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Appendix 8.1 Statement of Expertise

8.1.1 The evaluation of the Water (hydrological and hydrogeological) environment and the assessment of Effects and Potential Impacts, with Mitigation Measures and Remedial Impacts, was completed by Dr. Pamela Bartley (Hydro-G) who is considered a karst groundwater specialist with quarry, Section 4 Discharge Licencing and Public Water Supply expertise.

8.1.2 Hydro-G holds the required Professional Indemnity Insurance, Employers and Public Liability Insurance.

8.1.3 Pamela is a member of Engineers Ireland and the International Association of Hydrogeologists (Irish Group).

8.1.4 Pamela is a water focussed civil engineer with almost 30 years of practical experience in field-based groundwater investigations, drilling, instrumentation, surface water sampling, flow gauging and impact assessments, public water supply from groundwater boreholes, quarry assessments, Section 4 Discharge Licensing and wastewater treatment using Nature Based Systems.

8.1.5 Pamela completed her primary training in the RTC system. She completed a Certificate in Civil Engineering in Letterkenny RTC and a Diploma in Water and Wastewater Engineering at Sligo RTC in the early 1990's. Her Bachelor of Engineering degree was completed in the school of Civil Engineering at Queen's University, Belfast, and her postgraduate education at the School of Civil Engineering at Trinity College, Dublin (TCD). She completed an MSc. in Environmental Engineering at the School of Civil Engineering at TCD, which had geotechnical, hydrology, hydrogeology and legislation specialities and later a hydrogeologically focussed Ph.D at TCD.

8.1.6 Pamela is considered an Expert Service Provider to Uisce Eireann, she is a panel hydrogeologist, PSCS and PSDP approved and Supplier Number 1855 applies.

8.1.7 With respect to the extractive industry, Pamela is considered an EIA specialist with discharge licensing competency in the context of the Water Pollution Act, enacted Irish Regulation and EU Directives.

8.1.8 She has completed impact assessments and assisted in successful permission attainment for many regionally important quarries in SAC settings.

8.1.9 Pamela's quarry assessments, successful EIARs gaining planning and associated Section 4 Discharge Licences include, as follows:

(i) Bennettsbridge Limestone, Co. Kilkenny consent to continue at an existing site following previous refusals at Board level and successful review update of the Section 4 Discharge Licence (ENV/W/78, 2017) permitting a range of 22,000m3/d as the annual average with maximums up to 70,000m3/d throughout the rainfall season. The discharge is to a drain that discharges to the River Nore. The large range is because it is a diffuse karst aquifer and during high rainfall there is a large volume of water on the floor carried through the epikarst of the walls.

(ii) Mc Grath Limestone Works Ltd, Cong, Co. Galway (W391/05_R1, 2019) permitting a discharge of 10,000m3/d to the Cong Canal upstream of Lough Corrib (SAC, SPA, proposed NHA & Public Water Supply for Galway City and environs).

(iii) Churchill Stone Ltd. (Cassidys), Keeloges, Churchill, Letterkenny, Co. Donegal. Section 4 Discharge (Lwat65) permitting discharge to a headwater and upstream of the commencement of mapping for a Pearl Mussel River.

(iv) Harrington Concrete and Quarries, Ardgaineen, Co. Galway (W_502_22) permitting a discharge of 1,435m3/d to a grassed vegetation area, following an oil interceptor, and subsequent discharge to groundwater *via* a Nature Based System in a conduit karst aquifer in a Hydrometric Area of Lough Corrib SAC and SPA.

(v) MC Group, Castleisland (W214), Co. Kerry, permitting a discharge of 540m3/d to surface water.

Each of these quarries operates within SAC catchments or in proximity to NHA Bogs and they have successfully managed their discharge, under licence, for many years.

Appendix 8.2 Section 4 Discharge Licence W/469/13 (2013) & Galway County Council Compliance Letter

COMHAIRLE CONTAE NA GAILLIMHE

LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977 & 1990

LICENCE TO DISCHARGE TRADE OR SEWAGE EFFLUENT TO WATERS

Coshla Quarries Ltd.
Cashla
Athenry
Co. Galway

Reference No. in Register
W/469/13

Galway County Council in exercise of the powers conferred on it by the Local Government (Water Pollution) Act 1977 as amended by the Local Government (Water Pollution) Act 1990, hereby grants a licence, Reference number **W/469/13** to discharge trade effluent (*i.e. surface water runoff and groundwater ingested from the quarry area only*) from a silt settlement tank and petrol/oil interceptor at the **Coshla Quarries Ltd.** premises located at **Cashla, Athenry, Co. Galway** to groundwater subject to the conditions set out in the Schedule hereto.

Signed this 30th **day of** Aug **2013**

On behalf of Galway County Council.

Director of Services, Water and Environment,

IMPORTANT NOTICE

Any person may, **before the expiration of the prescribed period, appeal to An Bord Pleanala** against the grant or refusal of a licence, the conditions attached to a licence or the amendment or deletion of conditions or the attachment of new conditions following review of a licence. (See Section 8 Local Government (Water Pollution) Act, 1977).

The prescribed period as per Article 26 of the Local Government (Water Pollution) Regulations 1978 and 1992 is the period of one month beginning on the date of the grant or refusal of the licence or in the case of a decision of the Local Authority following on a review of a licence the date of that decision. (The relevant date is as shown above).

An appeal must be made in writing, stating the subject matter of the appeal and the grounds of appeal and must be accompanied by a deposit of €126. The address of An Bord Pleanala is 64 Marlborough Street, Dublin 1.

An Bord Pleanala, after consideration of any appeal lodged with it, may direct the Local Authority to grant or revoke a licence or to amend or attach conditions relating to it.

SCHEDULE TO LICENCE NO. W/469/13

RECEIVED: 04/03/2025

1. Scope

This licence refers to the silt settlement tank discharge of Coshla Quarries Ltd. located at Cashla, Athenry, Co. Galway. Surface water run-off and ground water ingested on site are pumped from a sump to the silt settlement tank and discharged to groundwater via a percolation lagoon. The maximum discharge is 360m^3 per day.

2. Silt Settlement Discharge

2.1. Discharge

The Licensee shall not discharge, cause or permit the discharge of any contaminated surface water or process water directly to any surface water or groundwater without prior treatment.

2.2. Treated Discharge

The treated discharge shall be discharged to groundwater without posing a pollution risk.

2.3. Discharge Performance Standards

The treated discharge, **prior to its release** to groundwater, shall comply with the following standards:

(a) The **Total Suspended Solids** concentration of the discharge from the settlement lagoon and oil interceptor shall not exceed 35mg/litre,

(b) The **Biochemical Oxygen Demand** concentration of the discharge from the settlement lagoon and oil interceptor shall not exceed 25mg/l

(c) The **Chemical Oxygen Demand** concentration of the discharge from the settlement lagoon and oil interceptor shall not exceed 100mg/l

(d) The **Nitrate (NO_3^-)** concentration of the discharge from the settlement lagoon and oil interceptor shall not exceed 50mg/l

(e) The **Total Hydrocarbon** concentration of the discharge from the settlement lagoon and oil interceptor shall not exceed 1 mg/l.

(f) The **Temperature** of the discharge from the settlement lagoon and oil interceptor shall not exceed 20^{o}C

(g) The **pH** of the discharge from the settlement lagoon and oil interceptor shall not exceed the range of 6-9 pH units.

(h) The **Flow** of the discharge from the settlement lagoon and oil interceptor shall not exceed a volume of 360m^3/day

(i) The **Colour** of the discharge from the settlement lagoon should not change significantly from day to day nor shall there be any evidence of oil and excess solids on visual inspection

(j) The **Conductivity** of the discharge from the settlement lagoon and oil interceptor shall not change significantly from day to day

(k) The **Turbidity** of the discharge from the settlement lagoon and oil interceptor shall not change significantly from day to day

3. Discharge Analysis

Analysis of the treated water prior to its discharge shall be carried out by an approved accredited laboratory where readings are not taken on site. The frequency of analysis and the parameters are outlined below. Results of the same shall be forwarded to the Environment Section of Galway County Council on a quarterly basis:

Parameter	Monitoring frequency	Analysis to be performed by accredited laboratory
Flow	Continuous - Daily	
Colour and visual inspection	Daily	
Conductivity	Continuous - Daily	
Turbidity	Continuous - Daily	
pH	Continuous - Daily	
	Quarterly	√
Temperature	Monthly	
	Quarterly	√
Total Suspended Solids	Monthly	
	Quarterly	√
Nitrates NO_3^-	Quarterly	√
Chemical Oxygen Demand	Quarterly	√
Biochemical Oxygen Demand	Quarterly	√
Total Hydrocarbons including Diesel range organics and petroleum range organics	Bi annually	√

4. Groundwater Analysis

Quarterly analysis of groundwater monitoring wells shall be carried out by an approved accredited laboratory.

The following parameters shall be measured and the analysis of the same forwarded to the Environment Section of Galway County Council:

Parameter	Units
(a) Water level	mAOD
(b) pH	pH units
(c) Conductivity	μS
(d) Suspended Solids	mg/l
(e) Nitrates	mg/l NO_3

Analysis shall be carried out on the following parameters; water level, pH, conductivity, nitrates and suspended solids.

Where quarrying activities are found to adversely affect local water supplies the provisions of the EPA Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-Scheduled Minerals)', Section 3.3.1 shall apply and the quarry shall provide a replacement water supply.

5. Petrol / Oil Interceptor

The petrol / oil interceptor should be inspected each working day to ensure it is operating correctly and daily records kept of this. These records should be made available to Galway County Council if requested.

6. Treatment Lagoon

6.1. Treatment process

All surface water runoff and groundwater ingested shall be treated in the settlement tank prior to discharge. The settlement tank shall be capable of fulfilling the requirements of this licence as outlined in condition No. 2.3 above. Failing this it will be necessary for the licensee to make the necessary changes to the system. The Environment Section of Galway County Council must be notified of any proposed alternations to the treatment process.

6.2. Metering

An approved flow meter shall be fitted to the discharge pipe to allow for the measuring and recording of the daily volume discharged. These records shall be maintained and be available on request to Galway County Council staff. Daily flow reading shall be submitted to the Environment Section of Galway County Council on a quarterly basis. The maximum volume of water discharged from the settlement tank via the oil interceptor is $360m^3$ per day.

6.3. Ready access

Access to the settlement lagoons and all its installations, shall be allowed to authorised persons appointed under the provisions of the Local Government (Water Pollution) Acts, 1977 and 1990.

6.4. Sampling

A sampling chamber shall be installed at the end of treatment system to allow for the taking of samples of the treated discharge in a safe manner. Ready access to the sampling chamber must be provided at all times.

6.5. Caretaker

The day to day inspection and maintenance of the settlement tank shall be the responsibility of the Licensee. The caretaker shall ensure that all pumps and meters are operating correctly and are part of the maintenance program. Records of all servicing shall be maintained and be available on request to Galway County Council staff. A copy of this licence shall be issued to all relevant personnel whose duties relate to any condition of the licence. The name and address of this appointed person shall be supplied to the Environment Section of Galway County Council within 4 weeks from the issuing of this licence. In the event of any change in personnel this change shall be made known immediately.

6.6. Notification of Non Compliance

The Environment Section of Galway County Council must be notified as soon as practicable after the occurrence of any of the following:

- Any discharge that does not comply with the requirements of the licence
- Any incident with potential for environmental contamination of surface water or groundwater

The licensee shall include as part of the notification, date and time of the incident, details of the occurrence and the steps taken to minimize the emissions and avoid recurrence.

The licensee shall notify the Environment Section of Galway County Council prior to further processing that may impact the effective working of the treatment system.

7. EPA Guidelines

All works must be carried out in accordance to the EPA guidelines 'Environmental Management in Extractive Industry (Non-Scheduled Minerals)'.

8. Annual Contribution

The Licence holder shall pay to Galway County Council an annual contribution of €550. The contribution will be used towards the cost of such monitoring of the activity, as the Council considers necessary for the performance of its duties under the Water Pollution Act 1977-1990.

This amount to be paid shall be adjusted annually in accordance with the Consumer Price Index value appertaining at the time when the payment becomes due. Galway County Council reserves the right to alter the rate of contribution each year in order to take account of the actual cost of monitoring incurred by it in the previous year and estimated for the next year.

9. Changes in ownership

The Environment Section of Galway County Council must be notified in writing of any change to company ownership and/or trading name.

END.

Áras an Chontae,
Cnoc na Radharc, Gaillimh.
H91 H6KX.

Áras an Chontae,
Prospect Hill, Galway.
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Seirbhísí Corparáideacha
Corporate Services
(091) 509 225
corpserv@galwaycoco.ie

Tithíocht
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Pleanáil
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(091) 509 308
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Timpeallacht & Tréidliacht
Environment & Veterinary
(091) 509 510
environment@galwaycoco.ie

Infreastruchtúr fisiciúil
agus Athrú Aeráide
Physical Infrastructure
and Climate Change
(091) 509 309
roads@galwaycoco.ie

Acmhainní Daonna
Human Resources
(091) 509 303
hr@galwaycoco.ie

Mótarcháin
Motor Taxation
(091) 509 099
motortax@galwaycoco.ie

Clár na dToghthóirí
Register of Electors
(091) 509 310
electors@galwaycoco.ie

Forbairt Tuaithe agus Pobail
agus Imeascadh
Rural and Community
Development and Integration
(091) 509 521
community@galwaycoco.ie

Leabharlann
Library
(091) 509 388
info@galwaylibrary.ie

Comhairle Chontae na Gaillimhe
Galway County Council

RECEIVED: 04/03/2025

Mr Martin Collins
Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

29th January 2025

Re: Discharge Licence Reference Number W 469/13

A Chara,

On the 17th December 2024 a site visit was carried out to Coshla Quarries, Cashla, Athenry County Galway. A sample of effluent was taken prior to discharge to the percolation lagoon. The analysis results for this sample are attached.

The results are in compliance with your discharge licence no. W 469/13. To ensure on-going compliance, the treatment plant must continue to be supervised and maintained on a regular basis.

Under conditions 3 and 4 of your discharge licence you are required to arrange for analysis of the treated effluent and groundwater 4 times per annum. Please submit analysis results within **one month** of the date of this letter.

If you have any queries regarding your discharge licence, please contact David O Connell or Fintan Donnelly at 091 509510.

Is mise le meas,

David O'Connell

David O Connell
Environment Section.

Laboratory Analysis Report

Sample Location : Private WWTP - Licenced
W 469/13 Coshla Quarries Ltd, Station : DP1200DPW469/130001
Grid Coordinates : X: 142700 Y: 228500

Sample Details : Reference : 24446612
Template : W 469/13 Coshla Quarries Ltd
Sampled by : Galway County Council
Sample Date: 17/12/2024 @ 10:50 Method: Grab

Laboratory : Roscommon Co Co
Analyst : Lab Admin

Sample Notes : ---- ----

Sample Parameters		Parameter Standards		Results	
Parameter	Unit	Max. Limit	Min. Limit	Date	Result
Biological Oxygen Demand	mg/l	25	--	17/12/24	< 1
COD Chemical Oxygen Demand	mg/l	100	--	17/12/24	< 20
pH	pH units	9	6	17/12/24	7.83
Suspended Solids	mg/l	35	--	17/12/24	4.5
Total Nitrogen N	mg/l	--	--	17/12/24	1.88
Total Phosphorus P	mg/l	--	--	17/12/24	0.013
Ammonia N	mg/l	--	--	17/12/24	0.141
Ortho-Phosphate P	mg/l	--	--	17/12/24	< 0.006

RECEIVED: 04/03/2025

Approved pp D O'Connell : Date 29/1/25 : Signed David O'Connell David O'Connell, Executive Technician

Queries in relation to this report should be addressed to environ@galwaycoco.ie

Appendix 8.3 Guidance Documents & Legislative Instruments

1) Department of Environment, Heritage and Local Government (2004) Quarries and Ancillary Activities – Guidelines for Planning Authorities.

2) Department of Housing, Planning and Local Government (2013) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

3) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Official Journal L 327, 22.12.2000, p. 1–73.

4) Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (EIA Directive).

5) EPA (1999) WWT systems for small communities and businesses.

6) EPA (2006) Environmental Management Guidelines for the Extractive Industry (Non-Scheduled Minerals).

7) EPA (2009) Code of Practice WW treatment for single houses.

8) EPA (2011) Guidance on the Authorisation of Discharges to Groundwater. Version 1 - December 2011.

9) EPA (2018) 30_13 Clare[Galway]_SC_060 Subcatchment Assessment WFD Cycle 2.

10) EPA (2021) Code of Practice Domestic Waste Water Treatment Systems (Population Equivalent ≤ 10). Published by the Environmental Protection Agency, Ireland. March 2021.

11) EPA (2022) Guidelines on the information to be contained in Environmental Impact Statements. ISBN 978-1-80009-005-7. May 2022.

12) European Communities (Birds and Natural Habitats) (AMENDMENT) Regulations, 2021. S.I. No. S.I. No. 293 of 2021.

13) European Communities (Birds and Natural Habitats) Regulations, 2011. S.I. No. 477 of 2011, as amended 2021 as S.I. No. 293 of 2021.

14) European Communities (Conservation Of Wild Birds (Lough Corrib Special Protection Area 004042)) Regulations 2012. S.I. No. 455 Of 2012.

15) European Communities (Quality of Salmonid Waters) Regulations, 1988. S.I. No. 293/1988.

16) European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2011, S.I. No. 389 of 2011.

17) European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2012, S.I. No. 149 of 2012.

18) European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2016. S.I. No. 366 of 2016.

19) European Communities Environmental Objectives (Groundwater) Regulations, S.I. No. 9 of 2010, as amended 2019 as S.I. No. 366 of 2019.

20) European Communities Environmental Objectives (Surface Waters) Regulations 2009 Statutory Instruments S.I. No. 272 of 2009, as amended 2012 (S.I. No. 327 of 2012), 2015 (S.I. No. 386 of 2015) and 2019 (S.I. No. 77 of 2019).

21) European Union (2017) Environmental Impact, Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU). Accessed through the Europa server (http://ec.europa.eu). Paper ISBN 978-92-7974373-3 KH-04-17-939-EN-C doi:10.2779/8247. PDF ISBN 978-92-7974374-0 KH-04-17-939-EN-N doi:10.2779/41362.

22) European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018. S.I. No. 296/2018.

23) European Union (Environmental Impact Assessment) (Environmental Protection Agency Act 1992) (Amendment) Regulations 2020. S.I. No. 191/2020.

24) European Union Conservation of Wild Birds (Inner Galway Bay Special Protection Area 004031) Regulations 2019 [S.I. No. 515 of 2019].

25) European Union Habitats (Galway Bay Complex Special Area of Conservation 000268) Regulations 2021 [S.I. No. 548 of 2021].

26) European Union (Drinking Water) Regulations 2023 (S.I. No. 99 of 2023).

27) European Union Habitats (Lough Corrib Special Area of Conservation 000297) Regulations 2022. S.I. No. 384/2022.

28) Ferguson & Leask (1988) The export of nutrients from surface coal mines. Environment Canada conservation and protection environmental protection pacific and Yukon region west Vancouver, British Columbia.

29) Institute of Geologists of Ireland (IGI, 2002) Geology in Environmental Impact Statements: A Guide

30) Institute of Geologists of Ireland (IGI, 2013). Guidelines for the Preparation of Soils, Geology & Hydrogeology Chapters of Environmental Impact Statements.

31) NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide.

32) NRA (2009) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. @ https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf.

33) Office of Public Works and Department of Environment, Heritage and Local Government (2009) The Planning System and Flood Risk Management: Guidelines for Planning Authorities.

34) SNH (2018) Scottish National Heritage A handbook on environmental impact assessment: Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland, Scottish Natural Heritage, 5th Edition, 2018. Section C8.

Appendix 8.4 Desk Study Resources, Data & Maps

The following Desk Study Resources, Books, Data & Mapping information were used in the compilation of this assessment:

- Bartley, P. (2003) Nitrate Responses in Groundwater beneath Dairy grassland Agriculture. PhD Tesis Trinity College Dublin. Vol I and Vol II. Available at https://www.tara.tcd.ie/handle/2262/76240/discover
- Boak, et al. (2007) Using Science to Create a Better Place: Hydrogeological Impact Appraisal for Dewatering Abstractions. Environment Agency, Science Report – SC40020/SR1. Bristol, UK.
- Boycott, T., Drew, D., Mullan, G., Podesta, J., Simms, M., Wilson, L. (2019) Caves of Mid-West Ireland. Counties Clare, Galway, Mayo and Roscommon. The University of Bristol Speleological Society ISBN 978-0-954850-1-3.
- Bradford, R., McCormack, T., Campanya, J., Naughton, O. (2019) Groundwater Flooding in Ireland: New Methods for Flood Monitoring And Mapping. IAH Irish Group Conference Tullamore, April 2019.
- Coxon, C., and Drew, D.P. (1986) Groundwater flow in the lowland limestone aquifer of eastern Co. Galway and eastern Co. Mayo, western Ireland. In: Paterson, K & Sweeting M. (eds), New Directions in Karst.
- Daly, D. (1985) Groundwater in County Galway with particular reference to its Protection from Pollution. Geological Survey of Ireland report for Galway County Council. 98pp.
- Department of Housing, Local Government and Heritage (2024). Water Action Plan 2024: A River Basin Management Plan for Ireland. Plus associated Appendices: *e.g.,* Appendix 2: Programme of Measures - List of Measures; https://www.gov.ie/en/policy-information/8da54-river-basin-management-plan-2022-2027/.
- Drew D.P. and Daly D. (1993) Groundwater and Karstification in Mid-Galway, South Mayo and North Clare. A Joint Report: Department of Geography, Trinity College Dublin and Groundwater Section, Geological Survey of Ireland. Geological Survey of Ireland Report Series 93/3 (Groundwater), 86 pp.
- Drew, D. (1990) The hydrology of the Burren, Co. Clare. Irish Geography 23(2), 69–89.
- Drew, D. (2001) The Burren and the Gort-Kinvara Lowland, Groundwater Flow Systems in Karstified Limestones.
- Drew, D. (2008) Hydrogeology of lowland karst in Ireland. Quarterly Journal of Engineering Geology and Hydrogeology 41(1), 61–72.
- Drew, D. and Jones, G.L. (2000) Post-Carboniferous Pre-Quaternary karstification in Ireland. Proceedings of the Geologists' Association 111, 345–53.
- Drew, D.P. (1973a) Hydrogeology of the north Co. Galway – south Co. Mayo lowland karst area, Western Ireland. International Speleology 1973, III, Sub –section Ca.
- Drew, D.P. (1973b). Ballyglunin Cave Co. Galway and the hydrology of the surrounding area. Irish Geography Vol. 6, No. 5. pp 610-617.
- Drew, D.P. (2003) The hydrology of the Burren and of the Clare and Galway Lowlands. In G. Mullan (ed.), Caves of County Clare and South Galway, 31–43. Bristol. University of Bristol Speleological Society.
- Drew, D.P., Doerfliger, N. and Formentin, K. (1997) The use of bacteriophages for multi-tracing in a lowland karst aquifer in western Ireland. In A. Kranjc (ed.) Tracer Hydrology, 33–8. Rotterdam, Balkema.
- EPA (2019) WFD Cycle 2 Catchment Galway Bay South East Subcatchment CARROWMONEASH [Oranmore]_SC_010.
- EPA (2019) WFD Cycle 2 Catchment Galway Bay South East. Sub Catchment 29_7 Cannahowna_SC_010.
- EPA (2023) River Quality Survey Biological, Report, Hydrometric Area 29.

