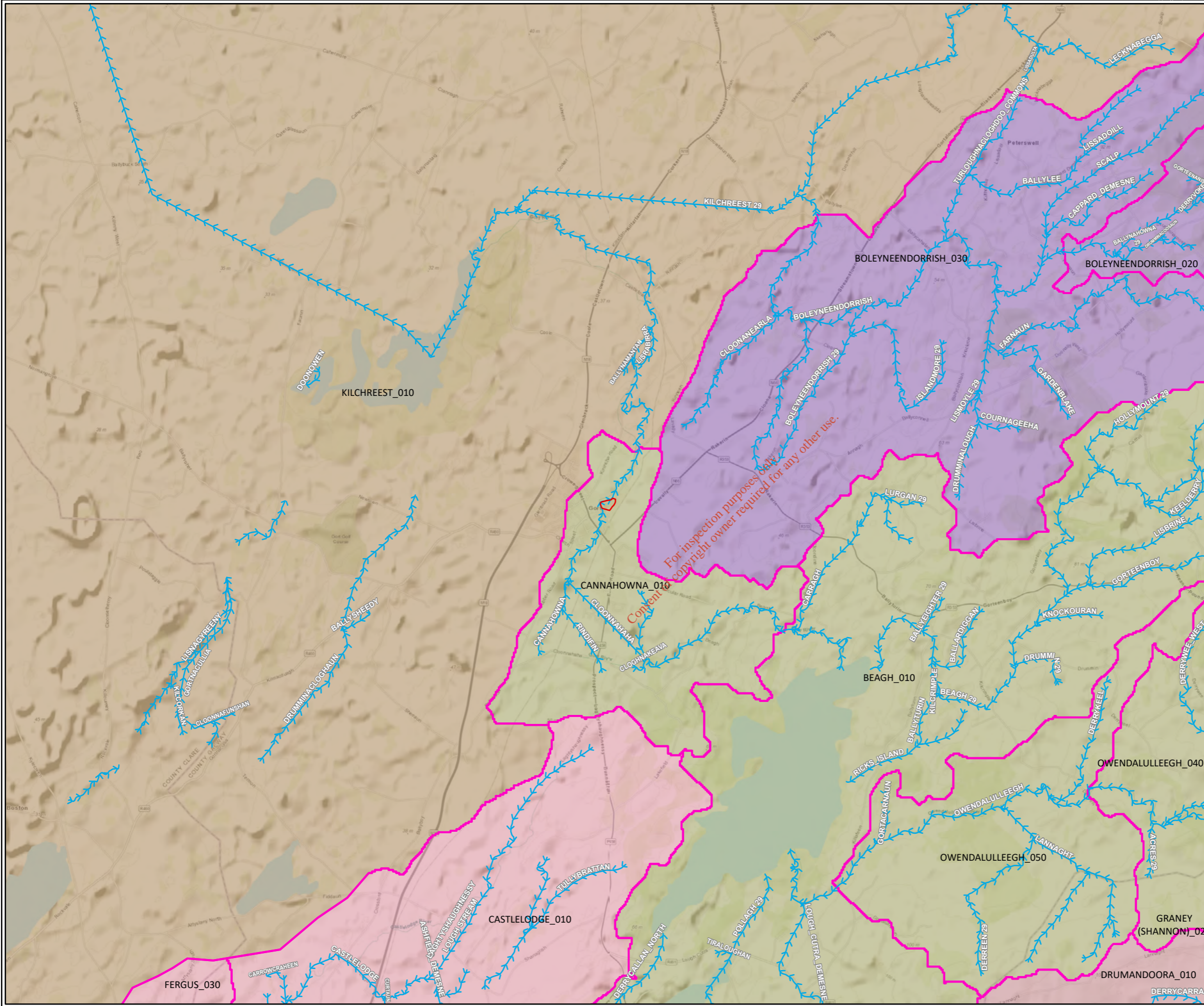
There are no recorded geo-hazards within the site boundary or in the surrounding area or region.

2.2.11 Archaeological Heritage

Review of the 1837-1842 and 1888-1913 OSI historical maps for the area do not indicate the presence of any significant archaeological features within the site boundaries. The 1837-1842 mapping did indicate the presence of a corn mill, a castle and barracks c.100 m to the south of the site, still displayed on the 1888-1913 maps.