- EPA (2024) WFD Cycle 3 HA 29 Galway Bay South East Catchment Report, May 2024. Catchment Science & Management Unit Environmental Protection Agency. May 2024.
- EPA Envision System (https://gis.epa.ie/EPAMaps/).
- GSI On-line Groundwater database. Aquifer Classification, Aquifer Vulnerability, Teagasc Soil Classification, Subsoils, Karst features, groundwater recharge.– online mapping resources (www.gsi.ie).
- Gill, L. (2010) 'Modelling a network of turloughs', [thesis], Trinity College (Dublin, Ireland). Department of Civil, Structural and Environmental Engineering, 2010, pp 397.
- Gill, L. *et al*. (2016). EcoMetrics – Environmental Supporting Conditions for Groundwater-dependent Terrestrial Ecosystems (2016-W-LS-13) EPA Research Report. Laurence Gill, Saheba Bhatnagar, Ella Bijkerk, Shane Regan, Celia Somlai, Owen Naughton, Bidisha Ghosh, Stephen Waldren, Catherine Coxon and Paul Johnston.
- GSI (2003, 2005) Bedrock Geology Sheets 11, 14 & 15, 1:100,000 Map Series. Geological Survey of Ireland.
- GSI (2004) 1st Draft Clarinbridge GWB Description June. Summary of Initial Characterisation.
- GWP Consultants and David Jarvis Associates Limited, UK (2014) A Quarry Design Handbook. 2014 Edition.
- HES (2020) Hydrology & Hydrogeology Chapter for Coshla Quarries Ltd. EIAR. PL Application.
- Irish Group. Karst Field Trip October (2001) Unpublished IAH Report.
- Kimberley, S., Naughton O., Regan, S. (2014) Assessing significant damage to selected Irish Groundwater Dependent Terrestrial Ecosystem (GWDTE) types as part of groundwater body classification under the EU Water Framework Directive. International Association of Hydrogeologists (IAH) Irish Group, Tullamore, Ireland. In: Water Resource Management: The role
- Kinahan, G.H. (1865) Explanations to cover sheets 115–116. Dublin. Memoirs Geological Survey of Ireland.
- Kozlowski, A. and Warny, J. 2009. Baptism of Fire: Underwater exploration beneath the Gort Lowlands. Irish Speleology18: 37 - 42.
- McCormack, T., Gill, L.W., Naughton, O., Johnston, P.M., (2014). Quantification of submarine/intertidal groundwater discharge and nutrient loading from a lowland karst catchment. Journal of Hydrology 519: 2318 – 2330.
- McCormack, T., Naughton, O., Bradford, R., Campanyà, J., Morrissey, P., Gill, L., (2020) GWFlood Project: Monitoring, Modelling and Mapping Karst Groundwater Flooding in Ireland Geological Survey Ireland Report
- McCormack, T., Naughton, O., Bradford, R., McAteer, J., (2018). "Satellite flood mapping: New approaches for monitoring and mapping groundwater flooding in Ireland", 38th Annual Groundwater Conference - International Association of Hydrogeologists (IAH) Irish Group, Tullamore, Ireland.
- Meehan, R., Gallagher, V., Hennessy, R., Parkes, M. & Gatley, S. 2019. *The Geological Heritage of County Galway. An Audit of County Geological Sites in County Galway*. Geological Survey Ireland. Unpublished Report.
- Met Eireann (https://www.met.ie/).
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Appendix 8.5 Scoping Responses of Relevance to Water: HSE & GSI

In this Appendix, the full Text of each Scoping Response are presented. The Impact Tables at the end of the EIAR Water Chapter incorporate all Risk information.

Hydro-G offers:

- All GSI data and mapping resources have been employed, as requested by the GSI.
- Impact on all wells has been considered and assessed as per the requests of the HSE.
- With respect to the HSE's request for assessment of the site's sanitary services, they were sanctioned and approved under historic planning permissions.
- Overall, there is Zero Risk presented by the site to groundwater for reasons expanded upon in the EIAR. The most significant points are that the site operates above the groundwater flow system and there are no direct links to any surface water or terrestrial water systems.
- A Quantitative Water Balance suggests that the site's management of waters arising, and discharge, accounts for <0.5% of the groundwater in the GWB and there is no net loss because the 'abstraction', after appropriate settlement time, becomes a Discharge returning the waters to the same hydrological system.
- The Conditions of the Section 4 Licence preclude impact. Refer to Appendix 8.2.
- In overall summary, the 'Source > Pathway > Model' by virtue of the application of the UK EA Dewatering Impact Appraisal Process and, in combination with the Section 4 Discharge Licence enables a conclusion of no residual risk.

It is acknowledged that the Statutory Scoping Responses are for the 2020 EIA submitted as PL20/499. However, the development description and site are essentially the same in all that matters.

Roinn Cumarsáide, Gníomhaithe
ar son na hAeráide & Comhshaoil
Department of Communications,
Climate Action & Environment

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

MKO
Tuam Road
H91 VW84
County Galway

27 November 2019

Re: Informal EIAR Scoping for Coshla Quarry extension, Cashla, Athenry, Co. Galway

Your Ref: 180918
Our Ref: 19/259

Thomas, a chara,

With reference to your email received on 14 November 2019, concerning the proposed extension of Coshla Quarry in the townland of Barrettspark, Co. Galway, Geological Survey Ireland (a division of Department of Communications, Climate Action and Environment) would like to make the following comments:

Geological Survey Ireland is the national earth science agency and has datasets on Bedrock Geology, Quaternary Geology, Geological Heritage Sites, Mineral deposits, Groundwater Resources and the Irish Seabed. These comprise maps, reports and extensive databases that include mineral occurrences, bedrock/mineral exploration groundwater/site investigation boreholes, karst features, wells and springs. Please see our website for data availability and we recommend using these various data sets, when undergoing the planning and scoping processes. Geological Survey Ireland should be referenced to as such and should any data or geological maps be used, they should be attributed correctly to Geological Survey Ireland.

Geoheritage
Geological Survey Ireland (GSI) is in partnership with the National Parks and Wildlife Service (NPWS, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs) to identify and select important geological and geomorphological sites throughout the country for designation as geological NHAs (Natural Heritage Areas). This is addressed by the Irish Geoheritage Programme (IGH) of GSI, under 16 different geological themes, in which the minimum number of scientifically significant sites that best represent the theme are rigorously selected by a panel of theme experts.

County Geological Sites (CGS), as adopted under the National Heritage Plan are now included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system. CGSs can be viewed online under the Geological Heritage tab on the online Map Viewer. Though the audit for Co. Galway will be published later this year, **our records show that there are no current CGSs in the vicinity of Coshla Quarry.**

Our aim is not to prevent further quarrying, as the very process of extraction provides Geological Survey Ireland with much valuable data that can be added to our national databases, but our purpose in protecting and promoting geological heritage is partly educational both for the public and the geologist. The IGH programme has numerous working quarries on its database where there are significant geological sections or features exposed within the quarry. In fact, new exposures through quarrying may reveal new features of interest to the geologist, and we have in the past requested that periodic monitoring of the new faces be permitted. In this respect, Geological Survey Ireland would appreciate notification of commencement from the applicant.

We also encourage discussion on end-of-life plans for the quarry and would be happy to recommend ways to promote the geology to the public or develop tourism or educational resources if appropriate. Geological Survey Ireland would like to offer help with interpretative signs where interesting geological features have been exposed, if appropriate.

The Geoheritage Programme tries to promote a partnership between geological heritage and active quarrying, with such measures as those outlined in the 'Geological Heritage Guidelines for the Extractive Industry', which can be downloaded here. This document, written in association with Irish Concrete Federation, acts as a comprehensive guide in the sustainable extraction of natural resources while preserving the geological heritage of Ireland.

Groundwater

Groundwater is important as a source of drinking water, and it supports river flows, lake levels and ecosystems. It contains natural substances dissolved from the soils and rocks that it flows through, and can also be contaminated by human actions on the land surface. As a clean, but vulnerable, resource, groundwater needs to be understood, managed and protected. Through our Groundwater Programme, Geological Survey Ireland provides advice and maps to members of the public, consultancies and public bodies about groundwater quality, quantity and distribution. Geological Survey Ireland monitors groundwater nationwide by characterising aquifers, investigating karst landscapes and landforms and by helping to protect public and group scheme water supplies. With regard to Flood Risk Management, there is a need to identify areas for integrated constructed wetlands. We recommend using the GSI's National Aquifer and Recharge maps on our Map viewer to this end.

Geological Survey Ireland commends the use of our subsoils, aquifer and groundwater vulnerability datasets in the 'Description of the development site' section of the informal EIAR scoping, and hope to see these datasets also included in the final EIAR.

I hope that these comments are of assistance, and if we can be of any further help, please do not hesitate to contact me, or my colleague Clare Glanville (Clare.Glanville@dccae.ie).

Le meas,

Amrine Dubois Gafar

Amrine Dubois Gafar
Geoheritage Programme

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Seirbhís Sláinte Timpeallachta,
Feidhmeannacht Na Seirbhíse Sláinte,
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HSE EIAR Scoping Consultation Report
Environmental Health Service Submission Report

Date:	12 December 2019
Our reference:	EHIS 1043
Consultant Reference:	180918
Report to:	McCarthy Neville O'Sullivan Ltd, Tuam Road, Galway
Type of Consultation:	EIA Scoping
Applicant:	Coshla Quarries Ltd.
Proposed development:	Proposed extension to Coshla Quarry at Cashla, Athenry, Co. Galway
Nature of Activity:	The proposed extension of the existing Coshla Quarry by approximately 8.4 hectares which will be contained within the existing quarry site boundary and for the continued operation of limestone quarrying activities at the existing Coshla Quarries Ltd. site at Cashla, Barrettspark, Co. Galway.

The EIAR should identify the nearest sensitive receptors and consider the impact of the existing and proposed development on them. Sensitive receptors include, but are not limited to

- occupied houses
- farms (including stud farms and facilities for the production of vegetables and crops)
- schools
- childcare facilities
- medical facilities and nursing homes
- golf courses, sports and community facilities and
- food premises.

General

The Environmental Health Service (EHS) considers the following should be assessed in the Environmental Impact Assessment (EIA)

- Any potentially significant emissions to surface water
- Any potentially significant emissions to ground water
- Any potentially significant emissions to air, including noise, vibration and dust

Other areas for consideration in the EIA include

- Staff welfare facilities
- Public consultation
- Potential for future health gain from the restoration of the proposed development
- Cumulative impacts of developments in the locality

In considering the measures to be employed by the developer to minimise the potential impacts of the proposed development to human health, reference was made by the EHS to the EPA's 'Environmental Management Guidelines on the Environmental Management in the Extractive Industry (Non-Scheduled Minerals) 2006'

It is recommended that an Environmental Management System (EMS) is put in place, with training of all site staff. There should be on-going review of the effectiveness of the EMS. The EMS should be devised in accordance with international standards such as ISO 14001 2015 and EU EMAS (1993).

When assessing the above potential impacts, the existing environment, the assessment methodology and evaluation criteria should be clearly reported in the EIAR. Existing baseline assessments (noise, dust, ground and surface water quality) should be included. Any mitigation proposed should be identified and the predicted residual impact clearly stated. Assessment should be carried out for both the operation phase and the remedial phase of the proposed development.

Emissions to surface water

Should any proposed activities result in potential discharges to surface water, these activities must comply with the provisions of the Local Government (Water Pollution) Acts 1977 and 1990 and the Water Services Acts 2007-2013. If a discharge licence is required, it is recommended that the developer undertake a surface water quality baseline study to assess the existing water quality and its assimilative capacity.

Where it is proposed that there will be discharges of treated effluent from the limestone quarry into nearby watercourses, the following Emission Limit Values (ELVs) are recommended

- pH less than 9
- BOD 25mg/l
- Total Suspended Solids 35mg/l
- NO_3 50mg/l
- Chemical Oxygen Demand 100mg/l O_2

The EIA should include details as to how these ELVs will be achieved.

A suitable drainage system should be provided which minimises surface water run-off into limestone quarry extraction pit workings. This system can be by means of open channels that drain to a central storage settlement lagoon with narrow bore discharge pipes to limit flow. Lagoons should be of sufficient size to cope with flooding and periods of heavy rain and should be adequately sealed with an impermeable material to prevent leaching to groundwater.

Hard standing areas used for refuelling vehicles should drain to hydro carbon interceptors prior to discharge.

Details of the fuels and chemicals used and stored on site and the method proposed for the bunding of fuel and chemical storage tanks should be provided in the EIA. Provision should be made for the inspection and monitoring of bunding structures.

In order to minimise the wastage of water, surface water should be used for activities such as wheel washing and dust suppression.

Emissions to Groundwater

It is recommended that detailed information is gathered on the location of private wells serving properties within a 2km radius of the proposed facility. The EIA should include proposals for sampling private wells (if planning permission is granted) prior to works commencing to the quarry extension; at least biannually during the operation of the quarry and twice within the first year following cessation of operations at the site. These wells should be assessed against the parameters specified in the Drinking Water Regulations (S.I No. 122 of 2014).
Reference should be made in the EIA to the Geological Survey of Ireland's (GSI) Groundwater Protection Scheme for Co. Galway to determine if there are vulnerable groundwater sources or aquifers in the vicinity of the proposed development.

Emissions to air, including noise, vibration and dust

The EHS recommends that the developer notes the limit values specified in the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) which apply to ambient air quality in the vicinity of developments such as limestone quarries.
The EIA should establish baseline air quality at the nearest sensitive receptors by means of background air quality monitoring. Air quality monitoring should be undertaken prior to the commencement of operations in the quarry extension and throughout the operation of the site using the Bergerhoff Method as specified in the German TA Luft Air Quality Standards (TA Luft 1986). Total dust deposition should not exceed 350mg/m2 /day when averaged over a thirty day period. This is a maximum limit and the EMS should be such that dust depositions seldom reach this level.

The Environmental Management System should include dust minimisation and suppressions measures to be employed to minimise the impact of dust emissions from the quarry. Methods can include, but are not limited to

- Wheel washing of every vehicle leaving the site
- Covering every load on vehicles leaving the site
- Protect and replace vegetation on site
- Where possible, use enclosed conveyors rather than trucks within the site
- Cover stockpiles to prevent windblown dust
- Spray and wash access and haul roads frequently to suppress dust
- Provide screening berms of adequate height

- Undertake regular plant and vehicle maintenance
- Undertake regular monitoring and inspection of access and haul roads to identify and attend to accidental spillages and structural defects to roads (i.e. potholes). Proposals for an agreement between the local roads authority and the applicant for the on-going maintenance of haul roads during the operation of the proposed development should be outlined.
- Considering meteorological conditions (wind speed and wind direction) when siting stockpiles

If it is proposed to undertake blasting on site, the EHS recommends that a Vibration Monitoring Report is included in the EIA which includes blasting methods to be employed during the operation of the proposed quarry. An advanced notification system, advising occupants in the locality of the date and time of proposed blasting, should be included in the EIA. Blasting should not occur during hours of darkness or at weekends.

Consideration should be given to adopting noise reduction measures recommended in the EPA's 'Environmental Management Guidelines on the Environmental Management in the Extractive Industry (Non-Scheduled Minerals) 2006' in particular those relating to adequate screening of the site, maintenance of plant and machinery, reducing truck movements within the site and efficient methods of blasting. Details of the proposed noise mitigation measures to be employed should be included in the EIA.

The EHS recommends that reference is made by the developer to the EPA's 'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities NG4' (January 2016). The existing background noise level should be considered when assessing the impact of noise from the proposed development on local receptors and when setting ELVs.
Details of the location and frequency of noise monitoring should be included in the EIA to be submitted as part of the Planning Application.

Staff Welfare Facilities

If it is proposed to provide staff welfare facilities details must be provided in the EIAR as to how it is proposed to dispose of any waste and effluent generated from such facilities.

Public consultation

The EHS emphasises the need for early and meaningful public consultation in the development process. Accurate information should be obtained regarding the location of sensitive receptors referred to above. There should be on-going engagement with these receptors during the EIA process and the EAIR should detail proposals for keeping sensitive receptors informed and any measures to be employed during the operational phase for dealing with enquiries and/or complaints from members of the public.

The future use of the restored site should be included in the public consultation process.

Site operation times should be agreed as part of the consultation process with local residents.

Potential for future health gain from the restoration of the proposed development

A Decommissioning and Site Restoration Plan for the proposed extraction facility should be put in place. The potential to provide a facility on site which will provide an opportunity for health gain for the wider community should be considered, for example, walkways, cycle paths, woodland paths, pitch and putt course or an amenity park including a number of these options.

Due to the potential risks associated with swimming in decommissioned quarries, a restoration option which involves the infilling of the quarry would be preferred.

Cumulative impacts of developments in the locality

Other extraction and quarrying facilities within a 5km radius of the proposed facility should be identified and assessed when considering the potentially significant cumulative impacts from the proposed development. The EIA should include cumulative traffic, noise, dust and hydrological impacts.

Any queries in respect of this scoping report should be forwarded to Mr Paul Harrington Principal Environmental Health Officer at the above address

Seamus Mitchell
Senior Environmental Health Officer
Galway

Caroline Hueston
Environmental Health Officer
Environment Operational Unit

Appendix 8.6 Impact Effect Assessment Methodologies & Detail

This appendix provides a logical work through of the procedure for determining likely Effects and completing the Impacts Section of the EIAR's Water Chapter so that all activities are listed from the enabling, operational and restoration phases and for each activity the potential Effects on the water environment are listed and mitigation measures applied to each. For each mitigation measure, residual impacts are then evaluated following consideration of application of the mitigation measure.

1. Legislation and Guidance

As previously stated, the complete list of Guidance and Legislation employed in the completion of this work was presented in Appendix 8.3.

- This EIA was completed in accordance with enacted EU and Irish legislation pertaining to Environmental Impact Assessment (Directive 2014/52/EU, meaning the EIA Directive and Irish EIA Regulations (2018, as amended 2020).
- The Impact Assessment was completed with reference to Guidance relating to EIA and the preparation of EIA Reports, which includes the EU (2017); Department of Housing, Planning and Local Government (2018) and EPA (2022) on Guidelines on the information to be contained in Environmental Impact Assessment Reports.
- Criteria for assessing importance of site attributes and their magnitude of importance were taken from the NRA Guidelines (NRA, 2008) and 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013).

The tools and structure of Impact Assessment are presented here. Industry Standard Tables for rating of the Importance of Criteria, Potential Impacts, Mitigation Measure, Residual Impacts are now presented.

2. Significance of Impact

Unless otherwise stated, the EPA's method (2022) of determining the significance of impacts has been applied. There are three components to Table 3.4 of EPA (2022) and they relate to Effects under headings as follows:

I. **Quality, Significance, Extent and Context of Effects**
II. **Probability & Duration of Effects**
III. **Types of Effects**

Each of the components **of EPA (2022)'s Table 3.4** is presented here labelled as Table 1 (a), (b) and (c).

Table 1 (a) - Criteria and Terminology to be Used in Description of Effects: Quality, Significance, Extent and Context of Effects (EPA, 2022, Table 3.4)

Quality of Effects It is important to inform the non-specialist reader whether an effect is positive, negative or neutral	**Positive Effects** A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
	Neutral Effects No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative/adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).
Describing the Significance of Effects ''Significance' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful (also see *Determining Significance* below.).	**Imperceptible** An effect capable of measurement but without significant consequences.
	Not significant An effect which causes noticeable[2] changes in the character of the environment but without significant consequences.
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very Significant An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects An effect which obliterates sensitive characteristics
Describing the Extent and Context of Effects Context can affect the perception of significance. It is important to establish if the effect is unique or, perhaps, commonly or increasingly experienced.	**Extent** Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Context Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)

As described in Table 1 (a), above.

- The Quality of Effects can be **Positive, Neutral** or **Negative/Adverse.**

- The Significance of Effects are described in Table 1 (a), above, under seven generalised degrees, which are described in EPA (2022) Table 3.4 as follows:

1) **Imperceptible:** An impact capable of measurement but without noticeable consequences.
2) **Not Significant:** An effect which causes noticeable changes in the character of the environment but without significant consequences.

3) **Slight:** An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.

4) **Moderate:** An impact that alters the character of the environment in a manner consistent with existing and emerging trends.

5) **Significant:** An impact, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.

6) **Very Significant:** An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.

7) **Profound:** An impact which obliterates sensitive characteristics.

- As shown in Table 1 (a), the Extent and Context of the Effect must also be described.

Table 1 (b) - Criteria and Terminology to be Used in Description of Effects: Probability & Duration of Effects (EPA, 2022, Table 3.4 continued)

Describing the Probability of Effects Descriptions of effects should establish how likely it is that the predicted effects will occur so that the CA can take a view of the balance of risk over advantage when making a decision.	**Likely Effects** The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Describing the Duration and Frequency of Effects 'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes.
	Brief Effects Effects lasting less than a day.
	Temporary Effects Effects lasting less than a year.
	Short-term Effects Effects lasting one to seven years.
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years.
	Reversible Effects Effects that can be undone, for example through remediation or restoration.
	Frequency of Effects Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually).

As described in Table 1 (b), above, EPA (2022) requires statements on the Probability, Duration and Frequency of Effects.

Table 1 (c) - Criteria and Terminology to be Used in Description of Effects: Types of Effects (EPA, 2022, Table 3.4 continued)

Describing the Types of Effects	**Indirect Effects (a.k.a. Secondary or Off-site Effects)** Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects.
	'Do-nothing Effects' The environment as it would be in the future should the subject project not be carried out.
	'Worst-case' Effects The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable Effects When the full consequences of a change in the environment cannot be described.
	Irreversible Effects When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SOx and NOx to produce smog).

As described in Table 1 (c), above, EPA (2022) requires a professional interpretation Describing the Types of Effects. Examples of the Types of Effects include, as follows:

- Indirect
- Cumulative
- Do Nothing
- Worst Case
- Indeterminable
- Irreversible
- Residual
- Synergistic

3. Significance of Effects

Using the definitions for the degree of impact significance outlined above, the methodology for combining project information was presented in EPA (2022), after SNH (2018), as their Figure 3.5 and is reproduced here as **Plate 1**.

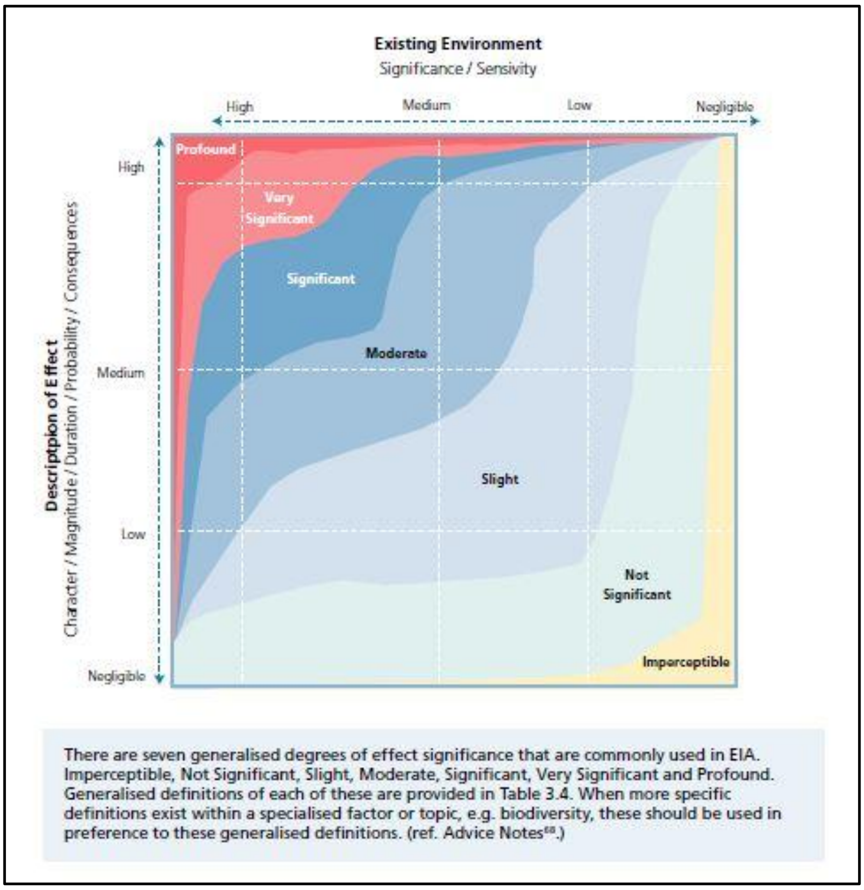


Plate 1 - EPA's Chart Showing 'Indicative' Typical Classifications of the Significance of Effects (EPA, 2022) as adapted from SNH (2018).

4. Hydrological and Hydrogeological Impact Assessment

The assessment of impacts within this chapter is carried out with respect to the hydrogeological and hydrological environment. Within this chapter, potential impacts are considered to be effects of the proposed development's resultant changes to the environment.

Criteria for assessing importance of site attributes and their magnitude of importance were evaluated using NRA Guidelines (NRA, 2008) [as prescribed in 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013)]. NRA rating criteria uses the same significance terminology as the EPA. However, the NRA & IGI Guidance suggest intermediate steps to justify using that terminology, as follows:

- **Step 1:** Quantify the Importance of a feature for hydrology and hydrogeology.
- **Step 2:** Estimate the Magnitude of the impact on the feature from the proposed development.
- **Step 3:** Determine the Significance of the impact on the feature from the matrix based on the Importance of the feature and the Magnitude of the impact.

IGI (2013) and NRA (2008) tables of significance to this study are presented here as Table 2These frameworks for assessment have been applied in the EIA relating to Water and Geology.

STEP 1:

The Criteria for Rating Site Importance of Hydrological Features (NRA, 2008) is presented in Table 2.

Table 2 Criteria for Rating Site Importance of Hydrological Features (NRA, 2008)

Importance of Attribute	Criteria	Example
Extremely High	Attribute has a high quality, or value on an international scale.	• River, wetland or surface water body ecosystem protected by EU legislation, e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations
Very High	Attribute has a high quality or value on a regional or national scale.	• River, wetland or surface water body ecosystem protected by national legislation – NHA status • Regionally important potable water source supplying > 2,500 homes • Quality Class A (Biotic Index Q4, Q5) • Floodplain protecting more than 50 residential or commercial properties from flooding • Nationally important amenity site for wide range of leisure activities
High	**Attribute has a high quality or value on a local scale.**	• Salmon fishery • Locally important potable water source supplying > 1000 homes • **Quality Class B (Biotic Index Q3-Q4)** • Floodplain protecting between 5 and 50 residential or commercial properties from flooding • Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale.	• Coarse fishery • Local potable water source supplying >50 homes • Quality Class C (Biotic Index Q3, Q2-3) • Floodplain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale.	• Locally important amenity site for small range of leisure activities • Local potable water source supplying <50 homes • Quality Class D (Biotic Index Q2, Q1) • Floodplain protecting 1 residential or commercial property from flooding • Amenity site used by small numbers of local people

The application of the NRA's (2008) criteria (Table 2) to the site under consideration enables an 'Importance Attribute' conclusion, as follows:

- With reference to hydrology, there are no direct links to any surface water system.

The Criteria for Rating Site Importance of Hydrogeological Features (IGI, 2013) is presented in Table 3.

Table 3 Criteria for Rating Site Importance of Hydrogeological Features (IGI, 2013, Table C3)

Importance of Attribute	Criteria	Example
Extremely High	Attribute has a high quality, significance or value on an international scale.	• Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status
Very High	Attribute has a high quality, significance or value on a regional or national scale.	• Regionally important aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status
High	**Attribute has a high quality, significance or value on a local scale.**	• **Regionally important aquifer.** Groundwater provides large proportion of base flow to local rivers Locally important potable water source supplying >1000 homes Outer source protection area for regionally important water source Inner source protection area for locally important water source
Medium	Attribute has a medium quality, significance or value on a local scale.	• Locally important aquifer. Potable water source supplying >50 homes
Low	Attribute has a low quality, significance or value on a local scale.	• Poor bedrock aquifer. Potable water source supplying < 50 homes

The application of the IGI's (2013) criteria (Table 3) to the site under consideration enables an 'Importance Attribute' conclusion, as follows:

- With reference to hydrogeology, the site and the aquifer within which it lies is deemed to be an attribute of '**Extremely High' importance rating** because it is mapped as a Regionally Important Karst Aquifer and, by virtue of base flow contributions, it is associated with Conservation Objective Coastal Waters.

STEP 2:
Using the Importance Criteria ratings of Table 3, the Criteria for Estimating the Magnitude of Impact on a Hydrogeology Attribute is provided in the IGI (2013) Guidance as shown in Table 4.

Table 4 Criteria for Estimating Magnitude of Impact on Hydrogeology Attribute (IGI, 2013, Table C5)

Impact Type	Magnitude	Example
Adverse	Negligible	• No measurable changes in attribute
	Small	• **Removal of small proportion of aquifer** • Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
	Moderate	• Removal of moderate proportion of aquifer • Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems Potential medium risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >1% annually
	Large	• Removal of large proportion of aquifer

		• Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems Potential high risk of pollution to groundwater from routine runoff Calculated risk of serious pollution incident >2% annually
Beneficial	Minor	Minor enhancement of aquifer
	Moderate	Moderate enhancement of aquifer
	Major	Major enhancement of aquifer

With respect to Baseline Information and the detail of Table 4:

- The Regionally Important Karst Aquifer is mapped by the GSI as having an area of 7,062.74 km^2, which is broadly equivalent to 7,062,740,000 m^2.
- The total area of the quarry site is 27.5 ha, which is equivalent to 27,500 m2.
- The area of the site relative to the area of the aquifer is 0.001%.

The use of criteria listed in Table 4 suggests that the proposed development may have a Potential Impact of **'Adverse'**, rather than 'Beneficial' and the Magnitude of Impact on the HYDROGEOLOGY Attribute (**Regionally Important Aquifer**), could be concluded, as **'Small' b**ased on the potential for removal of a **'small proportion of aquifer'**, **'minor changes to water supply springs and wells and river baseflow**' and a **'Potential Low Risk of Pollution to Groundwater from routine runoff'.**

The conclusion on the potential Magnitude of Impact on Hydrogeology is **'Small, Adverse'**.

STEP 3:
Using the IGI's (2013) Assessment Tables, the outcomes of Tables 3 and 4 are used to rate the potential Significance of the impact on the Aquifer.

Table 5 Criteria for Rating of Significant Environmental Impacts (IGI, 2013, Table C6)

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small**	Moderate	Large
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/Moderate	Severe/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

Using Table 5, the overall potential outcome on hydrogeological receptors, in the absence of Mitigation Measures, could be '**SIGNIFICANT**'.

The application of criteria, as outlined in Tables 1 to 5, above, to the specifics of the study area provides a framework for general screening of the likely impact to the hydrological and hydrogeological environment. The methodology involves the identification of all the potential receptors within the site boundary and surrounding environment. This information is gathered during the desk study, site walkover, site investigation and monitoring phases of the study.

Upon collation and consideration of all project information for the site and macro scale, an Impact Assessment is completed and reported under headings, as follows:

- Potential Impacts
- Mitigation Measures
- Residual Impacts
- Do Nothing
- Cumulative Impacts
- Transboundary Impacts
- Dewatering Impact Appraisal (UK Environment Agency)
- SAC Protection Measures

Refer to the Main Body of the EIAR for the detail of the Impact Assessment specific to the site under consideration.

A description of the UK Environment Agency's Dewatering Impact Appraisal is provided separately in the next Appendix.

Appendix 8.7 Dewatering Impact Appraisal Methodology (UK EA)

In addition to the application of Irish Guidelines as outlined in EPA (2022) and NRA (2008), and in the absence of Irish Guidance specifically focussed on quarries and hydrogeology, the work presented in this EIAR Section has also applied UK practical guidance as published by the UK Environment Agency (the public body equivalent of the Irish EPA). The UK Guidance provides a 'Hydrogeological impact appraisal for dewatering abstractions' (Boak, R. et. al. (2007) and the approach is succinctly outlined by the EA as follows:

> "The methodology for hydrogeological impact appraisal (HIA) is designed to fit into the Environment Agency's abstraction licensing process. It is also designed to operate within the Environment Agency's approach to environmental risk assessment, so that the effort involved in undertaking HIA in a given situation can be matched to the risk of environmental impact associated with the dewatering. The HIA methodology can be summarised in terms of the following 14 steps:
>
> - Step 1: Establish the regional water resource status.
> - Step 2: Develop a conceptual model for the abstraction and the surrounding area.
> - Step 3: Identify all potential water features that are susceptible to flow impacts.
> - Step 4: Apportion the likely flow impacts to the water features.
> - Step 5: Allow for the mitigating effects of any discharges, to arrive at net flow impacts.
> - Step 6: Assess the significance of the net flow impacts.
> - Step 7: Define the search area for drawdown impacts.
> - Step 8: Identify all features in the search area that could be impacted by drawdown.
> - Step 9: For all these features, predict the likely drawdown impacts.
> - Step 10: Allow for the effects of measures taken to mitigate the drawdown impacts.
> - Step 11: Assess the significance of the net drawdown impacts.
> - Step 12: Assess the water quality impacts.
> - Step 13: If necessary, redesign the mitigation measures to minimise the impacts.
> - Step 14: Develop a monitoring strategy.
>
> The steps are not intended to be prescriptive, and the level of effort expended on each step can be matched to the situation. Some steps will be a formality for many applications, but it is important that the same thought-process occurs every time, to ensure consistency. The methodology depends heavily on the development of a good conceptual model of the dewatering operation and the surrounding aquifer. The steps of the methodology are followed iteratively, within a structure with three tiers, and the procedure continues until the required level of confidence is achieved. Advice is also given on how to undertake HIA in karstic aquifers and fractured crystalline rocks." Boak, R. et. al. (2007).

Hydro-G has applied the UK Environment Agency's step wise process in order to present a Step Wise assessment of the potential for impact that might arise in response to the proposed development and its interaction with the water environment and Conservation Objective sites of the region.

Appendix 8.8 GSI Descriptor Sheets and EPA (2024) Reports

Clarinbridge GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
29 Galway Co. Co.	**Rivers**: Ballynamanagh, Dunkellin, Craughwell/Dooyertha, Clarinbridge, Kilcolgan, Toberdoney, Corrib, Raford. **Streams**: Carra **Lakes**: Ballinderreen, Cloghballymore, Derreen, Fingall, Kinlea, Loughaunagarraun, Loughaunrone, Parkatleva, Pollnacirca, Stillhouse, Toberawoneen, Tullaghnafrankagh.	Castletaylor Complex (000242), Greganna Marsh (000253), Galway Bay Complex (000268), Kiltiernan Lough (001285), Lough Fingall Complex (000606), Monivea Bog (000311), Rahasharne (000322).	375

Topography	The GWB occupies the area between Galway, Athenry, Kinvara and Loughrea, with Clarinbridge at a central location along the coastline. The land surface is low lying and relatively flat, with elevations ranging from sea level to 60 mAOD. The GWB is bounded to the west by the coastline, to the east by the poor aquifer lithologies of the Loughrea GWB, and to the north and south by surface water divides. Location and boundaries are shown in Figure 1.	
Geology and Aquifers	**Aquifer categories**	**Rkc:** Regionally important karstified aquifer. There are small isolated areas (8% of the total area) of **PI:** Poor aquifer, generally unproductive except for local zones.
	Main aquifer lithologies	Dinantian Pure Bedded Limestones dominate the GWB. Table 1 gives a list of rock units present in the GWB.
	Key structures	Broad open folds with north northeasterly trends predominate with the beds dipping at low angles. A NE-SW trending fault extends into the GWB through Athenry.
	Key properties	**Karstification** is widespread, with 97 features recorded. This is considered to represent only a fraction of existing features. **Transmissivity and Storativity:** Yields are variable, being distributed through all the well yield categories. 83% are either "excellent" (>400 m^3/d) or "good" (100-400 m^3/d), and 17% are either "poor" (<40 m^3/d) or "moderate" (40-100 m^3/d) [N=59]. The median yield is 218 m^3/d. Specific capacity values are available for 16 wells. The range is 0.87-1800 m^3/d/m, with a mean of 6 m^3/d/m, thus transmissivities range from 1 to greater than 3000 m^2/d. Transmissivity is estimated from test pumping data to be greater than 3000 m^2/d north of Ardrahan (O'Neill, 2002). Productivity values are distributed throughout all the productivity categories, with 53% either IV or V. Note: productivity is an index relating specific capacity to yield, and the higher the productivity the higher the transmissivity. Interpretation from groundwater flow directions and water tracing tests indicate that a zone of higher transmissivity exists stretching inland from the main Kilcolgan estuary (Drew and Daly, 1993). This zone is shown in Figure 2. The well yield data indicate the variability of the aquifer properties. Water table levels have high annual variations (0.5-18 m) (Drew and Daly, 1993), which indicates that the storativity is low - approximately 0.01-0.02 (Daly, 1985). Furthermore, the sites of greatest annual fluctuations coincide with the location of the main turloughs. The springs reflect the low storativity as many of the spring flows rise and fall quickly in response to rainfall events. **Groundwater velocity:** are in the order of 12-210 m/hr depending on location and groundwater levels. Groundwater velocities are in the order of 12-90 m/hr to Clarinbridge springs and 4-210 m/hr to Dunkellin springs. Groundwater velocities increase by 1.5 in high water conditions. The data suggest a zone of higher transmissivity stretching inland from the main discharge points at the head of the estuaries (Drew and Daly, 1993). **Groundwater flow directions and gradients:** Overall, flow directions are to the west, with groundwater discharging to littoral and intertidal springs at the head of the main estuaries. Figures 3 and 4 show groundwater flow directions under low flow and high flow conditions. Gradients were calculated by Drew and Daly (1993), given below and these reflect an increase in aquifer properties from east to west.

Typical gradients	Western area	Mid basin region	Eastern area
Summer	0.0009	0.003	0.008
Winter	0.002	0.004	0.017

Thickness	Most groundwater flows in an epikarstic layer a couple of metres thick and in a zone of interconnected solutionally-enlarged fissures and conduits that extends approximately 35 m below this. Deeper inflows can occur in areas associated with faults or dolomitisation. Significant fracturing occurs at 8-14 m above sea level and at 15-35 m below sea level (Drew and Daly, 1993).

Overlying Strata	**Lithologies**	Limestone Till dominates the GWB, accounting for over 75% of the area.
	Thickness	Depth to bedrock ranges from 0-13 m over the southern half of the GWB and 0-20 m over the northern half. Daly (1985) provides analysis on the depth to bedrock and shows that from east to west the general thickness decreases from greater than 3 m to less than 3 m.
	% area aquifer near surface	*[Information to be added at a later date]*
	Vulnerability	*[Information to be added at a later date]*
Recharge	**Main recharge mechanisms**	Both point and diffuse recharge occur. Diffuse recharge occurs via rainfall percolating through the permeable subsoil and rock outcrops. Point recharge occurs via swallow holes distributed across the GWB and via discrete sinks located in the beds of the main rivers, which generally rise to the east of the area on the poorer aquifers of the Loughrea GWB and flow onto the purer limestones of this GWB. Thus the majority of the sinks tend to be in the eastern side of the GWB. Migration of the active sink progresses upstream until the uppermost sink can take all the flow. Generally, the intake capacities of the sinks decreases in an upstream direction (Drew and Daly, 1993).
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	**Large springs and high yielding wells (m^3/d)**	Springs: (mean discharge, Drew and Daly, 1993): Kilcolgan > 100,000 m^3/d, Oranmore >30,000 m^3/d, Clarinbridge >60,000 m^3/d, Kilcornan >40,000 m^3/d Excellent wells: Athenry: 1,855 m^3/d, 2,180 m^3/d (2), 8000 m^3/d. 420 m^3/d (2), 523 m^3/d (2), 545 m^3/d (5), 545.5 m^3/d (3), 654 m^3/d, 740 m^3/d, 811 m^3/d, 873 m^3/d,
	Main discharge mechanisms	The large springs located at the head of the main estuaries are the main groundwater discharge points. There are also numerous springs located inland, many associated with turloughs. Some of the springs associated with the turloughs also act as sinks (estavelles) for 10-50 days a year (Drew and Daly, 1993). Springs located inland tend to cease to flow during low flow conditions. The two main rivers (Lavally and Dunkellin) drain much of the area and prior to the arterial drainage of the nineteenth century they never maintained an overland course to the sea. For most of the year the rivers (75% for the Dunkellin) sink in turloughs and in wetter conditions the turloughs overflow allowing the artificial channels to conduit water to the sea.
	Hydrochemical Signature	The GWB has a calcium bicarbonate signature as illustrated in Figure 5. The range and median values for selected parameters for Clarinbridge and Athenry are given below. Clarinbridge (n=6) / Athenry (n=12) Alkalinity (mg/l CaCO3): 276-348;282 / 154-376;320 Hardness (mg/l CaCO3): 300-372;326 / 197-400;342 Conductivity (microsiemens/cm): 607-725;615 / 494-743;692 The coastal springs become brackish under low flow conditions for the whole or a part of the tidal cycle. Salinity has not being detected in boreholes drilled close to the sea even after being pumped intensively (Drew and Daly, 1993). Surface water derived from the Loughrea GWB have higher concentrations of dissolved iron (0.2-0.7 mg/l in the Lavally River).
Groundwater Flow Paths		These rocks are generally devoid of intergranular permeability. Groundwater flows through fissures, faults, joints and bedding planes. In pure bedded limestones these openings are enlarged by karstification which significantly enhances the permeability of the rock. Karstification can be accentuated along structural features such as fold axes and faults. Groundwater flow through karst areas is extremely complex and difficult to predict. As flow pathways are often determined by discrete conduits, actual flow directions will not necessarily be perpendicular to the assumed water table contours, as shown by several tracing studies (Drew and Daly, 1993). The tracer tests show that groundwater can flow across surface water catchment divides and beneath surface water channels. Flow velocities can be rapid and variable, both spatially and temporally. Rapid groundwater flow velocities indicate that a large proportion of groundwater flow occurs in enlarged conduit systems. Groundwater flow in highly permeable karstified limestones is of a regional scale. Flow path lengths can be up to a several kilometres. Overall, groundwater flow will be towards the two main rivers and ultimately the main springs, but the highly karstified nature of the bedrock means that locally groundwater flow directions can be highly variable. Figures 2 and 3 shows the flow directions in low and high conditions. Figure 5 shows the traced flow lines in the area.

Groundwater & Surface water interactions	The area is drained by the rivers Lavally and Dunkellin and their tributaries, however the present day drainage network has been changed by arterial drainage that took place early in the nineteenth century. Figures 6, 7 and 8 show the pre/post arterial drainage network. According to Coxon and Drew (1983), much of the current stream network is a wet runoff system that is inactive during summer months. Thus prior to drainage, streams sank underground via the sinks within turloughs, approximately 5-15 km from the coast, before being discharged as springs on the coast. Artificial channels link the lower part of the catchments to the sea which conduit water during wet periods. The drainage density has increased from 0.2 to 4.0 km/km^2 (Drew, 1984). There is a high degree of interconnection between groundwater and surface water in karstified limestone areas such as in this GWB. Even though large areas of peat and tills overlie the GWB, collapse features in these areas provide a direct connection between the surface and the groundwater systems. The close interaction between surface water and groundwater in karstified aquifers is reflected in their closely linked water quality. Any contamination of surface water is rapidly transported into the groundwater system, and vice versa. Furthermore, there are a number of terrestrial ecosystems within this GWB with varying dependence on groundwater.
Conceptual model	• The GWB occupies the area between Galway, Athenry, Kinvara and Loughrea, with Clarinbridge at a central location along the coastline. The land surface is low lying and relatively flat, with elevations ranging from sea level to 60 mAOD. • The GWB is bounded to the west by the coastline, to the east by the poor aquifer lithologies of the Loughrea GWB, and to the north and south by surface water divides. • A large number of karst features occur, including turloughs, caves, dolines, swallow holes and springs. • The GWB is composed primarily of high transmissivity karstified limestone (**Rk**^{c}). Transmissivity and well yields are variable. Storativity is low. Gradients tend to be steeper inland. A zone of higher transmissivity stretches inland from Kilcolgan. • Rapid groundwater flow velocities have been recorded through groundwater tracing. • Recharge occurs via point and diffuse mechanisms. Point recharge occurs via swallow holes and via discrete sinks located in the beds of the main rivers. The majority of the sinks in the rivers tend to be in the eastern side of the GWB. • The large springs located at the head of the main estuaries are the main groundwater discharge points. The two main rivers (Lavally and Dunkellin) drain much of the area and prior to the arterial drainage of the nineteenth century they never maintained an overland course to the sea. In winter groundwater discharges to the many turloughs and transmitted via the artificial channels that were installed to alleviate flooding. • In general, the degree of interconnection in karstic systems is high and they support regional scale flow systems. • Surface water catchments are often bypassed by groundwater flowing beneath surface water channels and across surface water catchment divides. • Most of the groundwater flow occurs in the upper epikarstic layer and in a zone of interconnected solutionally enlarge bedding planes and fissures, generally extending to a depth of 30 m. • Groundwater storage in karstified bedrock is low and the potential for contaminant attenuation in such aquifers is limited. • There is a high degree of interaction between surface water and groundwater. Prior to drainage, streams sank underground via the sinks within turloughs, approximately 5-15 km from the coast, before being discharged as springs on the coast. Artificial channels link the lower part of the catchments to the sea which conduit water during wet periods.
Attachments	Table 1, 2, 3 and Figure 1, 2, 3, 4, 5, 6, 7 and 8.
Instrumentation	**Stream gauges:** 29001*, 29002, 29003, 29004*, 29005, 29006*, 29007, 29010, 29011, 29012, 29013, 29014, 29015. * Adjusted dry water flow available **EPA Water Level Monitoring boreholes:** (GAL265), (GAL275) **EPA Representative Monitoring points:** (GAL004), (GAL019)
Information Sources	Daly, D. (1995) *A report on the Flooding in the Glenamaddy area.* Groundwater Section Report File 2.2.7. 34pp. Daly, D. (1985) *Groundwater in County Galway with particular reference to its Protection from Pollution.* Geological Survey of Ireland report for Galway County Council. 98pp. Deakin, J., Daly D. (2000) *County Clare Groundwater Protection Scheme*. Main Report. Clare County Council & Geological Survey of Ireland. Drew, D. (2001) The Burren and the Gort-Kinvara Lowland, Groundwater Flow Systems in Karstified Limestones. Irish Group. Karst Field Trip October 2001. Unpublished IAH Report. Drew D.P. and Daly D. (1993) *Groundwater and Karstification in Mid-Galway, South Mayo and North Clare.* A Joint Report: Department of Geography, Trinity College Dublin and Groundwater Section, Geological Survey of Ireland. Geological Survey of Ireland Report Series 93/3 (Groundwater), 86 pp. Drew, D.P. (1984). *The effect of Human Activity on a Lowland Karst Aquifer*. In A. Burger (Ed) Hydrogeology of Karstic Terrains : Case histories. International Association Hydrogeologists, Hannover, Vol 1. (1984) p195-200. Hickey, C., Lee, M., Drew, D., Meehan, R. and Daly D. (2002) *Lowland Karst of North Roscommon and Westmeath*. International Association of Hydrogeologists Irish Group. Karst Field Trip October 2002. Unpublished IAH Report. Naughton, M. (1975) *Groundwater and related features in a temperate limestone area.* B.A. (Mod) Dissertation, (unpublished). Geography Department, Trinity College Dublin. O'Neill Groundwater Engineering. (2002). Project Number 840101. Permission for the continuance and extension of quarry use and retention of plant at Tonroe, Ardrahan, Co. Galway.

Disclaimer	Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae.

Table 1. List of Rock units in GWB

Rock unit name and code	Description	Rock unit group	Aquifer Classification
Newtown Member (TUnt)	Cherty limestone	Dinantian Pure Bedded Limestones	Rkc
Burren Formation (BU)	Pale grey clean skeletal limestone	Dinantian Pure Bedded Limestones	Rkc
Visean Limestones (undifferentiated) (VIS)	Undifferentiated limestone	Dinantian Pure Bedded Limestones	Rkc
Metagabbro & orthogneiss suite (Om)	Undifferentiated	Granites & other Igneous Intrusive rocks	Pl

Figure 1. Location and boundaries of GWB

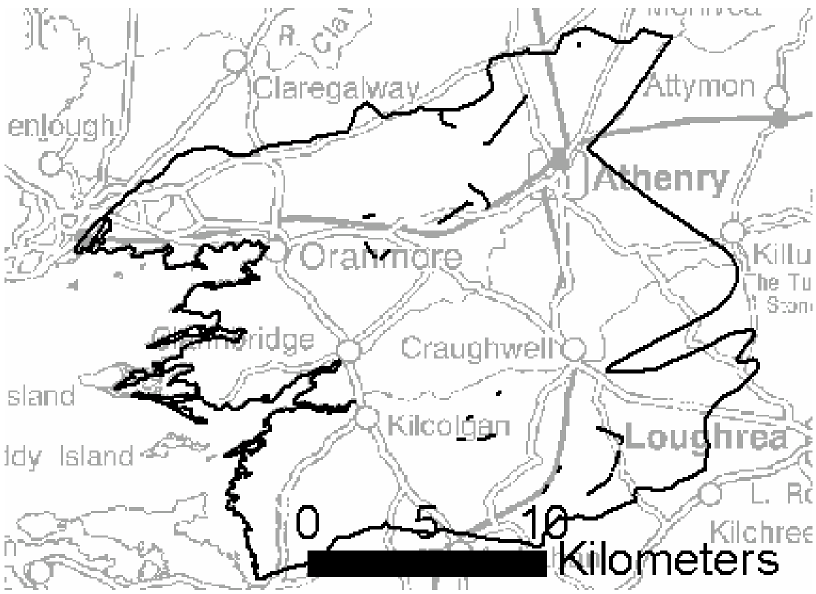
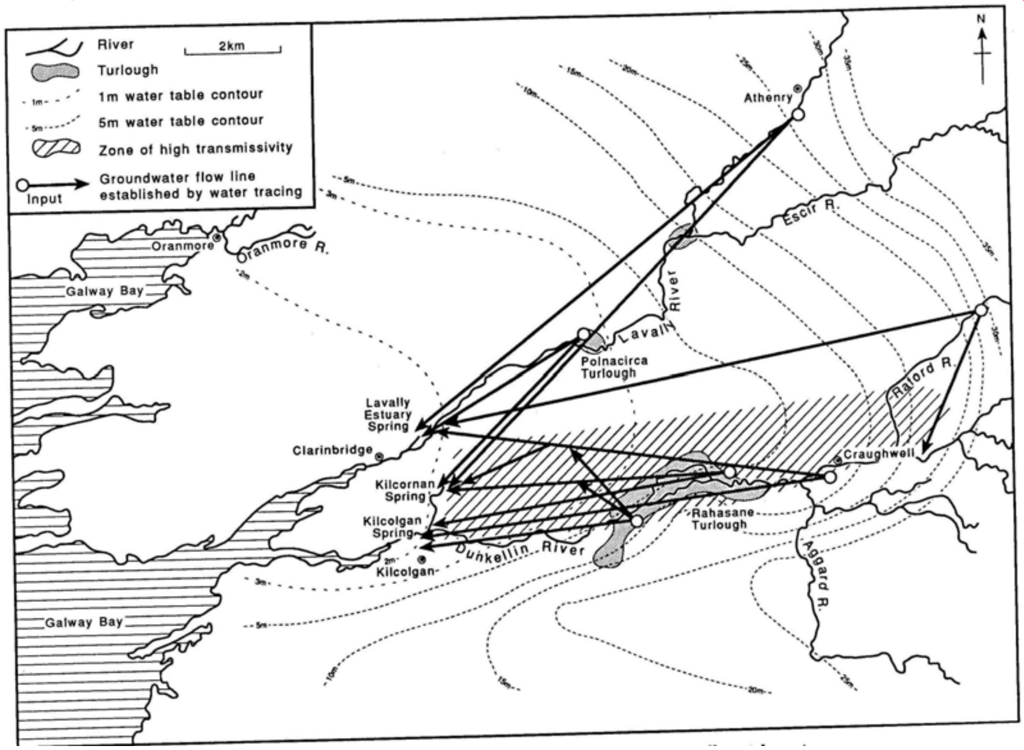


Figure 2. Groundwater flow lines established from tracing and zone of high Transmissivity (taken from Drew and Daly, 1993).