Review of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs’ online historic environment viewer/database indicates the presence of a corn mill, a castle and a ringfort – rath (barracks built around 18th century) within c.100 m of the site, which corresponds with the monuments shown in the 1837-1842 and 1888-1913 OSI maps. The historic environment viewer does note that the castle’s only surviving fragments appear to have been reinstated into later barrack walls, and there is no information available for the corn mill.

There are several others National Monuments around the site boundaries, particularly in Gort town, in a 1 km radius.



Site Boundary

Rivers

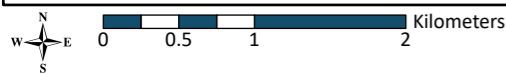
WFD River Sub Basins

WFD Sub Catchments

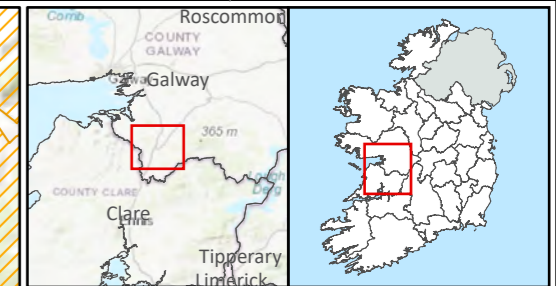
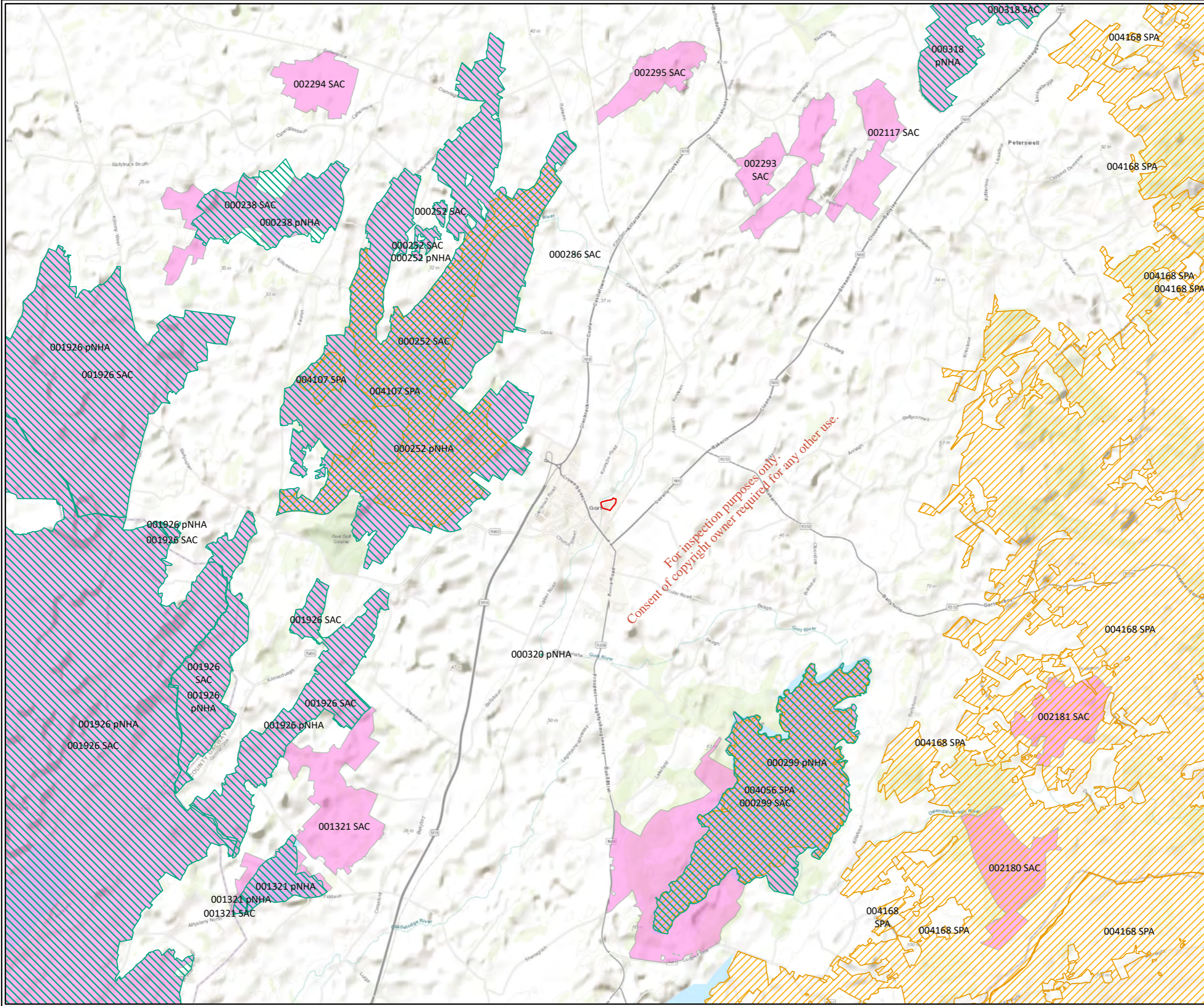
- Boleyneendorrish_SC_010
- Cannahowna_SC_010
- Fergus_SC_010
- Graney[Shannon]_SC_020
- Kilchreest_SC_010