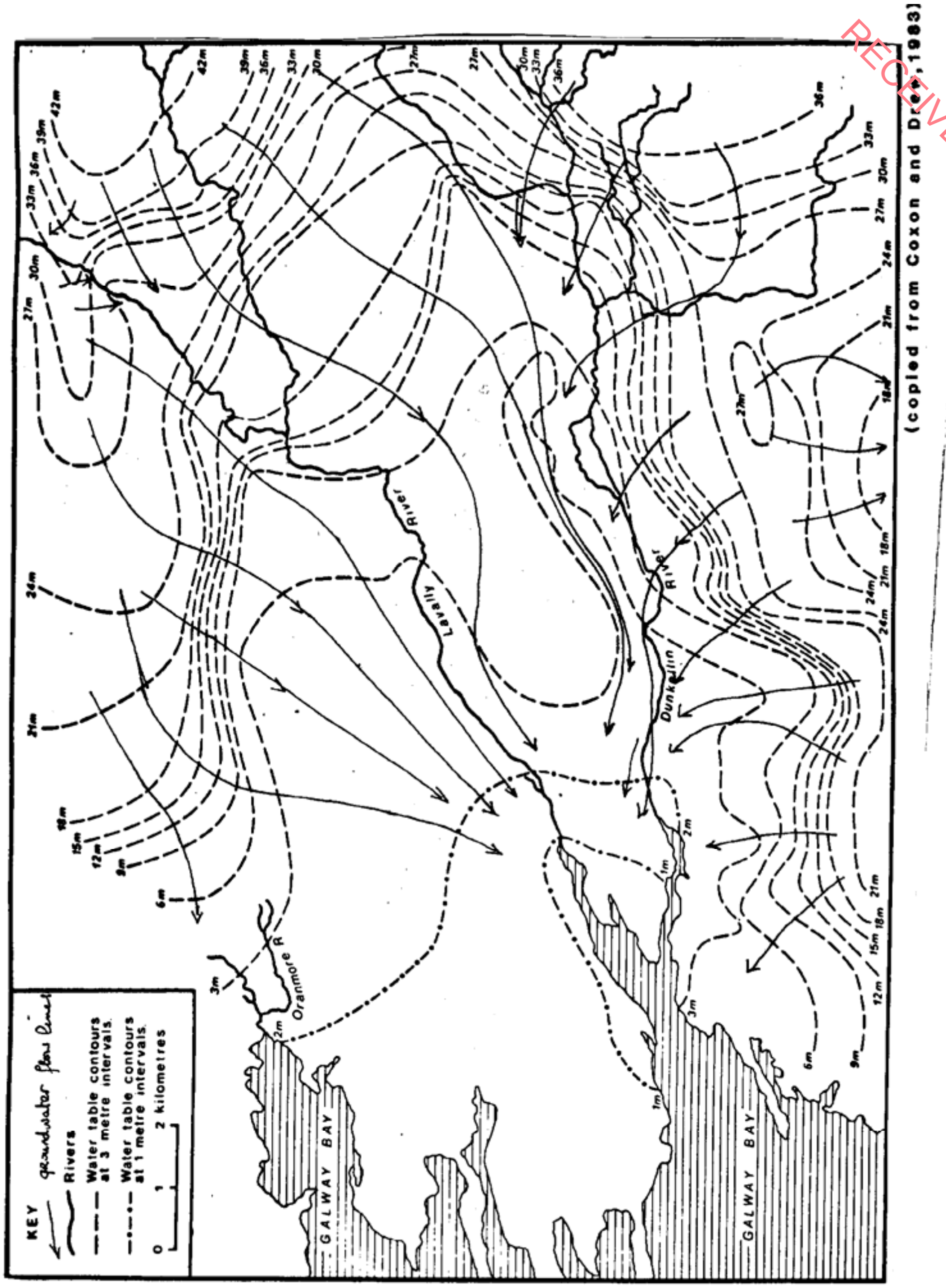


Figure 3 Groundwater flow directions during low flow conditions (taken from (Drew and Daly, 2993).

Figure 4 Groundwater flow directions and levels during high flow conditions (taken from Drew and Daly, 1993).

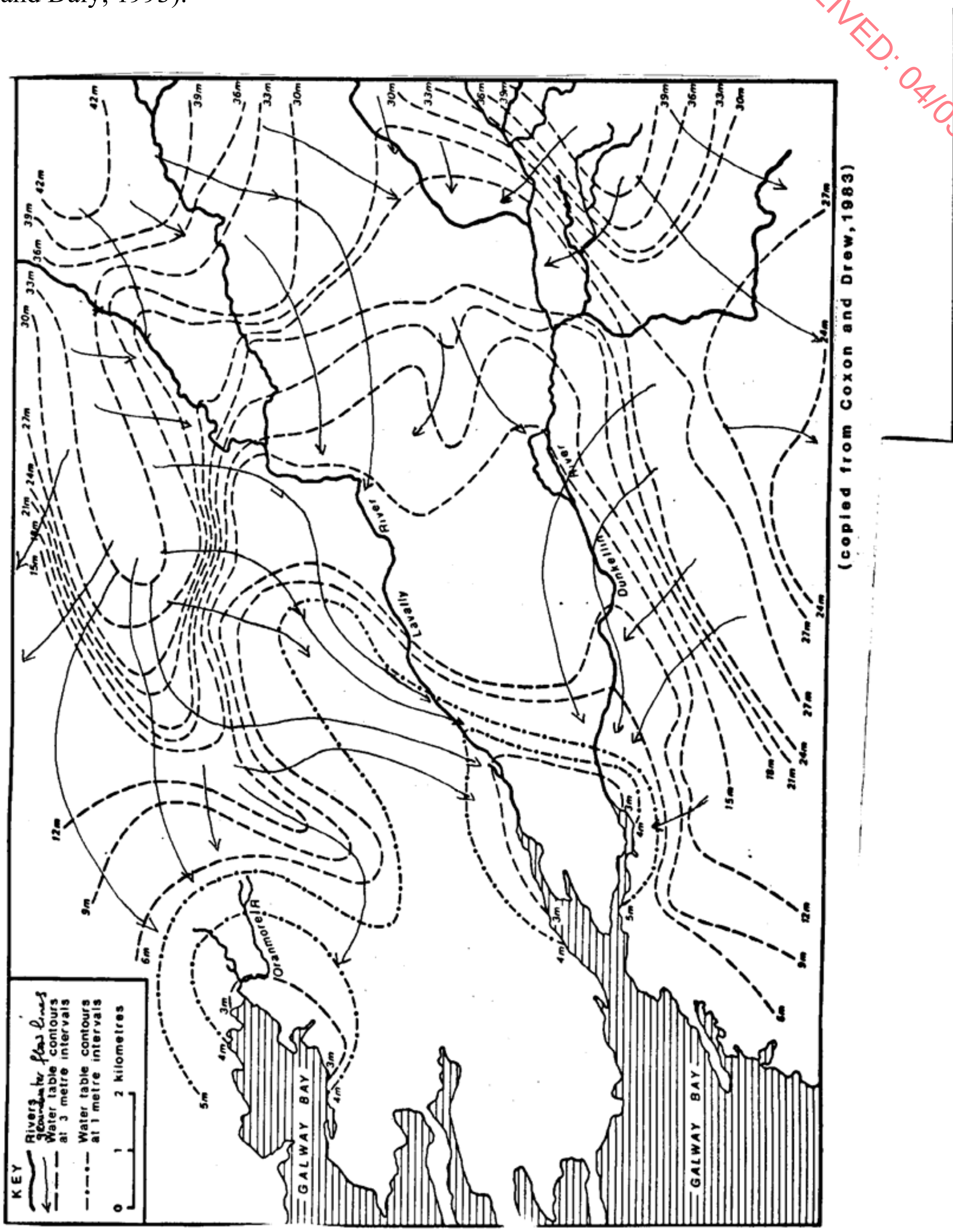
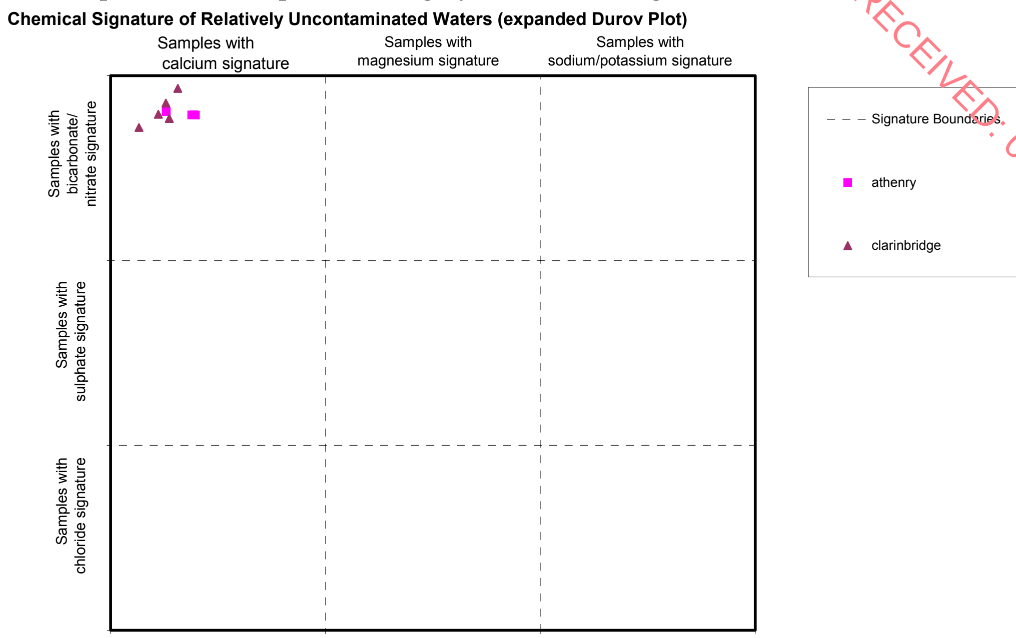


Figure 5 Expanded Durov plot showing hydrochemical signature.



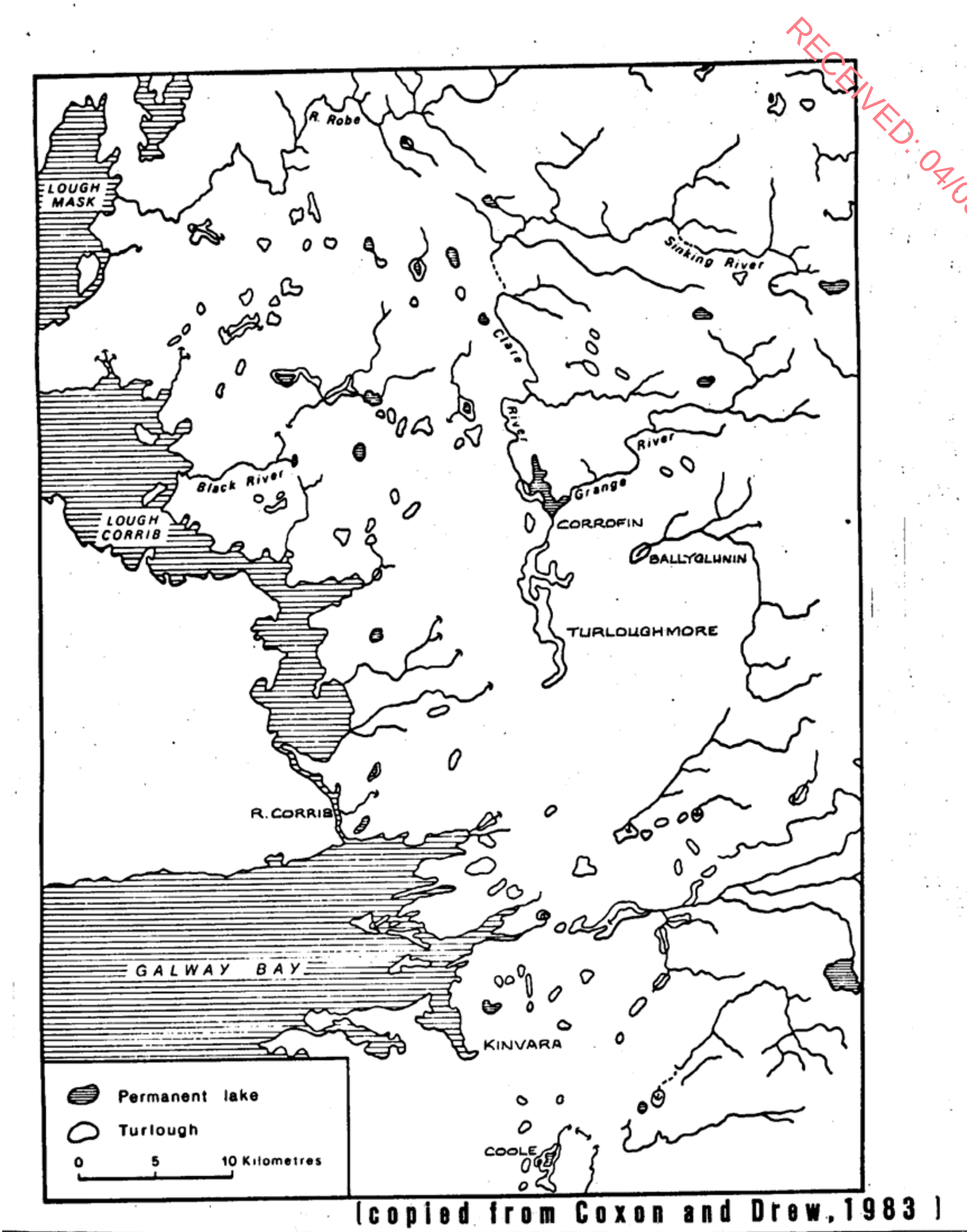


Figure 6 Prearterial Drainage conditions

Figure 7 Post arterial drainage conditions.

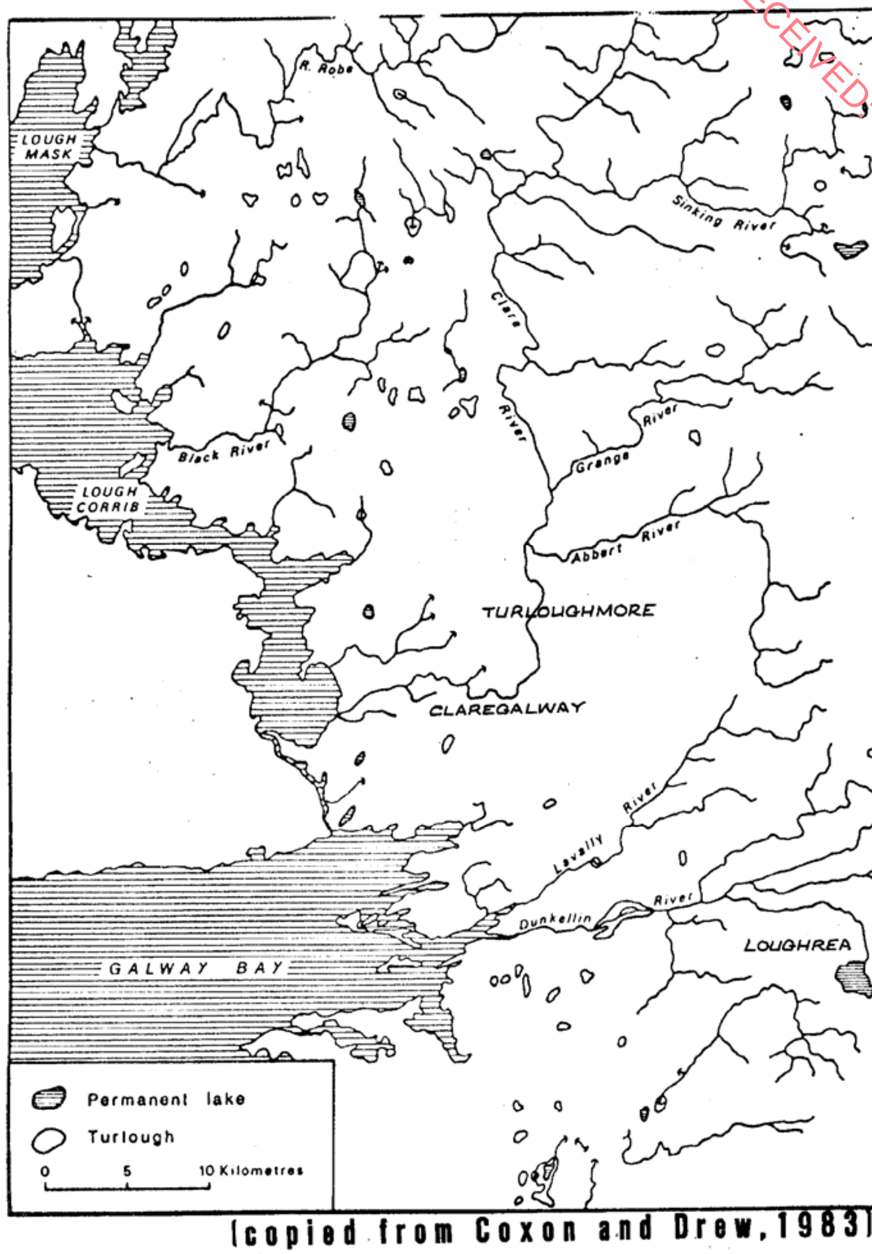
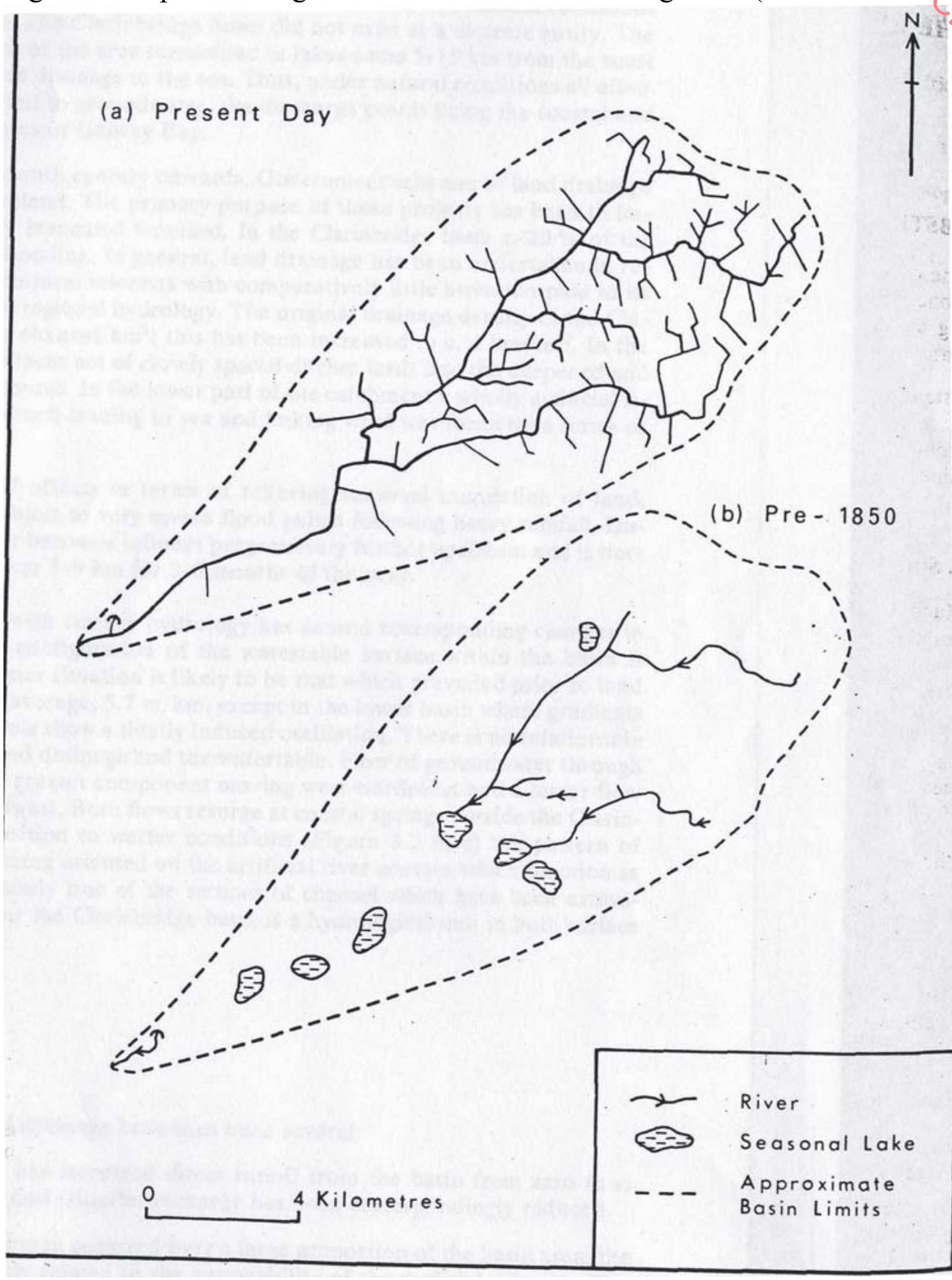


Figure 8 Pre/post drainage conditions of the Clarinbridge area (taken from Drew, 1984).



Clare-Corrib GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
30 Galway, Mayo Roscommon Co.Co's	**Rivers**: Abbert River, Black River, Cregg River, Dalgan River, Grange River, Killaclogher River, Kilshanvy River, River Clare, River Nanny, Sinking River, Togher River, Waterdale River **Lakes**: Corrib	000296 LISNAGEERAGH BOG AND BALLINASTACK TURLOUGH 000247 SLIEVE BOG 001237 BOYOUNAGH TURLOUGH 000224 ALTORE LAKE 000301 LOUGH LURGEEN BOG/GLENAMADDY TURLOUGH 000215 RATHBAUN TURLOUGH 001282 KILTULLAGH LOUGH 000263 DRUMBULCAUN BOG 000297 LOUGH CORRIB 000323 RICHMOND ESKER NATURE RESERVE 000289 KNOCKAVANNY TURLOUGH 000295 LEVALLY LOUGH 001254 DERRINLOUGH BOG 001255 DERRYNAGRAN BOG AND ESKER 000282 KILLOWER TURLOUGH 000331 TURLOUGH O'GALL 000234 BELCLARE TURLOUGH 001319 SUMMERVILLE LOUGH 001294 LOUGH HACKET 001288 KNOCKMAA HILL 000385 ROSTAFF TURLOUGH 002038 CASTLE HACKETT SOUTERRAIN 001322 TURLOUGH MONAGHAN 001788 TURLOUGHCOR 001280 KILLACLOGHER BOG 000307 LOUGH TEE BOG 001709 TIAQUIN BOG 000311 MONIVEA BOG 000287 KILTULLAGH TURLOUGH	~1422

Topography		The land surface is characterised by small hills and low ridges, with ground elevations ranging from 10-160 mAOD. The topographic surface slopes gently westwards. Elevations are highest (100-160 mAOD) in the north (south of Ballyhaunis, west of Ballinlough) and south (just north of Monivea). To the west of a line running north-south from Claremorris to Athenry the elevation is 10-40 mAOD, and to the east of this line, the elevation is 40-70 mAOD.
Geology and Aquifers	**Aquifer categories**	The main aquifer category in this GWB is: **Rk^c:** Regionally important karstified aquifer dominated by conduit flow. There are some small areas (in the vicinity of Headford) with an aquifer category of: **Ll**: Locally important aquifer which is moderately productive only in local zones.
	Main aquifer lithologies	This GWB is composed primarily of Dinantian Pure Bedded Limestones. There are some small areas (in the vicinity of Headford) of Dinantian Pure Unbedded Limestones.
	Key structures	Few faults are mapped in this area; this may reflect the lack of major variation in the rock lithology. The dips over the GWB area are generally less than 10^o, except near faults, where steeper dips result from fault drag. Shallow synclines aligned with the axes in an E-W direction cross the GWB.
	Key properties	**Karstification** is widespread in this GWB. Recorded karst features number 219, but are considered to represent only a fraction of existing features. A histogram showing the different types of karst features currently in the database is provided in Figure 3. **Transmissivity and Storativity:** Well yields are variable, being distributed through all the well yield categories. Using 60 wells located in the GWB, 59% are either "excellent" (>400 m^3/d) or "good" (100-400 m^3/d), and 23% are either "poor" (<40 m^3/d) or "failed", with the remainder "moderate" (40-100 m^3/d). The median yield is 131 m^3/d. Histograms showing the distribution of well yields and productivity are given in Figures 4 and 5. Note: productivity is an index relating specific capacity to yield - the higher the productivity the higher the transmissivity. Productivity values are distributed throughout all the productivity categories, indicating the variability of the aquifer properties throughout the GWB. Analysis of the areal distribution of the data suggests that it is difficult to predict the aquifer properties in any particular place, with a few possible exceptions. For instance, in the vicinity of Tuam the well yields that are "excellent" are accompanied by several large springs, and just north of Monivea there is a cluster of "failed" wells (also due in part to silting up of the boreholes) which suggests that there may be an increase in yield from south to north across the GWB. Water table levels have high annual variations, which indicates that the storage is low - approximately 0.01-0.02 (Daly, 1985). The springs in the GWB also reflect the low storativity as many of the spring flows rise and fall quickly in response to rainfall events. Furthermore during prolonged drought many springs cease to flow and well yields drop significantly.
	Continues next page	**Groundwater velocity:** Tracer tests indicate variable groundwater velocities. Furthermore, tracer test data illustrates anisotropy in the transmissivity, with higher east-west transmissivity. Groundwater velocities in the E-W domain are in the order of 100-450 m/hr, as evidenced by the following tests: Lassanny Swallow hole to Ballyhaunis spring (440m/hr); Ballyglunin Cave to Aucloggeen Spring (200m/hr). Groundwater velocities in the N-S domain are in the order of 6-35m/hr, as evidenced by the following tests: L.Hackett to Kilcoona spring (35m/hr); Pollnahallia to Bunatober spring (6m/hr). Extensive conduit systems exist, as exemplified by the Ballyglunin Cave system. The mapping of this system indicates conduit development along the N-S and W-E joint sets, with an overall dip to the west (Drew and Daly, 1993).

		Groundwater flow directions and gradients: Overall, flow directions are to the southwest, with all groundwater discharging to L. Corrib. Although, there are six surface water catchments within the GWB, a *key* aspect is that groundwater can flow across the surface water divides and beneath surface water channels, as evidenced by the tracer test data. Examples of this key property are listed as follows: 1) water that sinks at Ballyglunin Cave emerges at Aucloggeen Spring, which crosses two surface water catchments. 2) water sinking along an losing stretch of the River Clare remerges as the headwater of the Black River. 3) recent tracing tests in the Ballinlough area of Roscommon indicate a link across the Shannon RBD into the Western RBD, from Coolcam (Roscommon) to Meeltraun (Mayo). 4) water along an losing stretch of the Sinking River flows about 10 km underground to join the River Clare. Drew (1976 (a)) suggests that groundwater flow is concentrated along the axes of shallow synclines. Gradients are variable, irregular due to the uneven distribution of transmissivity and are in the order of 0.01-0.002 (Drew and Daly, 1993; Daly, 1985)).
	Thickness	The Dinantian Pure Bedded Limestones are generally over 100 m thick. Most groundwater flows in an epikarstic layer a couple of metres thick and in a zone of interconnected solutionally-enlarged fissures and conduits that extends approximately 30 m below this. Deeper inflows can occur in areas associated with faults or dolomitisation.
Overlying Strata	**Lithologies**	Till is the dominant subsoil type, covering approximately 65% of the GWB. Cutover Peat comprises 23% of the area, sand/gravel covers approximately 3% and alluvium 2%. A full breakdown of the subsoil lithology is given in Table 1. A large proportion of the sand/gravel forms a random hummocky topography, although long sinuous, braided ridges of sand/gravel (eskers) have also been deposited especially in the east. A small portion of the north eastern area of the GWB around Cloonfad is described under the Roscommon Groundwater Protection Scheme (Lee and Daly, 2003) The till in this area is described as "SILT" (BS 5930), and is classed as "Moderate" permeability. There are also areas of "clayey" till, often underlying areas of raised bog (Drew and Daly, 1993). The thin till cover over much of the west part of the area is generally free draining (Daly, 1985).
	Thickness	East of a line linking Athenry – Tuam – Dunmore, the subsoil is "generally thicker" (Daly, 1985; Drew and Daly, 1993). This is supported by the occurrence of rock at or near surface, which is generally restricted to the western and southwestern part of the GWB. Analysis of the available depth to bedrock borehole data is limited as most of the data are clustered in three main areas: western, northeastern and central (area around Tuam) parts of the GWB. Nevertheless the data show a *general* increase in subsoil thickness in an easterly direction: average depth to bedrock increases from 4 m to 9 m from the west to east. In addition, there are instances of depth to bedrock greater than 20 m around Dunmore (northeast of GWB). However, there are also pockets of deeper till in the southwestern part of the GWB.
	% area aquifer near surface	50% of the GWB to the west of the line Athenry – Tuam – Dunmore is only covered by shallow till. 4% of the total GWB area has rock at or near surface.
	Vulnerability	The vulnerability for a small portion of the north eastern area of the GWB around the area of Cloonfad is described in the County Roscommon Groundwater Protection Scheme (Lee and Daly, 2003). In this area the vulnerability classification is variable dependent on the depth to bedrock. For the rest of the area. *[Information to be added at a later date]*
Recharge	**Main recharge mechanisms**	Both point and diffuse recharge occur in this GWB. Diffuse recharge occurs over the GWB via rainfall percolating through the permeable subsoil. Despite the presence of peat and till, point recharge to the underlying aquifer occurs by means of swallow holes and collapse features/dolines. Dolines have been recorded even in areas of thick peat deposits (Hickey et al, 2002). Point recharge occurs via many small sinks that are present in the low permeability till areas where the subsoil is breached. Recharge also occurs along 'losing' sections of streams. There are well defined stretches of the River Clare, Sinking River and Abbert River that are losing (Daly, 1985; Drew and Daly, 1993).
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	**Large springs and large known abstractions (m^3/d)**	Large Springs: Corrandulla GWS (6764 m^3/d), Kilbannon GWS (5995 m^3/d), Mullacultra GWS (3270 m^3/d), Barnaderg Group Scheme (5000 m^3/d), Ballyhaunis WSS (12000 m^3/d), Tobernanny, Gortgarrow, Lettera Large known borehole abstractions: Gallagh GWS (523 m^3/d), Rusheens Tuam GWS (114 m^3/d), Roadstone Ltd (227 m^3/d), Belclare (114 m^3/d). *[Information to be added to and checked]*
	Main discharge mechanisms	The main groundwater discharges are to the streams, rivers and large springs found within the body. The large springs at Kilcoona, Bunatober and Aucloggeen and others issue from the bottom of a limestone scarp that is thought to represent an ancient shoreline of L. Corrib. Further these springs are likely to represent overflow springs and deeper groundwater flow discharges to outlets beneath the present day L. Corrib (Drew, 1993). In winter groundwater will fill the turloughs found in the area and partly discharge via the artificial channels that were installed to alleviate flooding.

Hydrochemical Signature	The groundwater has a calcium bicarbonate signature. Two groundwater provinces are suggested by Drew and Daly (1993). Firstly, there is a shallow groundwater component that is characterised by high suspended solids and relatively low electrical conductivities (300-400 µS/cm). Springs that are fed by this component typically have a "flashy" throughput and often cease to flow during prolonged drought. Secondly, there is a deeper groundwater component that is characterised by relatively non-turbid groundwater with higher electrical conductivities (>450 µS /cm). Springs fed by this deeper component often have smoother hydrographs where there is a gradual change in discharge. Several large springs comprise both flow components, examples are Lettera, Tobernanny and Bunatober springs.
Groundwater Flow Paths	These rocks are generally devoid of intergranular permeability. Groundwater flows through fissures, faults, joints and bedding planes. In pure bedded limestones these openings are enlarged by karstification which significantly enhances the permeability of the rock. Karstification can be accentuated along structural features such as fold axes and faults. Groundwater flow through karst areas is extremely complex and difficult to predict. As flow pathways are often determined by discrete conduits, actual flow directions will not necessarily be perpendicular to the assumed water table contours, as shown by several tracing studies (Drew and Daly, 1993). The tracer tests show that groundwater can flow across surface water catchment divides and beneath surface water channels. Flow velocities can be rapid and variable, both spatially and temporally. Rapid groundwater flow velocities indicate that a large proportion of groundwater flow occurs in enlarged conduit systems. Groundwater flow in highly permeable karstified limestones is of a regional scale. Flow path lengths can be up to a several kilometres, for example 9.6 km from Ballyglunin Cave to Aucloggeen Spring. Overall, groundwater flow will be towards the River Clare and L. Corrib, but the highly karstified nature of the bedrock means that locally groundwater flow directions can be highly variable.
Groundwater & Surface water interactions	The area is drained by the River Clare and its tributaries, however the present day drainage network has been changed significantly by arterial drainage that took place early in the nineteenth century. Figures 1 and 2 show the pre/post arterial drainage network. According to Coxon and Drew (1983), much of the current stream network is a storm runoff system that is inactive during summer months. Thus, prior to drainage, streams sank underground via the turloughs present in the GWB. Many of the streams have well defined losing stretches where they lose water to the underground system (Daly, 1985). There is a high degree of interconnection between groundwater and surface water in karstified limestone areas such as in this GWB. Even though large areas of peat and tills overlie the body, collapse features in these areas provide a direct connection between the surface and the groundwater systems. The close interaction between surface water and groundwater in karstified aquifers is reflected in their closely linked water quality. Any contamination of surface water is rapidly transported into the groundwater system, and vice versa. Furthermore, there are a number of terrestrial ecosystems within this GWB with varying dependence on groundwater.

Conceptual model

- The north, south and west groundwater divides of this GWB are topographic highs that coincide with surface water catchment boundaries. It is bounded to the east by Lough Corrib.
- The topography is undulating with ground elevations ranging from 10-160 mAOD. A large proportion of the body is overlain by till, which thickens in an easterly direction.
- The area is principally drained by the River Clare and its tributaries, however the present day drainage network has been changed significantly by arterial drainage that took place early in the nineteenth century. Much of the current stream network is a storm runoff system and is inactive during summer months. Prior to artificial drainage, streams sank underground via a few turlough sinks in the GWB.
- Within the GWB, surface water catchments are often bypassed by groundwater flowing beneath surface water channels and across surface water catchment divides.
- A large number of karst features occur within the body. These include turloughs, caves, dolines, swallow holes and springs.
- The GWB is composed primarily of high transmissivity karstified limestone (**Rk^c**). Transmissivity and well yields are variable. Storage in the GWB is low.
- Groundwater flows through a network of solutionally enlarged bedding planes, fissures and conduits.
- Rapid groundwater flow velocities have been recorded through groundwater tracing. The tracing indicates an anisotropy in the transmissivity, with faster groundwater flow velocities and higher transmissivity in an E-W direction, which may be linked to shallow E-W trending synclinal axes and steeper E-W hydraulic gradients.
- Recharge in this GWB occurs via losing streams, point and diffuse mechanisms. Despite the presence of peat and till, point recharge to the underlying aquifer occurs by means of swallow holes and collapse features/dolines.
- The groundwater in this body is generally unconfined but may become locally confined beneath thick, low permeability subsoil. Most of the groundwater flow occurs in the upper epikarstic layer and in a zone of interconnected solutionally enlarge bedding planes and fissures, generally extending to a depth of 30 m.
- In general, the degree of interconnection in karstic systems is high and they support regional scale flow systems. Flow paths have been measured up to 10 kilometres in length.
- Some areas in this GWB are of extreme vulnerability due to the thin nature of the subsoil, as well as the frequency of karst features, allowing point recharge. Groundwater storage in karstified bedrock is low and the potential for contaminant attenuation in such aquifers is limited.
- The main discharges are to the rivers, large springs and L. Corrib. In winter groundwater discharges to the many turloughs and transmitted via the artificial channels that were installed to alleviate flooding.
- There is a high degree of interaction between surface water and groundwater in this GWB. There are a number of terrestrial ecosystems within this GWB which have varying dependence on groundwater.
- There are potentially two groundwater provinces within the GWB but this is uncertain. The groundwater has a calcium bicarbonate signature.

Attachments

Figures 1, 2, 3, 4 and 5.

Instrumentation

Stream gauges: 30002, 30003, 30004, 30006, 30007, 30010, 30011, 30012, 30013, 30014, 30015, 30020, 30022, 30023, 30024, 30025, 30026, 30029, 30030, 30032, 30040, 30045, 30053, 30055, 30071, 30101, 30103.
EPA Water Level Monitoring boreholes: Lackagh, GAL287, Tuam (Coca Cola), GAL291, Shrule, MAY085
EPA Representative Monitoring points:

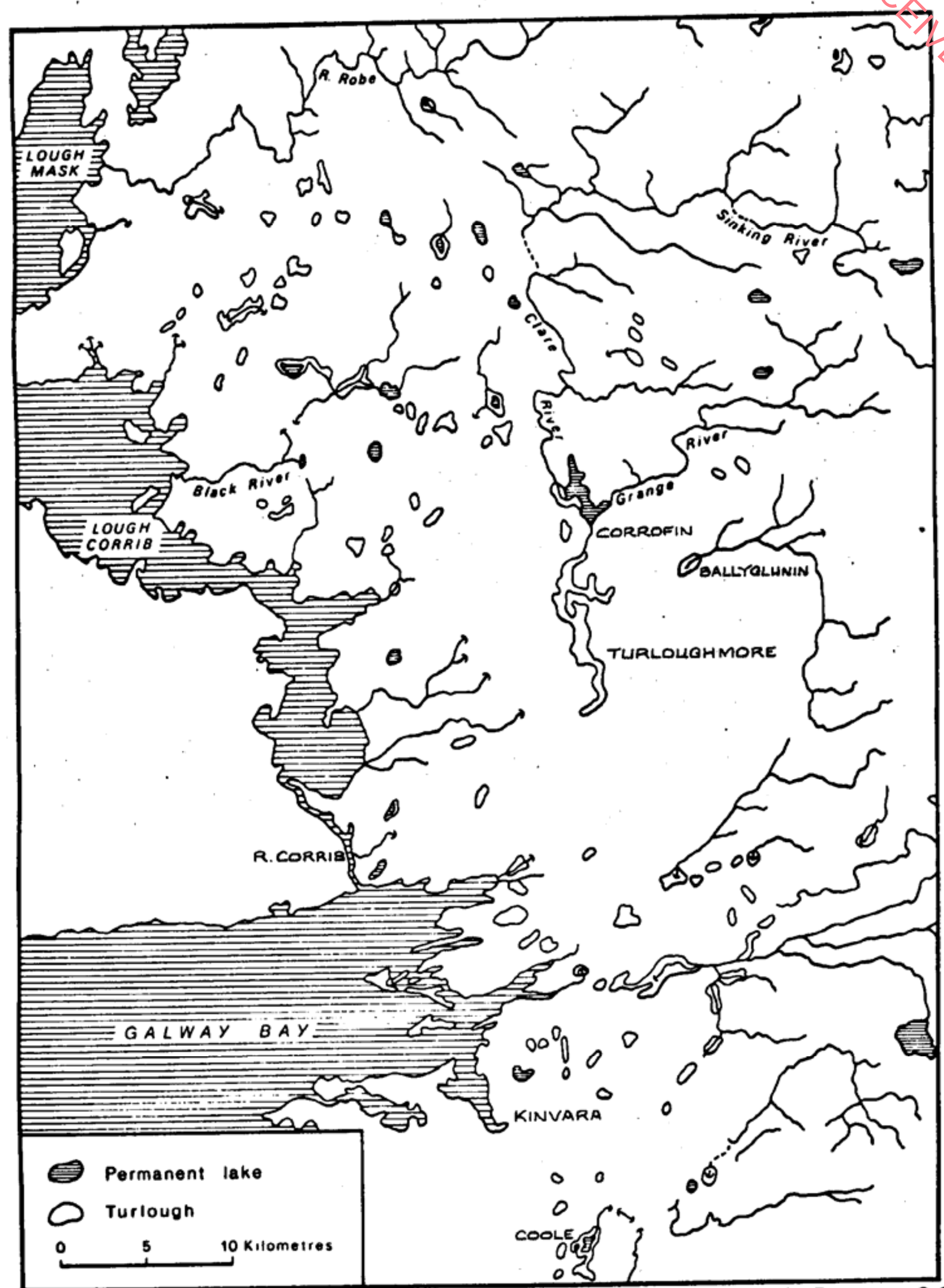
Information Sources

Daly, D. (1995) *A report on the Flooding in the Glenamaddy area.* Groundwater Section Report File 2.2.7. 34pp.
Daly, D. (1992) *A report on the Flooding in the Claregalway area.* Groundwater Section Report File 2.2.7. 12pp.
Daly, D. (1985) *Groundwater in County Galway with particular reference to its Protection from Pollution.* Geological Survey of Ireland report for Galway County Council. 98pp.
Drew D.P. and Daly D. (1993) *Groundwater and Karstification in Mid-Galway, South Mayo and North Clare.* A Joint Report: Department of Geography, Trinity College Dublin and Groundwater Section, Geological Survey of Ireland. Geological Survey of Ireland Report Series 93/3 (Groundwater), 86 pp
Drew, D.P. (1973a) *Hydrogeology of the north Co. Galway – south Co. Mayo lowland karst area, Western Ireland.* International Speleology 1973, III, Sub –section Ca.
Drew, D.P. (1973b). *Ballyglunin core Co. Galway and the hydrology of the surrounding area.* Irish Geography Vol. 6, No. 5. pp 610-617.
Doak, M. (1995) *The Vulnerability to Pollution and Hydrochemical Variation of Eleven Springs (Catchments) in the Karst Lowlands of the West of Ireland*. Unpublished M.Sc. thesis, Sligo Regional Technical College.
Hickey, C., Lee, M., Drew, D., Meehan, R. and Daly D. (2002) *Lowland Karst of North Roscommon and Westmeath.* International Association of Hydrogeologists Irish Group. Karst Field Trip October 2002. Unpublished IAH Report.
Lee, M. & Daly D. (2003) *County Roscommon Groundwater Protection Scheme*. Main Report. Roscommon County Council & Geological Survey of Ireland, 54pp.
Hickey, C., Lee, M., Drew, D., Meehan, R. and Daly D. (2002) Lowland Karst of North Roscommon and Westmeath. International Association of Hydrogeologists Irish Group. Karst Field Trip October 2002. Unpublished IAH Report.

Disclaimer

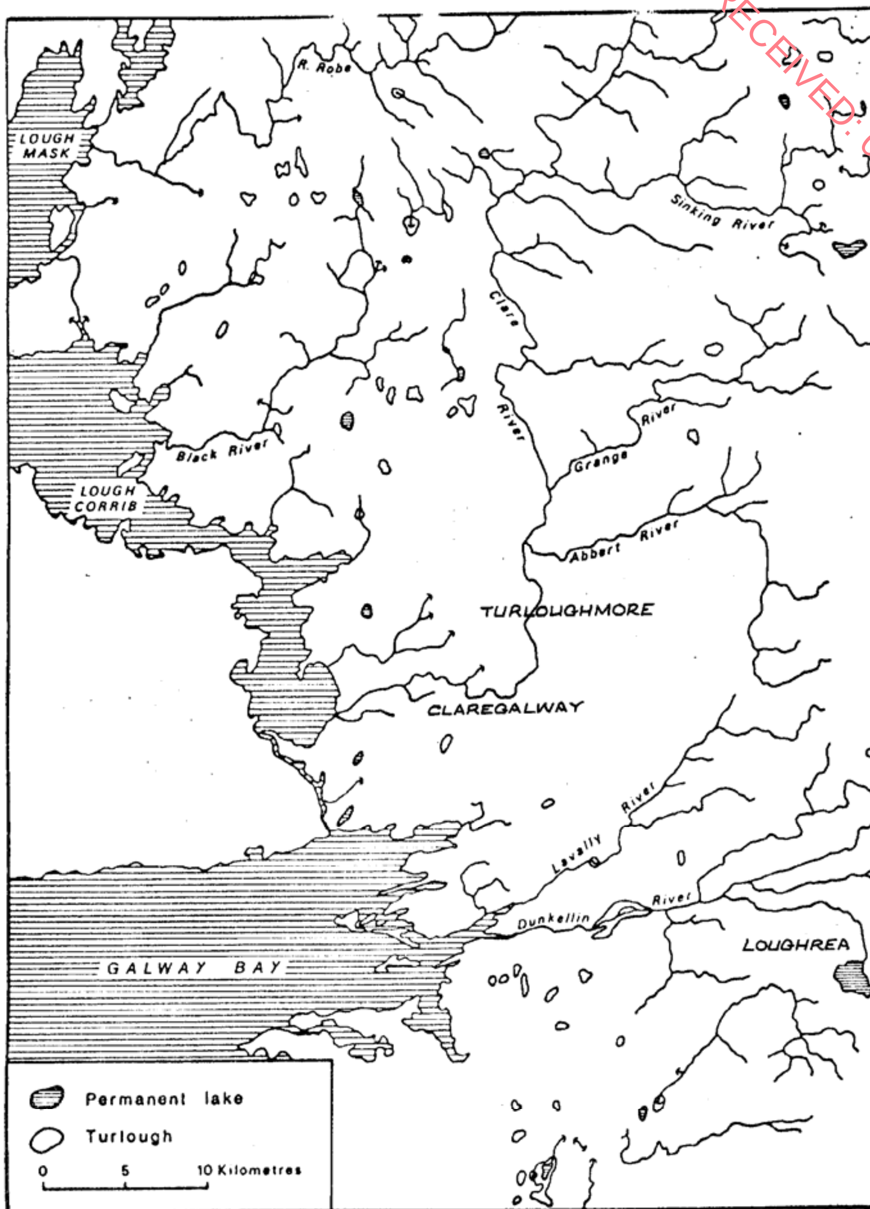
Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae.

Figure 1 Pre Arterial Drainage.