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TITLE:	River and Waterbody Catchment	
PROJECT:	Gort Historic Landfill ERA	
FIGURE NO:	2.7	
CLIENT:	Galway County Council	
SCALE:	1:50,000	REVISION: 0
DATE:	15/10/2020	PAGE SIZE: A3



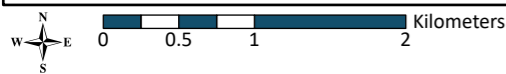
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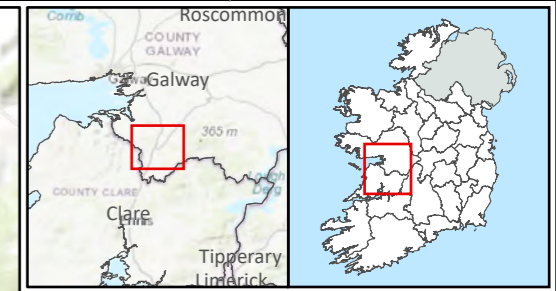
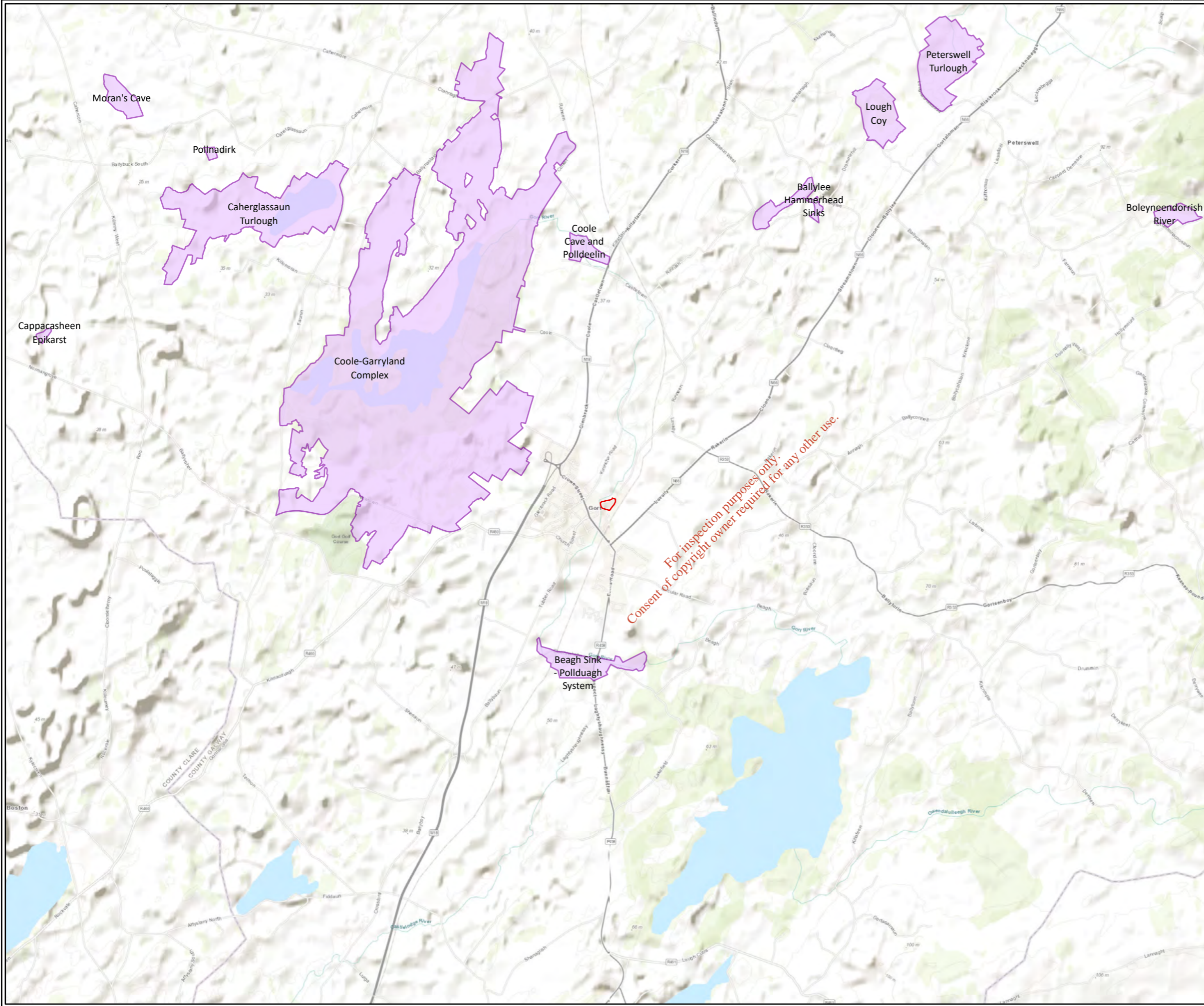