(copied from Coxon and Drew, 1983)

Figure 2 Post Arterial Drainage



(copied from Coxon and Drew, 1983)

Figure 3 Histogram of Karst features in Clare-Corrib GWB

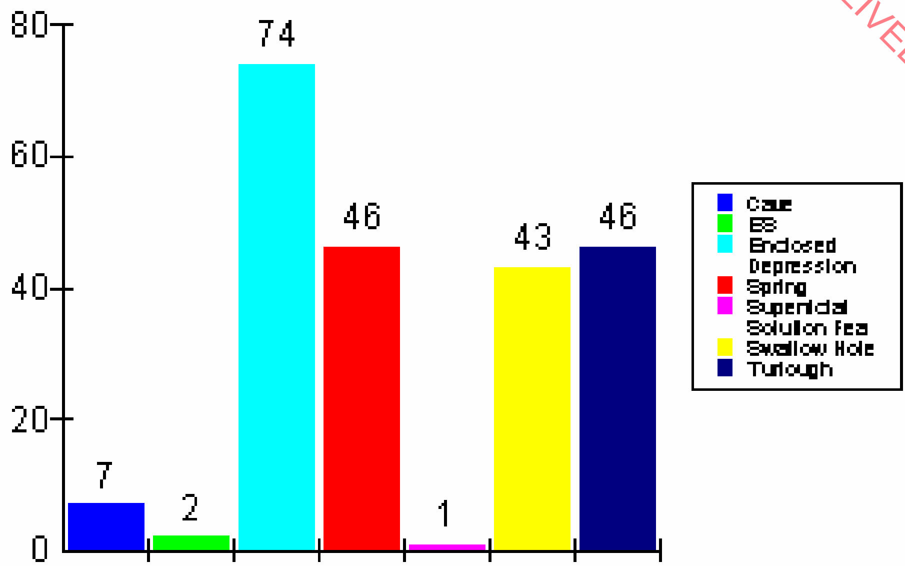


Figure 4 Histogram of Well Yields in Clare-Corrib GWB

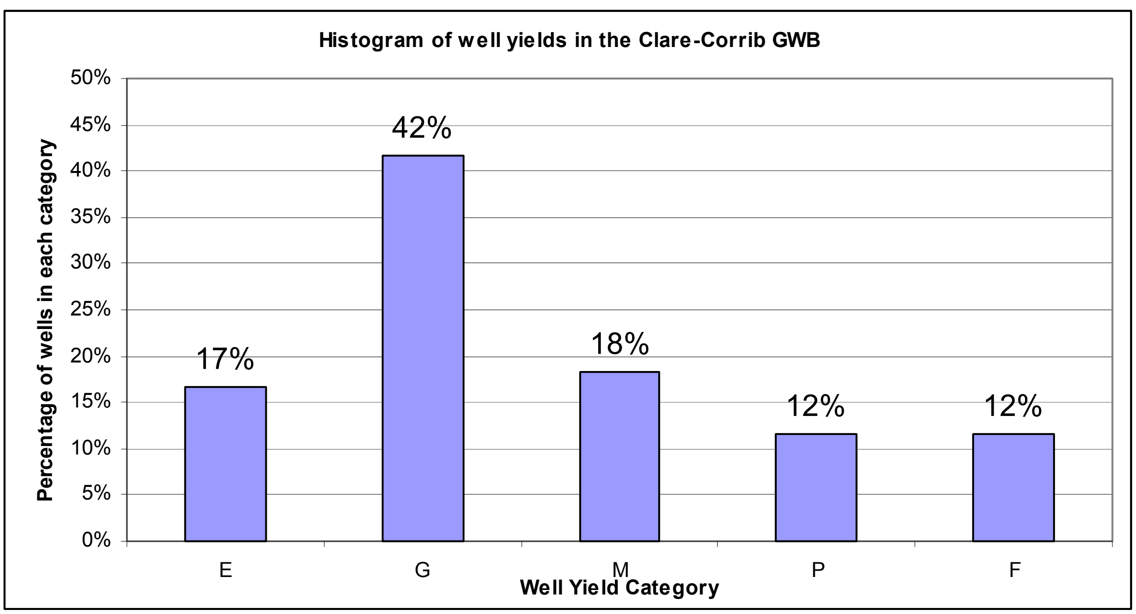


Figure 5 Histogram of Well Productivities in Clare-Corrib GWB

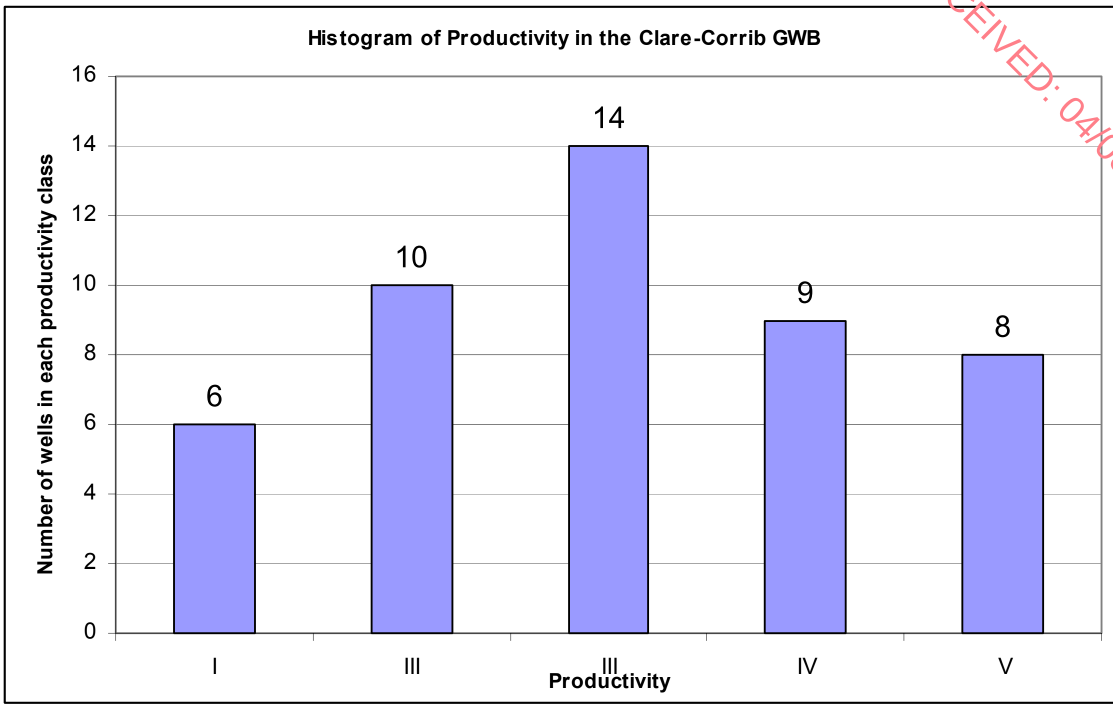
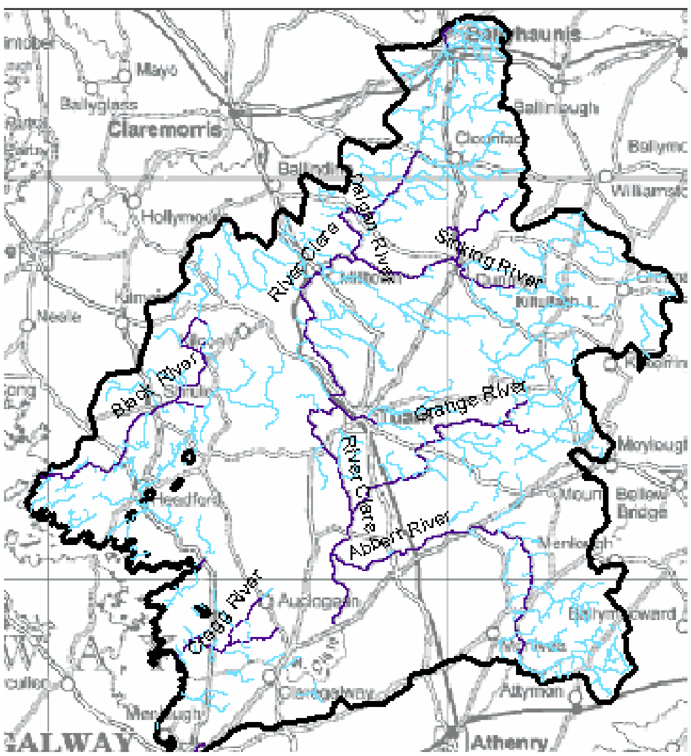


Table 1. Subsoil types in Clare-Corrib Groundwater.

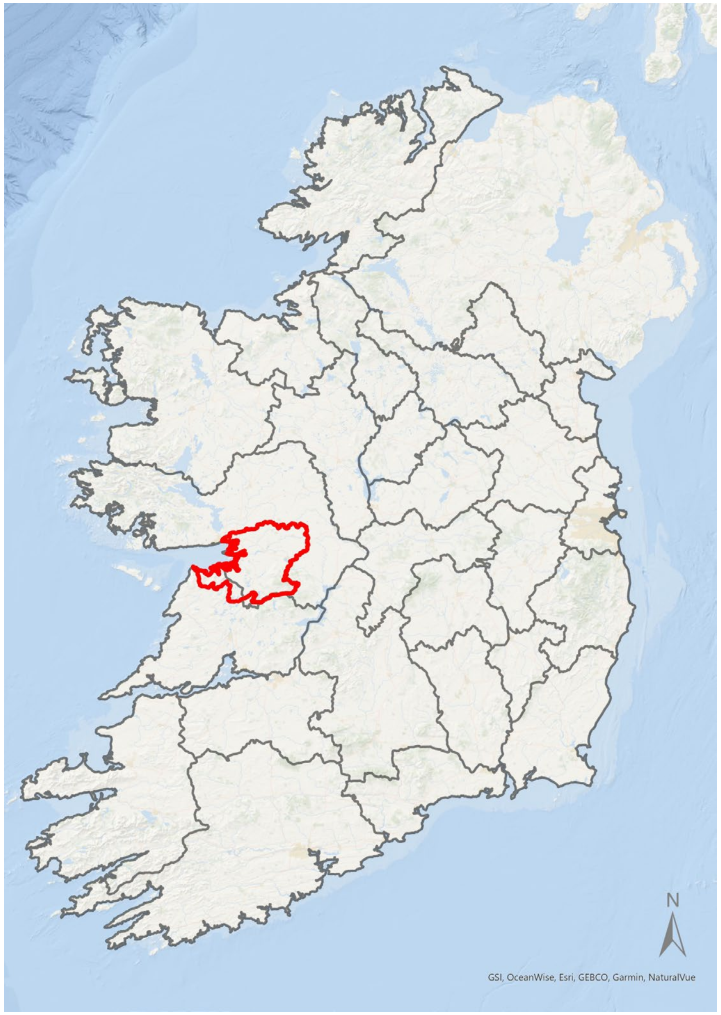
PAR_MAT	Full name	Area sq m	% of GWB
TLs	Limestone Till	881175858	59.9%
TGr	Granitic Till	355611	0.0%
TDSs	Devonian Sandstone Till	72907274	5.0%
RsPt	Raised Peat	15612	0.0%
Rck	Rock	7076384	0.5%
nodata	nada	6512889	0.4%
Mrl	Marl	781353	0.1%
Made	Made Ground	7776478	0.5%
Lk_isle		513	0.0%
Lake		3857021	0.3%
L	Lake sediments undifferentiated	10777977	0.7%
KaRck	Karstified limestone bedrock at surface	53547458	3.6%
GLs	Limestone sands and gravels (Carboniferous)	45700893	3.1%
Esk	Eskers	1989472	0.1%
Cut	Cutover Peat	343496766	23.4%
BktPt	Blanket Peat	2558408	0.2%
BasEsk	Basic esker sands and gravels	5158629	0.4%
A	Undifferentiated alluvium	26211636	1.8%

Clare-Corrib GWB (For reference only)



List of Rock units in Clare-Corrib GWB

Unit Name	Code	Description	Rock Unit
Ardnasillagh Formation	AS	Dark cherty limestone, thin shale	Dinantian Pure Bedded Limestones
Aughnanure Oolite Formation	AU	Cross-bedded massive oolitic limestone	Dinantian Pure Bedded Limestones
Ballysteen Formation	BA	Dark muddy limestone, shale	Dinantian Lower Impure Limestones
~~Boyle Sandstone Formation~~	~~BO~~	~~Sandstone, siltstone, black mudstone~~	~~Dinantian Mixed Sandstones, Shales and Limestones~~
~~Cloonfad Felsite~~	~~CfFe~~	~~Felsite~~	~~Granites & other Igneous Intrusive rocks~~
Cong Canal Formation	NL	Medium to thick-bedded pure limestone	Dinantian Pure Bedded Limestones
Cong Limestone Formation	CO	Thick-bedded pure limestone	Dinantian Pure Bedded Limestones
Coranellistrum Formation	CT	Medium to thick-bedded pure limestone	Dinantian Pure Bedded Limestones
Illaunagappul Formation	IL	Limestone, thin shale partings	Dinantian Pure Bedded Limestones
Kilbryan Limestone Formation	KL	Dark nodular calcarenite & shale	Dinantian Lower Impure Limestones
Knockmaa Formation	KA	Thick-bedded pure limestone	Dinantian Pure Bedded Limestones
Lucan Formation	LU	Dark limestone & shale (Calp") "	Dinantian Upper Impure Limestones
Oakport Limestone Formation	OK	Pale grey massive limestone	Dinantian Pure Bedded Limestones
Oldchapel Limestone Formation	OC	Dark fine limestone & calcareous shale	Dinantian Pure Bedded Limestones
~~Owenriff Member~~	~~OUor~~	~~Dark limestone with thin shales~~	~~Dinantian Lower Impure Limestones~~
Two Mile Ditch Member	KAtm	Thick-bedded limestone, clay wayboards	Dinantian Pure Bedded Limestones
Visean Limestones (undifferentiated)	VIS	Undifferentiated limestone	Dinantian Pure Bedded Limestones
Waulsortian Limestones	WA	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones



Cycle 3

HA 29 Galway Bay South East Catchment Report, May 2024

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

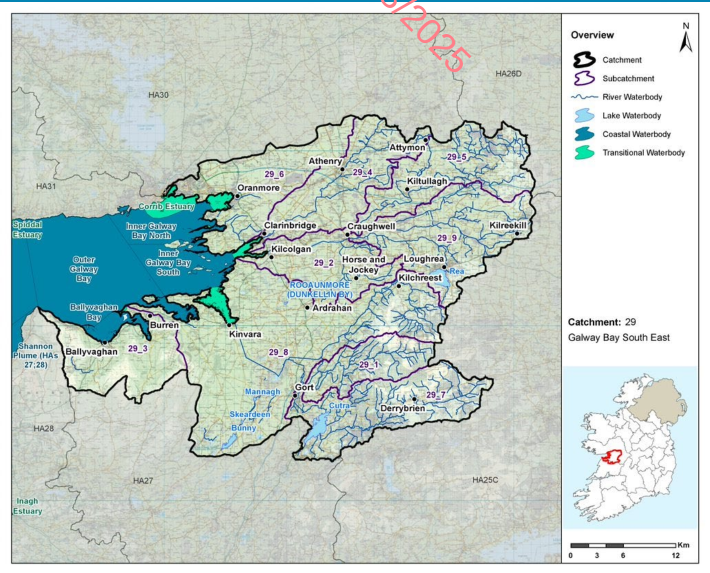
Introduction

This report provides an overview of the water quality in the Galway Bay South East Catchment and the pressures impacting on water quality. This report is based on data up to 2021. The latest water quality data, dashboards and maps throughout this report are available on catchments.ie and EPA Water Map.

The Galway Bay South East Catchment includes the area drained by all streams entering tidal water in Galway Bay between Black Head and Renmore Point, Galway, draining a total area of 1,270km². The largest urban centre in the catchment is the eastern part of Galway City. The other main urban centres in this catchment are Athenry, Loughrea, Gort, and Oranmore. This catchment is predominantly underlain by karstified limestone, including the northern part of the Burren in County Clare, and the groundwater and surface water systems in the area are closely interlinked.

The Galway Bay South East Catchment is divided into nine subcatchments and has 68 surface water bodies and 28 groundwater bodies.

[*View the Galway Bay South East Catchment on the EPA Water Map*]



Overview of Subcatchments in the Galway Bay South East Catchment

Previous Catchment Assessments

Previous catchment assessments, which provide additional historic context and information, are archived on catchments.ie:

- Cycle 2 Catchment Assessments – published September 2018
- Cycle 3 Draft Catchment Assessments – published September 2021

Online Dashboards

Links to online dashboards are provided in this report – these numbers may vary from those in this document as time progress and the online dashboards are updated based on the latest data and scientific assessments.

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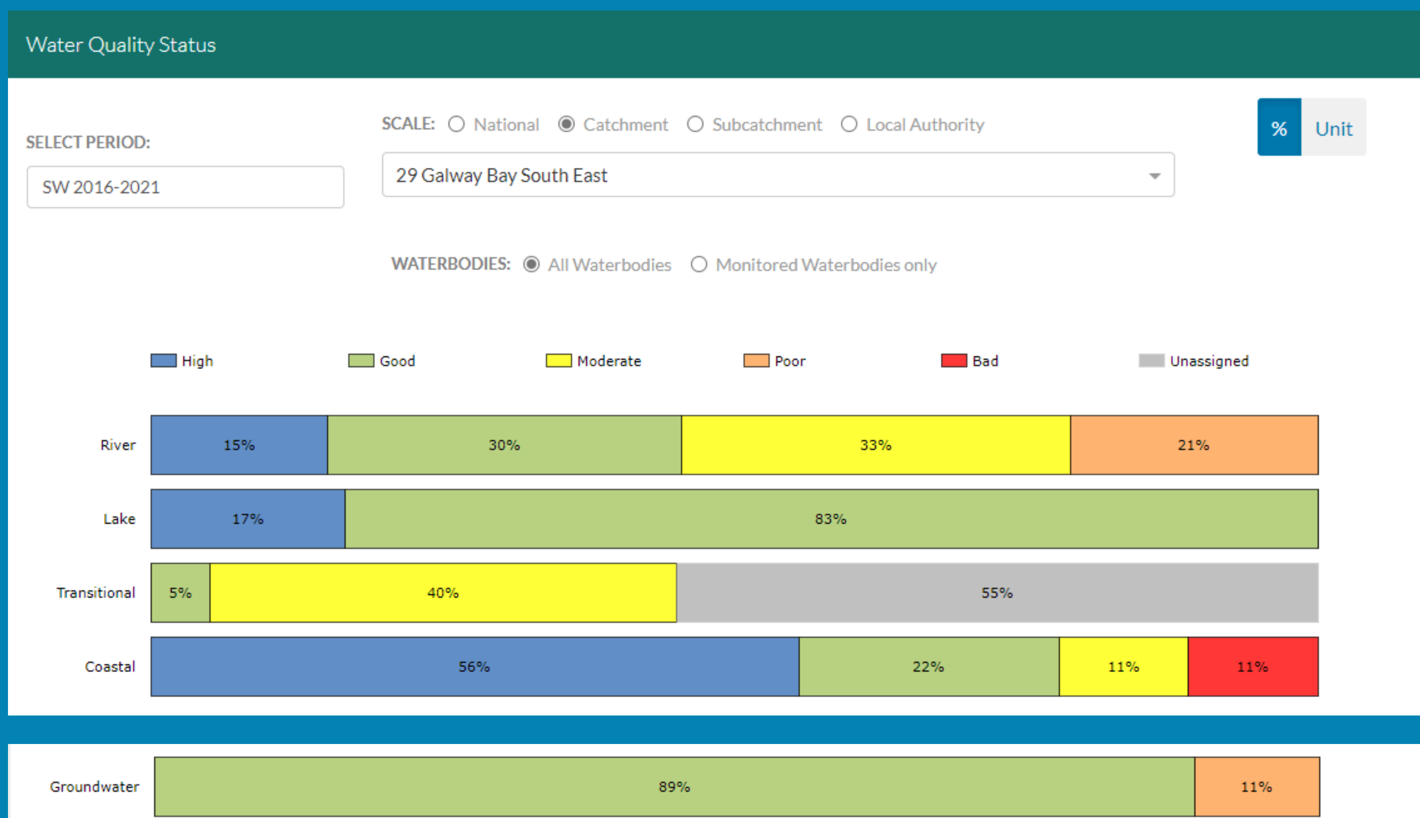
Water Quality Summary

The dashboard below provides a breakdown of water quality status for surface and groundwater bodies in the Galway Bay South East Catchment.

A total of 43% of surface waterbodies were at Good or High Ecological Status in the 2016-2021 monitoring period. Eighty-nine percent of groundwater bodies were at Good status.

Go to EPA Water Maps for WFD Status

[EPA Water Map]



Water quality status 2016-2021 for the Galway Bay South East Catchment.

View Online Dashboard: *https://www.catchments.ie/data/#/dashboard/waterquality*

High Status Objective Waterbodies

High status waters are prioritised for protection and action.

There are eight waterbodies with a **High Ecological Status Objective** (HSO) in the Galway Bay South East Catchment, with two currently not meeting their environmental objective of High.

Grants for septic tank upgrades may be available in high status objective catchment areas - you can learn more and check your Eircode for eligibility here: https://www.gov.ie/en/publication/6cc1e-domestic-waste-water-treatment-systems-septic-tanks

The EPA Water Map shows the locations of HSO waterbodies. See *Status and Risk / High Status Objectives.*

Water Quality Status - High Status Objective Waterbodies

SELECT TYPE: All Surface Waters

SCALE: Catchment / Local Authority

29 Galway Bay South East

	SW 2007-2009	SW 2010-2012	SW 2010-2015	SW 2013-2018	SW 2016-2021
BOLEYNEENDORRISH_010 (River)	Unassigned	High	High	High	High
BOLEYNEENDORRISH_020 (River)	Unassigned	High	High	High	High
Bunny (Lake)	Good	High	Good	Good	Good
Outer Galway Bay (Coastal)	Unassigned	Good	High	High	High
OWENDALULLEEGH_010 (River)	High	High	High	Good	High
OWENDALULLEEGH_020 (River)	Unassigned	High	High	High	High
OWENDALULLEEGH_030 (River)	High	High	Moderate	Good	Good
OWENDALULLEEGH_040 (River)	High	High	High	High	High

Water quality status for High Ecological Status Objective waterbodies.
View Online Dashboard: https://www.catchments.ie/data/#/dashboard/waterquality

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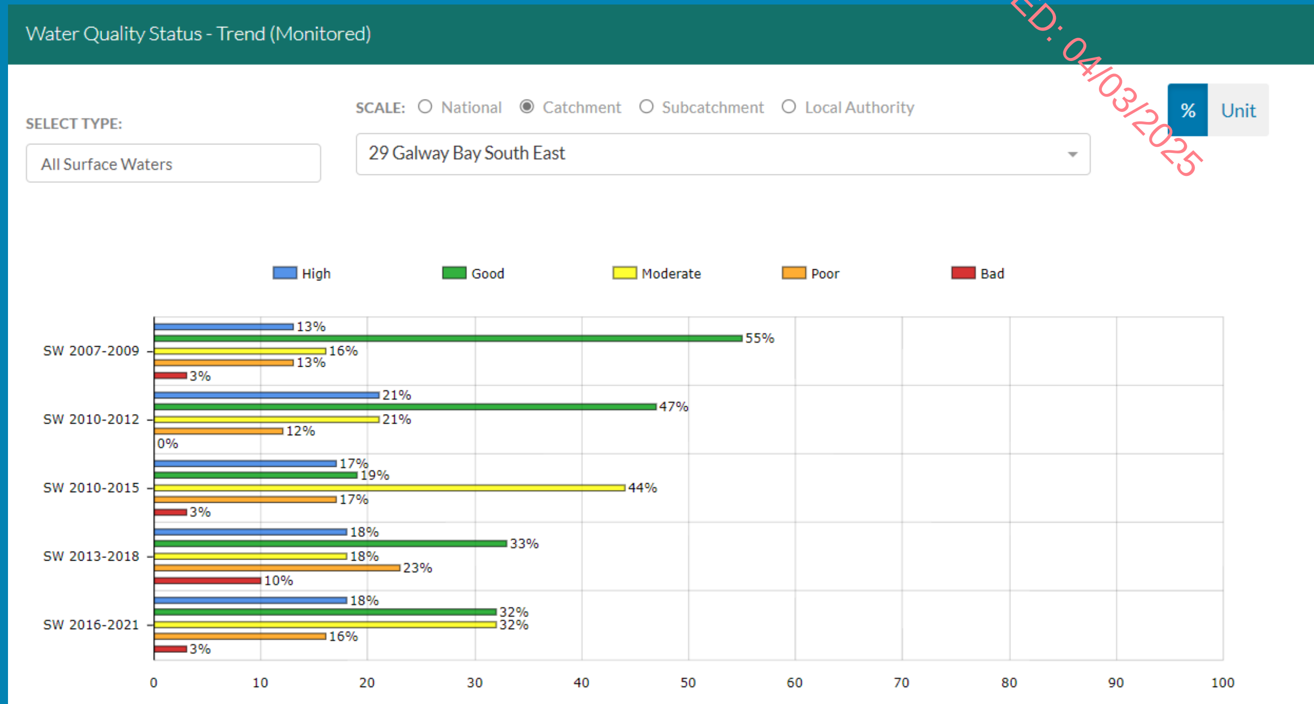
Water Quality Changes

Below illustrates the changes in ecological status in monitored surface waterbodies over the last five monitoring cycles in the Galway Bay South East Catchment. Nationally while there have been improvements in some waterbodies, these have been offset by declines elsewhere.



Ecological status trends for monitored surface waterbodies over the last five monitoring cycles in the Galway Bay South East *Catchment.* ***View online dashboard:*** https://www.catchments.ie/data/#/dashboard/waterquality

A total of 52 (54%) waterbodies are currently meeting their environmental objective of Good or High Ecological Status.

	Total	Achieving Environmental Objectives (2016-2021)	High Status Environmental Objectives Waterbodies	Achieving High Status Environmental Objectives (2016-2021)
Rivers	33	14 *(42%)*	6	5 *(83%)*
Canals	-	-	-	-
Lakes	6	5 *(83%)*	1	0 *(0%)*
Transitional	20	1 *(5%)*	-	-
Coastal	9	7 *(78%)*	1	1 *(100%)*
Groundwater	28	25 *(89%)*	-	-

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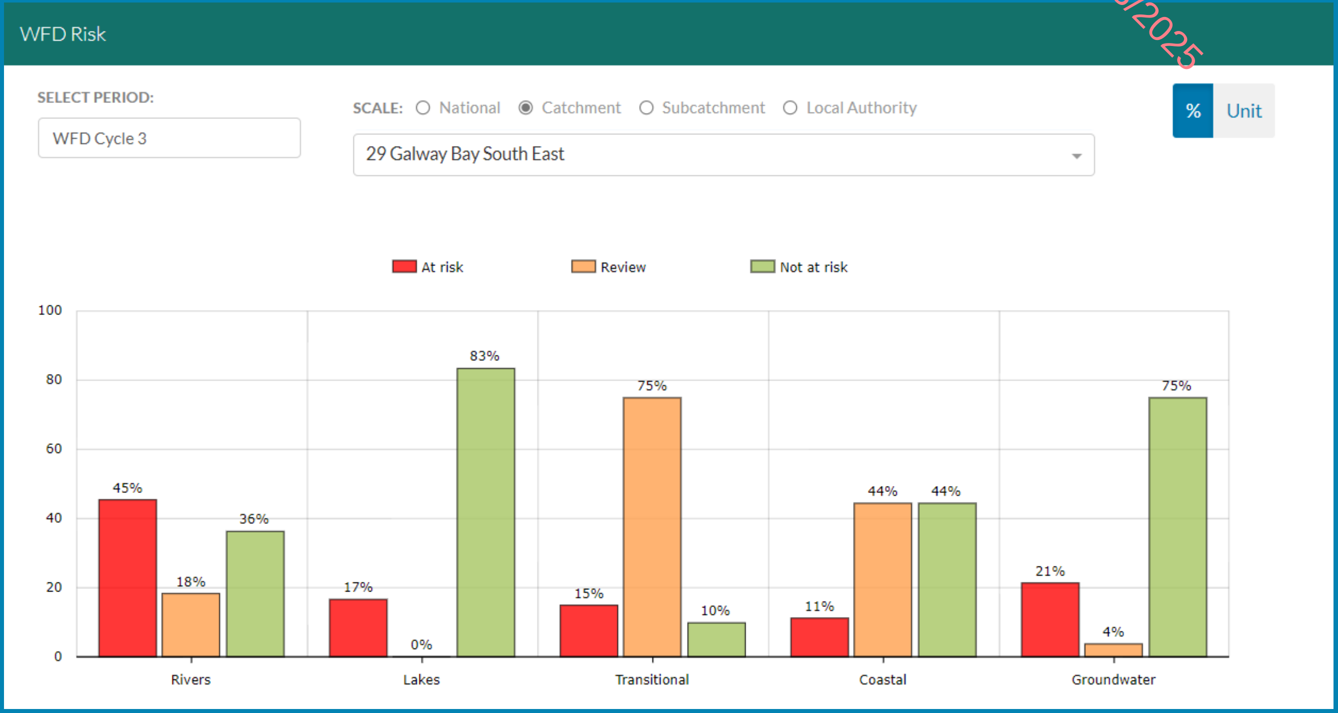
WFD Risk

A total of 26 (27%) waterbodies are *At Risk* of not meeting their environmental objective in the Galway Bay South East Catchment, while 26 (27%) are under *Review* and 44 (46%) are *Not At Risk.*

Go to [EPA Water Map](#) to see WFD Risk for this catchment



WFD Risk for the Galway Bay South East *Catchment based on 2016-2021 data.*
View Online Dashboard: https://www.catchments.ie/data/#/dashboard/waterquality

There are currently no heavily modified water bodies (HMWBs) in the Galway Bay South East Catchment.

There are no artificial waterbodies in the Galway Bay South East Catchment.

The [EPA's characterisation outcome report](#) has more information on WFD Risk

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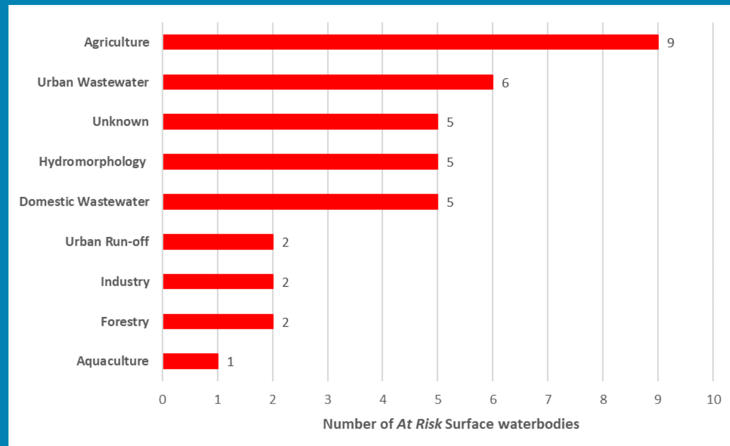
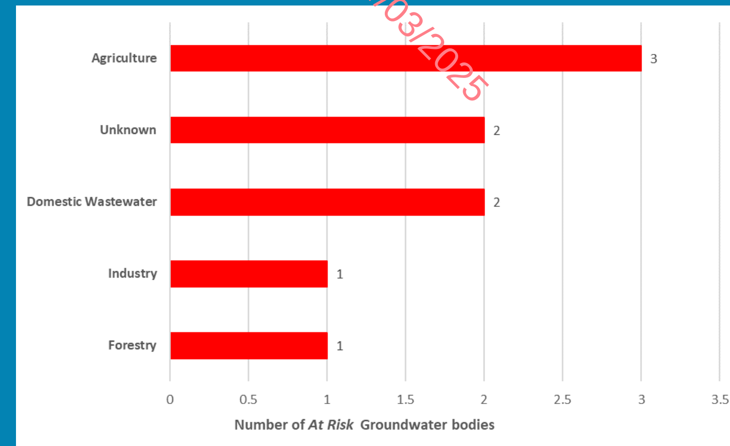
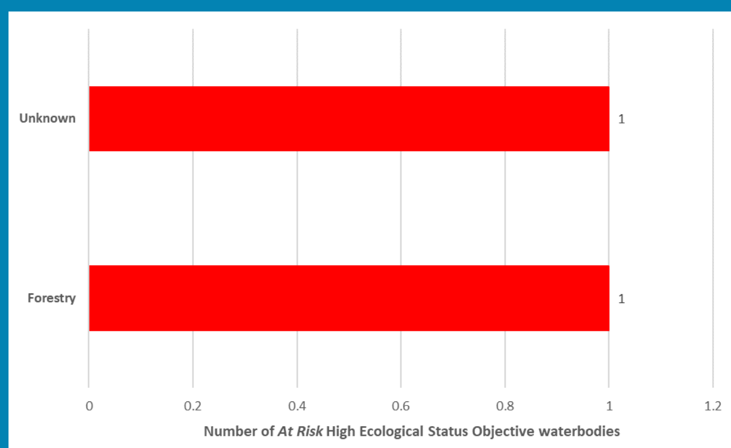
Significant Pressures driving risk

Click here for more information on significant pressures

Significant pressure types impacting the 20 *At Risk* surface waterbodies and six groundwater bodies are broken down in the figures below, including significant pressure information for the two *At Risk* High Ecological Status Objective waterbodies.







The issues driven by these pressures are mainly nutrient pollution, organic pollution and altered morphological condition (habitat) impacts for surface water and nutrient pollution, chemical quality diminution for surface water and groundwater chemical dependent terrestrial ecosystem damage for groundwaters. For more information, see https://www.catchments.ie/data/#/dashboard/pressure?_k=i351zs.

Go to the Summary Information section to get significant pressure and issue data for At Risk waterbodies within the Galway Bay South East Catchment.

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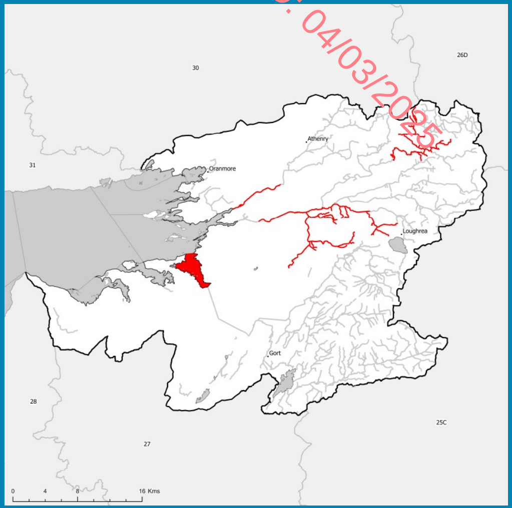
Significant Pressures

River Waterbody
Significant Pressure in Waterbody *At Risk*
Other Waterbodies
Lake, Coastal and Transitional Waterbody
Significant Pressure in Waterbody *At Risk*
Other Waterbodies

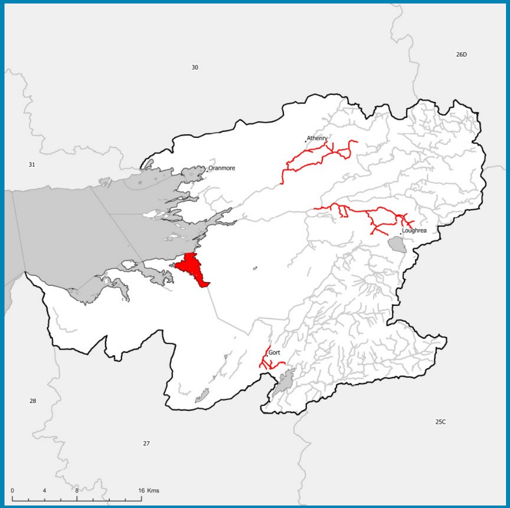
Agriculture is the top significant pressure impacting 46% of the 26 *At Risk* waterbodies within the Galway Bay South East Catchment, followed by 27% impacted by domestic wastewater and 23% by urban wastewater.

i

ii



iii



The catchments.ie dashboards will show all significant pressures identified for this catchment.

www.catchments.ie/data/#/dashboard/pressure

Go to the EPA Water Maps for the locations of all significant pressure types identified for this catchment

Locations of At Risk surface waterbodies impacted by i) Agriculture, ii)Domestic Wastewater and iii) Urban Wastewater.

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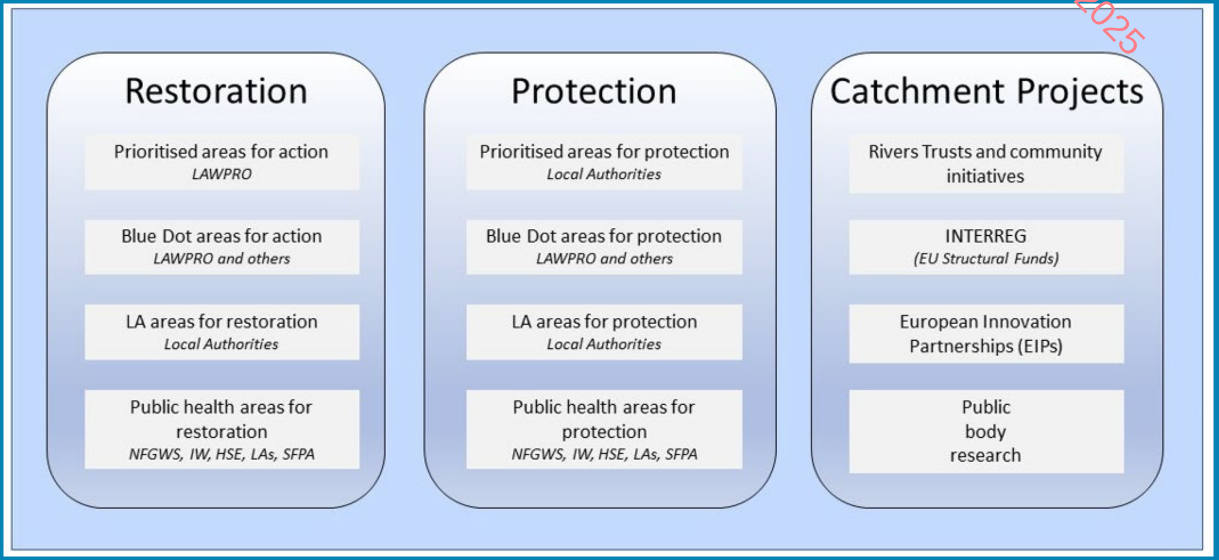
Priority Areas for Action

A number of waterbodies have been prioritised through the selection of Areas for Action. There were two Priority Areas for Action identified for the second river basin management planning cycle in the Galway Bay South East Catchment. This has increased to a total of eight Areas for Restoration, two Areas for Protection and two Catchment Projects for the third cycle. ***Go to the summary information section to get Area for Action information for waterbodies within the Galway Bay South East Catchment.***



Types of Areas for Action under the third cycle River Basin Management Plan

- View the current progress of Areas for Action and Summary Reports completed by LAWPRO, on catchments.ie and the EPA Water Map:
  - https://www.catchments.ie/data/#/areaforaction
  - https://gis.epa.ie/EPAMaps/default?easting=?&northing=?&lid=EPA:WFD_AreasForAction

- LAWPRO have also published detailed desktop studies on Prioritised Areas for Action (PAAs) which are available their website: https://lawaters.ie/desktop-studies/

- Information on Areas for Action for the second cycle is available in Cycle 2 Catchment Assessments which have been archived on catchments.ie: https://www.catchments.ie/download/cycle-2-catchment-assessments-published-september-2018/

Summary information for all waterbodies in the Galway Bay South East Catchment

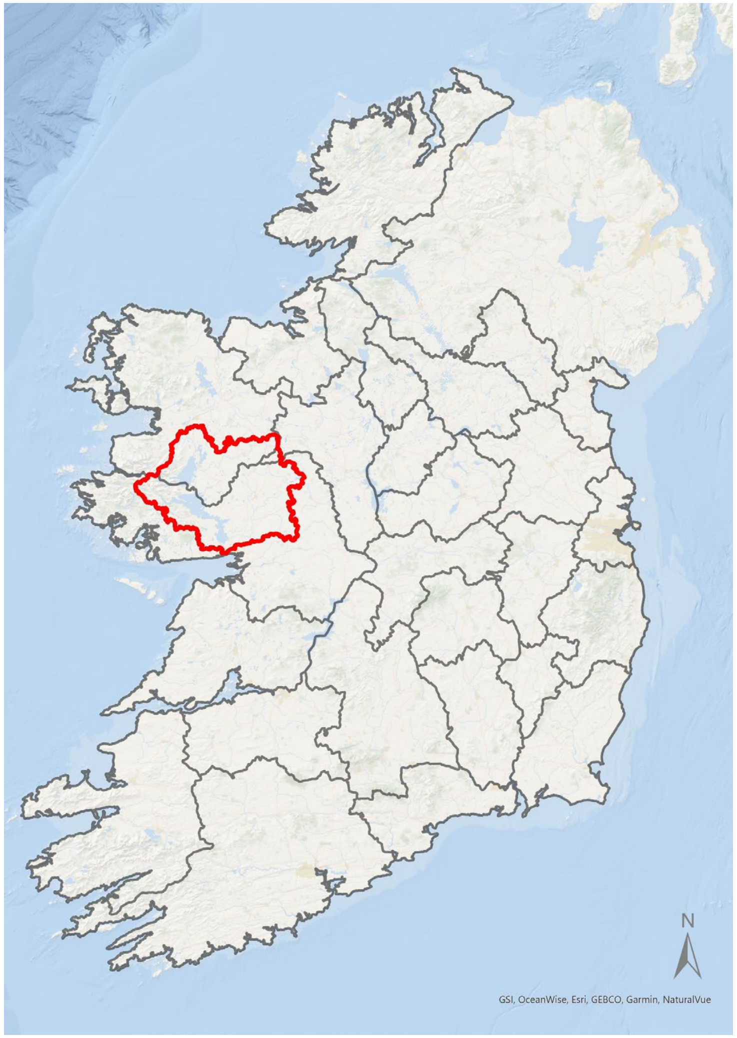
The next page provides a table with a breakdown of key information for all waterbodies in this catchment. The key is provided below. Additional information for each waterbody is available on https://www.catchments.ie/data, including a breakdown of status, a monitoring schedule for monitored waterbodies and downloadable chemistry results, where available.

Protected Area categories	BW: Bathing Water DW: Drinking Water Fish: Salmonid Waters NSA: Nutrient Sensitive Areas SAC: Special Area of Conservation, Natura 2000 (water dependent habitats and species) SF: Shellfish Area SPA: Special Area of Protection, Natura 2000 (water dependent habitat and species)
Significant pressure* types categories ** For At Risk waterbodies only*	Ab: Abstractions Ag: Agriculture Aq: Aquaculture At: Atmospheric DWW: Domestic Wastewater For: Forestry HPS: Historically polluted sites HYMO: Hydromorphology Ind: Industry IS: Invasive Species M+Q: Mines and Quarries Peat: Peat Drainage and Extraction UR: Urban Run-Off UWW: Urban Wastewater Was: Waste WT: Water Treatment

Catchment Code	Waterbody (WB) Code	WB Name	WB Type	Local Authority	Protected Area	Status 10-15	Status 13-18	Status 16-21	Environmental Objective	Environmental Objective Date	WFD Risk 16-21	Significant Issue(s)	Significant Pressure(s)	Area for Action (AFA)	AFA (lead, type)	Link to WB page on catchments.ie	Link to WB on EPA Water Map
27, 28, 29	IE_SH_070_0000	Shannon Plume (HAs 27;28)	Coastal	Clare County Council	BW; SAC; SPA;	Unassigned	High	High	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
28, 29, 31, 32	IE_WE_010_0000	Aran Islands, Galway Bay, Connemara (HAs 29;31)	Coastal	Galway County Council	BW; SAC; SPA; SF;	Unassigned	High	High	Good	2021 or earlier	Review					View WB Page	View WB on EPA Water Map
29, 31	IE_WE_100_0000	Outer Galway Bay	Coastal	Galway County Council	BW; SAC; SPA;	High	High	High	High	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_110_0000	Ballyvaghan Bay	Coastal	Clare County Council	BW; SAC; SPA; SF;	Unassigned	Good	High	Good	2021 or earlier	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_130_0000	Aughinish Bay	Coastal	Clare County Council	SAC; SPA; SF;	Unassigned	Unassigned	Good	Good	2021 or earlier	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_160_0000	Inner Galway Bay South	Coastal	Galway County Council	BW; SAC; SPA; SF;	Unassigned	Good	High	Good	2021 or earlier	Not at risk			Clarinbridge and Kinvara_Public Health	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_160_0700	Rincarna Pools South	Coastal	Galway County Council	SAC; SPA;	Unassigned	Bad	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_160_0710	Rincarna Pools North	Coastal	Galway County Council	SAC; SPA;	Poor	Bad	Bad	Good	2022-2027	At risk	UnknownImpactType	Unknown			View WB Page	View WB on EPA Water Map
29, 31	IE_WE_170_0000	Inner Galway Bay North	Coastal	Galway County Council	BW; SAC; SPA; SF;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
25B, 25C, 26D, 26G, 29	IE_SH_G_019	Aughrim	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
27, 28, 29	IE_SH_G_047	Burren	Groundwater	Clare County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
25C, 27, 29	IE_SH_G_071	Crusheen	Groundwater	Clare County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
27, 29	IE_SH_G_080	Ennis	Groundwater	Clare County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	At risk	ChemicalQualityDiminutionForSW, Nutrients	Ag, For, Unknown			View WB Page	View WB on EPA Water Map
25C, 25D, 27, 29	IE_SH_G_157	Lough Graney	Groundwater	Clare County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
27, 28, 29	IE_SH_G_212	Slieve Elva	Groundwater	Clare County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
26B, 26C, 26D, 26E, 26G, 29, 30	IE_SH_G_225	Suck South	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
25B, 25C, 26D, 26G, 29	IE_SH_G_236	Tynagh	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
27, 28, 29	IE_WE_G_0001	Ballyvaughan Uplands	Groundwater	Clare County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
27, 29	IE_WE_G_0002	Kinvara-Gort	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29, 30, 31, 32	IE_WE_G_0006	Maam-Clonbur	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29, 30	IE_WE_G_0007	Loughrea	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29, 30	IE_WE_G_0008	Clarinbridge	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
26D, 29, 30, 34	IE_WE_G_0020	Clare-Corrib	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_G_0087	GWDTE-Galway Bay Complex Fens (SAC000268)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_G_0088	GWDTE-Ballinaduff Turlough (SAC002295)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_G_0090	GWDTE-Ballyvelaghan Turlough (SAC000268)	Groundwater	Clare County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
25C, 27, 29	IE_WE_G_0091	GWDTE-Caherglassaun Turlough (SAC000238)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Poor	Poor	Poor	Good	2022-2027	At risk	GWChemicalDependentTerrestrialEcosystemDamage, Nutrients	Unknown			View WB Page	View WB on EPA Water Map
29	IE_WE_G_0092	GWDTE-Cahermore Turlough (SAC002294)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
25C, 29	IE_WE_G_0093	GWDTE-Coy Turlough (SAC002117)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	At risk	ChemicalQualityDiminutionForSW, Nutrients	Ag			View WB Page	View WB on EPA Water Map
27, 29	IE_WE_G_0095	GWDTE-Gortboyheen Turlough (SAC000054)	Groundwater	Clare County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_G_0096	GWDTE-Kiltiernan Turlough (SAC001285)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Review					View WB Page	View WB on EPA Water Map
27, 29	IE_WE_G_0098	GWDTE-Lough Mannagh Turlough (SAC001926)	Groundwater	Clare County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_G_0099	GWDTE-Muckinish Turlough (SAC000054)	Groundwater	Clare County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
25C, 26D, 29, 30	IE_WE_G_0100	GWDTE-Rahasane Turlough (SAC000322)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	At risk	ChemicalQualityDiminutionForSW, Nutrients	DWTS, Ag			View WB Page	View WB on EPA Water Map
29	IE_WE_G_0105	GWDTE-Tullynafrankagh Turlough (SAC000606)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Poor	Poor	Poor	Good	2022-2027	At risk	GWChemicalDependentTerrestrialEcosystemDamage, Nutrients	DWTS			View WB Page	View WB on EPA Water Map
29, 30	IE_WE_G_0106	GWDTE-Lough Corrib Fens 3 & 4 (SAC000297)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map

29	IE_WE_G_0117	Industrial Facility (P0056-01)	Groundwater	Galway County Council	DWPA; SAC	Poor	Poor	Poor	Good	2022-2027	At risk	Chemical, ChemicalQualityDiminutionForSW, Nutrients	Ind			View WB Page	View WB on EPA Water Map
29	IE_WE_27_114	Bunny	Lake	Clare County Council	SAC;	Good	Good	Good	High	2022-2027	At risk	Hydrological, Morphological	Unknown	Lough Bunny	Clare County Council, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29_107	ROOAUNMORE (DUNKELLIN BY)	Lake	Galway County Council	SAC;	Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_29_168	Mannagh	Lake	Galway County Council	SAC;	Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_29_181	Skeardeen	Lake	Clare County Council	SAC;	Unassigned	Unassigned	High	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_29_194	Rea	Lake	Galway County Council	BW; DWPA; SAC; SPA;	Moderate	Good	Good	Good	2021 or earlier	Not at risk			St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29_37	Cutra	Lake	Galway County Council	SAC; SPA;	Moderate	Good	Good	Good	2021 or earlier	Not at risk			Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29B020100	BEAGH_010	River	Galway County Council	SAC; SPA;	Moderate	Moderate	Good	Good	2021 or earlier	Not at risk			Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29B030300	BALLYMABILLA_010	River	Galway County Council		Moderate	Good	Good	Good	2021 or earlier	Not at risk			Raford	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29B040100	BOLEYNEENDORRISH_010	River	Galway County Council	SAC;	High	High	High	High	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_29B040300	BOLEYNEENDORRISH_020	River	Galway County Council	SAC;	High	High	High	High	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_29B040800	BOLEYNEENDORRISH_030	River	Galway County Council		Moderate	High	Good	Good	2021 or earlier	Not at risk			Ballyaneen Rakerin GWS. Peterswell Castledaly GWS.	NFGWS, Protection	View WB Page	View WB on EPA Water Map
29	IE_WE_29C010200	CANNAHOWNA_010	River	Galway County Council	DWPA;	Good	Poor	Moderate	Good	2022-2027	At risk	Hydrological, Organic	Unknown, UWW	Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C020040	CLARINBRIDGE_010	River	Galway County Council		Moderate	Good	Good	Good	2021 or earlier	Not at risk			Clarinbridge	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C020200	CLARINBRIDGE_020	River	Galway County Council	SAC;	Unassigned	Moderate	Moderate	Good	2022-2027	Review			Clarinbridge	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C020300	CLARINBRIDGE_030	River	Galway County Council		Poor	Poor	Moderate	Good	2022-2027	At risk	Nutrients, Organic	UWW	Clarinbridge	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C020400	CLARINBRIDGE_040	River	Galway County Council		Poor	Poor	Poor	Good	2022-2027	At risk	Nutrients	UWW	Clarinbridge	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C020500	CLARINBRIDGE_050	River	Galway County Council		Poor	Poor	Poor	Good	2022-2027	At risk	Nutrients, Organic	DWTS, UR, Ag	Clarinbridge	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C031000	CARRA STREAM_010	River	Galway County Council		Moderate	Poor	Poor	Good	2022-2027	At risk	Sediment, Morphological, Nutrients	Ag, HYMO	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C032000	CARRA STREAM_020	River	Galway County Council		Good	Good	Good	Good	2021 or earlier	Not at risk			St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29C050400	CARROWMONEASH (Oranmore)_010	River	Galway County Council	SAC; SPA;	Unassigned	Unassigned	Poor	Good	2022-2027	Review			Carrowmoneash	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29G220860	GLENINAGH_SOUTH_010	River	Clare County Council	SAC;	Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_29K010100	KILCOLGAN_010	River	Galway County Council	SAC; SPA;	Unassigned	Poor	Moderate	Good	2022-2027	At risk	Sediment, Morphological, Organic	HYMO, UR	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29K010200	KILCOLGAN_020	River	Galway County Council		Poor	Poor	Poor	Good	2022-2027	At risk	Nutrients, Organic	Ag, UWW	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29K010400	KILCOLGAN_030	River	Galway County Council		Moderate	Bad	Poor	Good	2022-2027	At risk	Sediment, Morphological, Nutrients, Organic	UWW, Ag, DWTS, HYMO, Ind	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29K010600	KILCOLGAN_040	River	Galway County Council	SAC; SPA;	Moderate	Poor	Poor	Good	2022-2027	At risk	Morphological, Nutrients, Organic	HYMO, Ind, Ag, DWTS	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29K010700	KILCOLGAN_050	River	Galway County Council	SAC; SPA;	Unassigned	Moderate	Moderate	Good	2022-2027	Review			St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29K022100	KILCHREEST_010	River	Galway County Council	SAC; SPA;	Unassigned	Unassigned	Good	Good	2021 or earlier	Review			Kilchreest	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29L010600	LECARROW STREAM_010	River	Galway County Council		Moderate	Good	Moderate	Good	2022-2027	At risk	Nutrients	Ag	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29O010500	OWENDALULLEEGH_010	River	Galway County Council		High	Good	High	High	2021 or earlier	Not at risk			Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29O010700	OWENDALULLEEGH_020	River	Galway County Council		High	High	High	High	2021 or earlier	Not at risk			Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29O010800	OWENDALULLEEGH_030	River	Galway County Council		Moderate	Good	Good	High	2022-2027	At risk	Morphological	For	Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29O010900	OWENDALULLEEGH_040	River	Galway County Council		High	High	High	High	2021 or earlier	Not at risk			Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29O011000	OWENDALULLEEGH_050	River	Galway County Council	SAC;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	Hydrological, Morphological	For, HYMO	Owendalulleegh Lough Cutra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29R010100	RAFORD_010	River	Galway County Council		Good	Poor	Good	Good	2021 or earlier	Not at risk			Raford	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29R010200	RAFORD_020	River	Galway County Council		Moderate	Moderate	Moderate	Good	2022-2027	At risk	Nutrients	Ag, DWTS	Raford	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29R010500	RAFORD_030	River	Galway County Council		Good	Good	Good	Good	2021 or earlier	Review			Raford	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29R090950	ROCKHILL (Galway)_010	River	Galway County Council	SAC; SPA;	Unassigned	Poor	Moderate	Good	2022-2027	Review			Carrowmoneash	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29T010300	TOBERDONEY_010	River	Galway County Council		Moderate	Moderate	Moderate	Good	2022-2027	At risk	Nutrients	Ag	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_29T010700	TOBERDONEY_020	River	Galway County Council		Poor	Moderate	Moderate	Good	2022-2027	At risk	Sediment, Nutrients	Ag	St Cleran's	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map