- Site Boundary
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)
- Proposed Natural Heritage Area (pNHA)
- Natural Heritage Area (NHA)

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TITLE:	Ecologically Protected Sites	
PROJECT:	Gort Historic Landfill ERA	
FIGURE NO.:	2.8	
CLIENT:	Galway County Council	
SCALE:	1:50,000	REVISION: 0
DATE:	15/10/2020	PAGE SIZE: A3





- Site Boundary
- Geological Heritage Sites (Audited Boundaries)

TITLE:	Geological Heritage	
PROJECT:	Gort Historic Landfill ERA	
FIGURE NO:	2.9	
CLIENT:	Galway County Council	
SCALE:	1:50,000	REVISION: 0
DATE:	15/10/2020	PAGE SIZE: A3





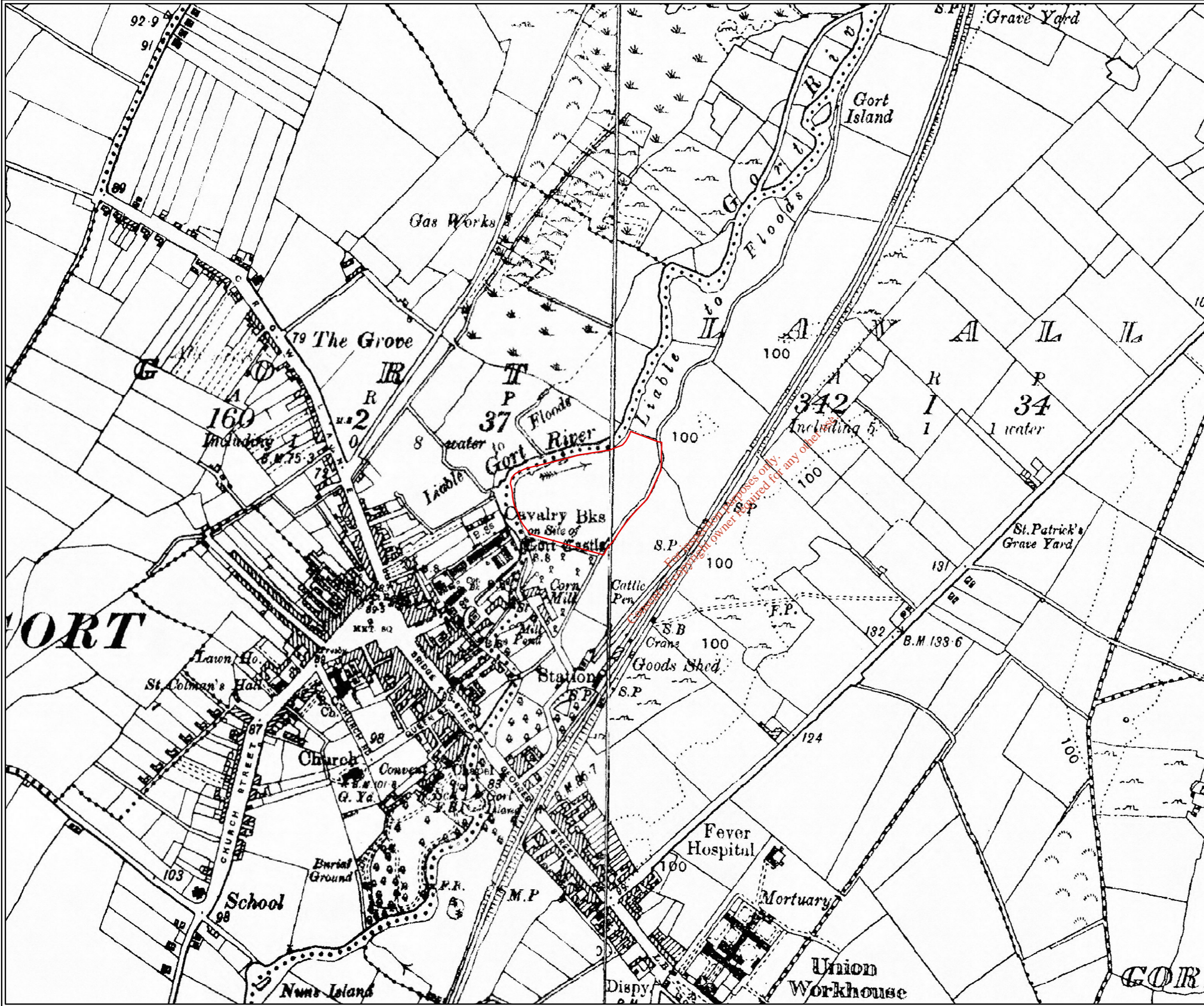
2.2.12 Site History

The earliest historical map available on the OSI website dates from 1837-1842 and 1888-1913. The OSI identifies the land within the site boundary was mainly cropping rock with a small portion of deciduous plantation. There are no distinct features noted within the site boundary or in the vicinity, on both map series that would indicate any specific use or activity at the site.

OSI aerial imagery, from 1995 and 2000, shows evidence of activity at the landfill site, while on imagery from 2005-2012 and 2011-2013 indicates this activity seems to have ceased.

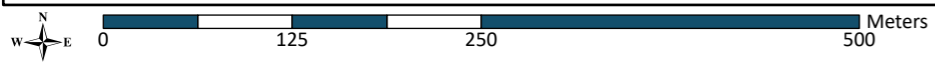
OSI historical mapping presented in Figure 2-10 and Aerial Imagery in Figure 2-11.

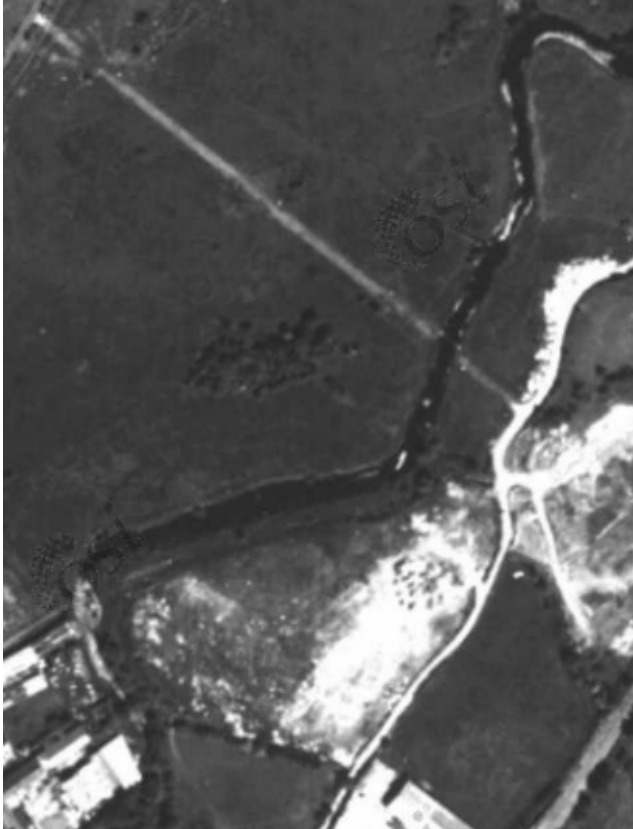
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Site Boundary

TITLE:	OSi Historical Mapping		
PROJECT:	Gort Historic Landfill ERA		
FIGURE NO:	2.10		
CLIENT:	Galway County Council		
SCALE:	1:5,000	REVISION:	0
DATE:	15/10/2020	PAGE SIZE:	A3





Historical Aerial Imagery (1995)



Historical Aerial Imagery (2000)



Historical Aerial Imagery (2005-2012)



Historical Aerial Imagery (2011-2013)

Figure 2-11: Historical Aerial Imagery¹