29	IE_WE_110_0100	Muckinish Lough	Transitional	Clare County Council	SAC;	Unassigned	Bad	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_120_0100	Murree Lough	Transitional	Clare County Council	SAC; SPA;	Moderate	Moderate	Unassigned	Good	Unknown	At risk	UnknownImpactType	Unknown			View WB Page	View WB on EPA Water Map
29	IE_WE_140_0100	Aughinish Lagoon	Transitional	Clare County Council	SAC; SPA;	Unassigned	Poor	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_140_0200	Carrownahallia Lagoon, Aughinish	Transitional	Clare County Council	SAC; SPA;	Unassigned	Moderate	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_150_0100	Rossalia Lagoon	Transitional	Clare County Council	SAC; SPA;	Unassigned	Poor	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_160_0100	Kinvarra Bay	Transitional	Galway County Council	SAC; SPA; SF;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	Nutrients, Organic	DWTS, Aq, UWW	Clarinbridge and Kinvara_Public Health	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_160_0200	Bridge Lough, Knockakilleen	Transitional	Galway County Council	SAC; SPA; SF;	Bad	Good	Moderate	Good	2022-2027	At risk	UnknownImpactType	Unknown			View WB Page	View WB on EPA Water Map
29	IE_WE_160_0300	Loughaungreena (Doorus Loughs)	Transitional	Galway County Council	SAC;	Unassigned	Moderate	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_160_0400	Lough Fadda (Doorus Loughs)	Transitional	Galway County Council	SAC;	Unassigned	Moderate	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_160_0500	Lough Namona (Doorus Loughs)	Transitional	Galway County Council	SAC;	Unassigned	Bad	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_160_0600	Lough Sallagh (Doorus Loughs)	Transitional	Galway County Council	SAC; SPA; SF;	Unassigned	Moderate	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_160_0800	Dunbulcaun Bay	Transitional	Galway County Council	SAC; SPA; SF;	Unassigned	High	Good	Good	2021 or earlier	Not at risk			Clarinbridge and Kinvara_Public Health	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29	IE_WE_170_0100	Mweeloon Pool South	Transitional	Galway County Council	SAC; SPA;	Unassigned	Poor	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_170_0150	Mweeloon Pool North	Transitional	Galway County Council	SAC; SPA;	Unassigned	Poor	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_170_0200	Loughaunascalia, Ardfry Point	Transitional	Galway County Council	SAC; SPA;	Unassigned	Moderate	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_170_0300	Ardfry Oyster Pool	Transitional	Galway County Council	SAC; SPA;	Unassigned	Poor	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_170_0400	Turreen Lough (Rinville West)	Transitional	Galway County Council	SAC; SPA;	Unassigned	Moderate	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29	IE_WE_170_0500	Oranmore Bay	Transitional	Galway County Council	SAC; SPA;	Unassigned	High	Unassigned	Good	Unknown	Not at risk					View WB Page	View WB on EPA Water Map
29	IE_WE_170_0600	Renmore Lough, Galway City	Transitional	Galway City Council	SAC;	Unassigned	Moderate	Unassigned	Good	Unknown	Review					View WB Page	View WB on EPA Water Map
29, 30, 31	IE_WE_170_0700	Corrib Estuary	Transitional	Galway City Council	BW; SAC; SPA;	Good	Good	Moderate	Good	2022-2027	Review			Corrib	Galway City Council, Protection	View WB Page	View WB on EPA Water Map



Cycle 3

HA 30 Corrib Catchment Report, May 2024

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

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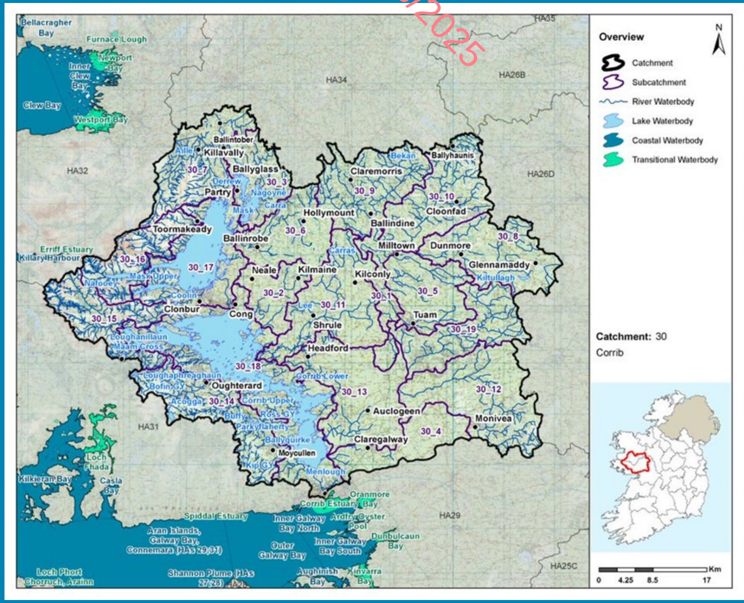
Introduction

This report provides an overview of the water quality in the Corrib Catchment and the pressures impacting on water quality. This report is based on data up to 2021. The latest water quality data, dashboards and maps throughout this report are available on catchments.ie and EPA Water Map.

The Corrib Catchment includes the area drained by the River Corrib and all streams entering tidal water between Renmore Point and Nimmo's Pier, Galway, draining a total area of 3,112km². The largest urban centre in the catchment is Galway City. The other main urban centres in this catchment are Tuam, Ballinrobe, Claremorris and Ballyhaunis.

The Corrib catchment is divided into 19 subcatchments and has 97 river waterbodies, 30 lake waterbodies, one transitional waterbody, no coastal waterbodies and 31 groundwater bodies.

View the Corrib Catchment on the EPA Water Map



Overview of Subcatchments in the Corrib Catchment

Previous Catchment Assessments

Previous catchment assessments, which provide additional historic context and information, are archived on catchments.ie:

- Cycle 2 Catchment Assessments – published September 2018
- Cycle 3 Draft Catchment Assessments – published September 2021

Online Dashboards

Links to online dashboards are provided in this report – these numbers may vary from those in this document as time progress and the online dashboards are updated based on the latest data and scientific assessments.

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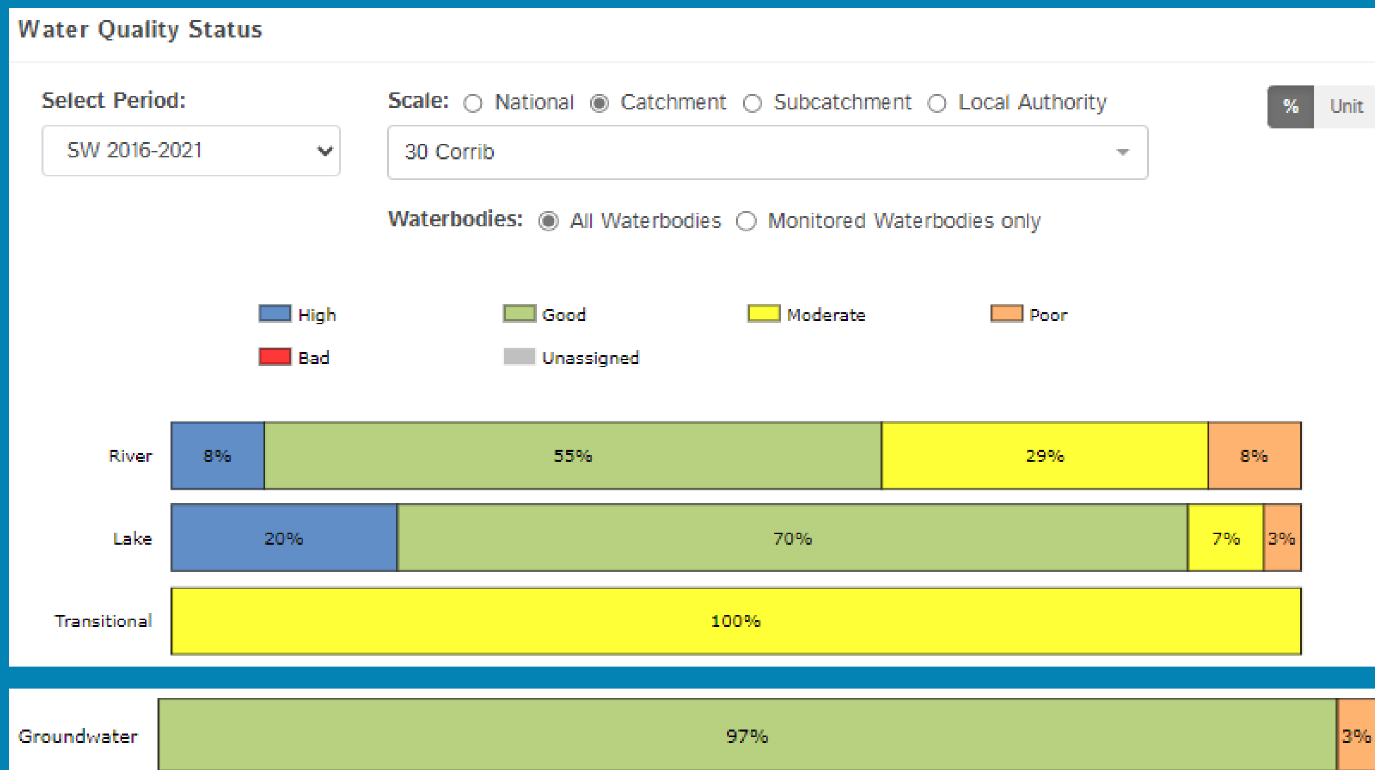
Water Quality Summary

The dashboard below provides a breakdown of water quality status for surface and groundwater bodies in the Corrib Catchment.

A total of 69% of surface waterbodies were at Good or High Ecological Status in the 2016-2021 monitoring period. Ninety-seven percent of groundwater bodies were at Good status.

Go to EPA Water Maps for WFD Status

[EPA Water Map]



Water quality status 2016-2021 for the Corrib Catchment. ***View Online Dashboard:*** *https://www.catchments.ie/data/#/dashboard/waterquality*

High Status Objective Waterbodies

High status waters are prioritised for protection and action.

There are 12 waterbodies with a **High Ecological Status Objective** (HSO) in the Corrib Catchment, with seven currently not meeting their environmental objective of High.

Grants for septic tank upgrades may be available in high status objective catchment areas - you can learn more and check your Eircode for eligibility here: https://www.gov.ie/en/publication/6cc1e-domestic-waste-water-treatment-systems-septic-tanks

The EPA Water Map shows the locations of HSO waterbodies. See *Status and Risk / High Status Objectives.*

	SW 2007-2009	SW 2010-2012	SW 2010-2015	SW 2013-2018	SW 2016-2021
AILLE (MAYO)_030 (River)	High	Unassigned	Good	Good	Good
Bofin GY (Lake)	High	High	High	High	High
CAMMANAGH_010 (River)	High	High	High	Good	Good
DOOGHTA_020 (River)	Unassigned	Unassigned	High	High	High
FAILMORE_010 (River)	High	Good	Good	High	High
FINNY_010 (River)	High	High	Good	Good	High
GLENGAWBEG_010 (River)	Good	Good	High	Good	Good
Loughanillaun Maam Cross (Lake)	High	Good	Good	Good	Good
Mask (Lake)	High	Good	Good	Good	Good
Maumwee (Lake)	High	High	Good	Good	Good
OWENRIFF (CORRIB)_010 (River)	High	Good	Good	Good	High
OWENRIFF (CORRIB)_020 (River)	Good	Good	Good	Bad	Poor

Water quality status for High Ecological Status Objective waterbodies.
View Online Dashboard: https://www.catchments.ie/data/#/dashboard/waterquality

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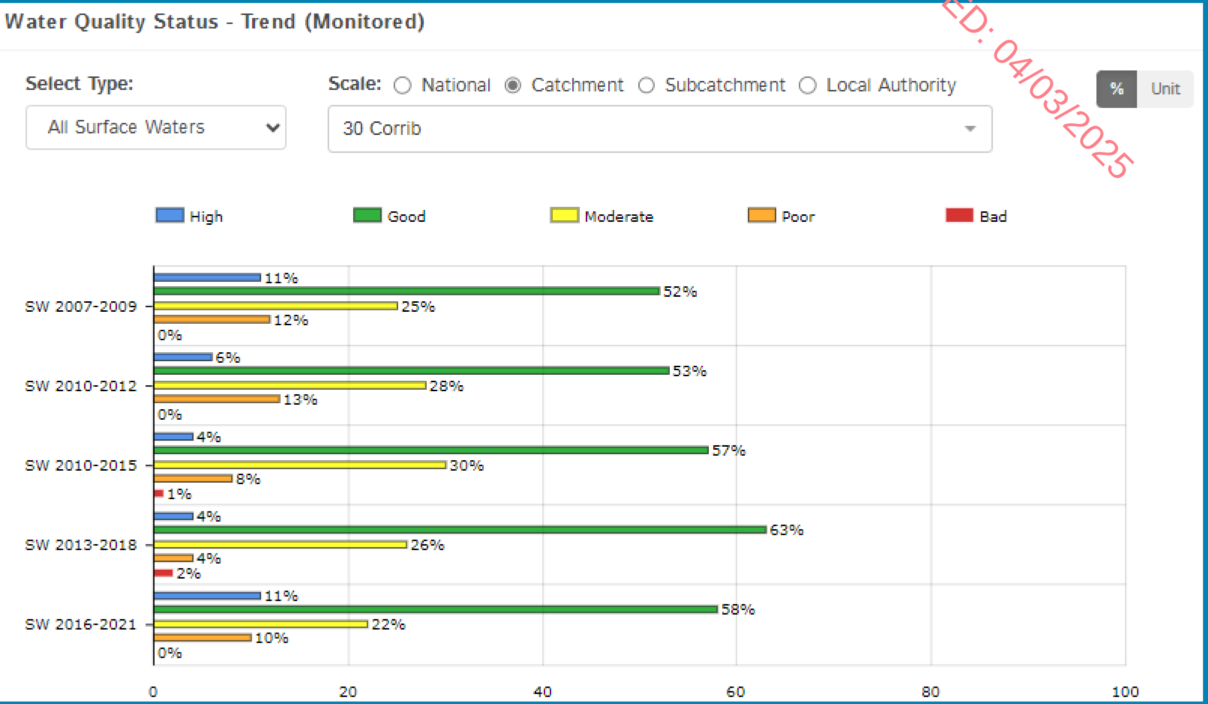
Water Quality Changes

Below illustrates the changes in ecological status in monitored surface waterbodies over the last five monitoring cycles in the Corrib Catchment. Nationally while there have been improvements in some waterbodies, these have been offset by declines elsewhere.



Ecological status trends for monitored surface waterbodies over the last five monitoring cycles in the Corrib Catchment.
View online dashboard: https://www.catchments.ie/data/#/dashboard/waterquality

A total of 112 (70%) waterbodies are currently meeting their environmental objective of Good or High Ecological Status.

	Total	Achieving Environmental Objectives (2016-2021)	High Status Environmental Objectives Waterbodies	Achieving High Status Environmental Objectives (2016-2021)
Rivers	97	58 *(60%)*	8	4 *(50%)*
Canals	-	-	-	-
Lakes	30	24 *(80%)*	4	1 *(25%)*
Transitional	1	0 *(0%)*	0	0 *(0%)*
Coastal	-	-	-	-
Groundwater	31	30 *(97%)*	0	0 *(0%)*

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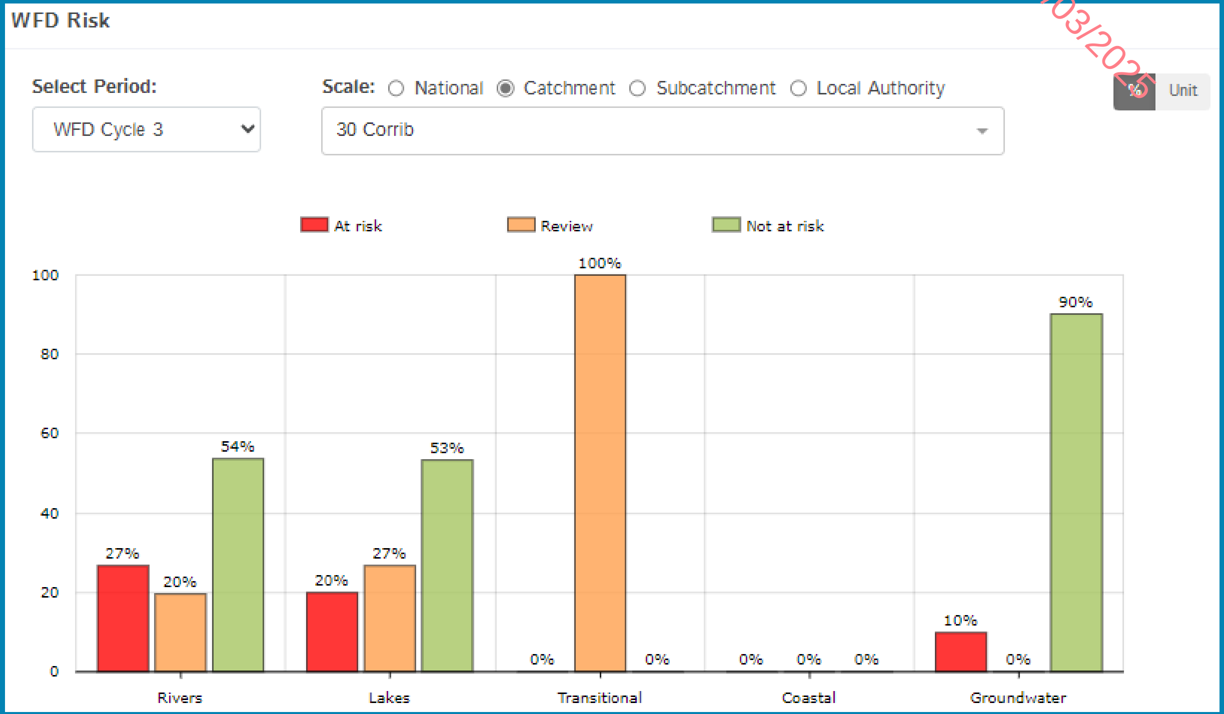
WFD Risk

Go to [*EPA Water Map*]() *to see WFD Risk for this catchment*

A total of 35 (22%) waterbodies are *At Risk* of not meeting their environmental objective in the Corrib Catchment, while 28 (18%) are under *Review* and 96 (60%) are *Not At Risk.*



WFD Risk for the Corrib Catchment based on 2016-2021 data.
View Online Dashboard: https://www.catchments.ie/data/#/dashboard/waterquality

There are currently no heavily modified water bodies (HMWBs) in the Corrib catchment.

There are no artificial waterbodies in the Corrib Catchment.

The [***EPA's characterisation outcome report***]() ***has more information on WFD Risk***

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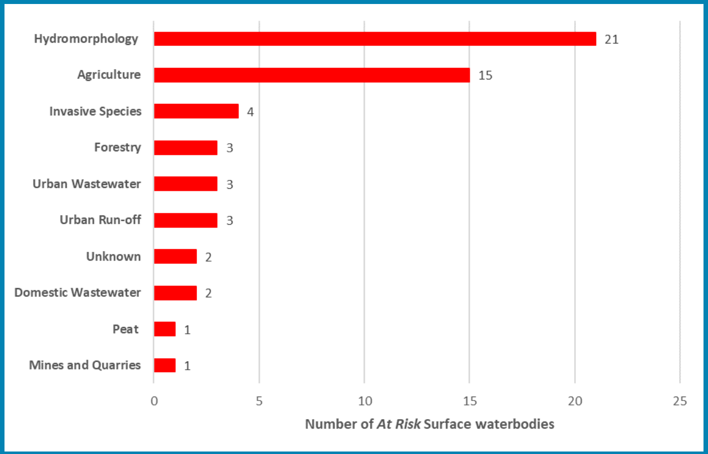
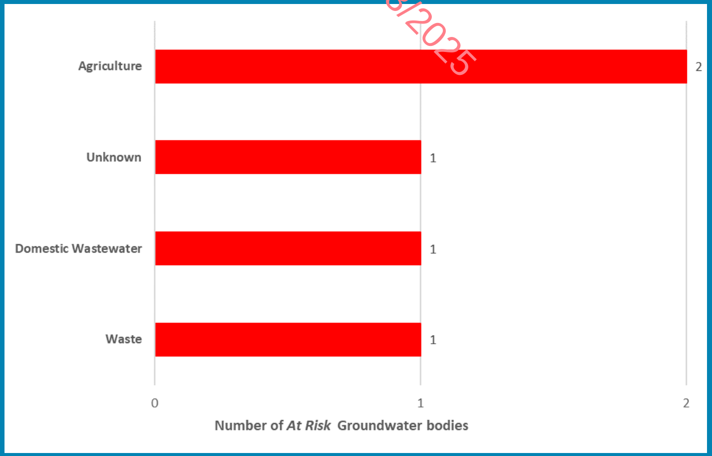
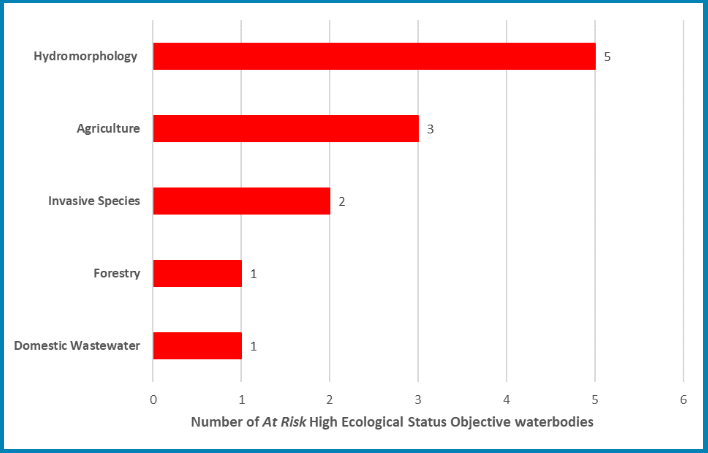
Click here for more information on significant pressures

Significant Pressures driving risk

Significant pressure types impacting the 32 *At Risk* surface waterbodies and three groundwater bodies are broken down in the figures below, including significant pressure information for the seven *At Risk* High Ecological Status Objective waterbodies.







The issues driven by these pressures are mainly altered morphological condition (habitat), nutrient pollution and altered hydrological condition (flow/level) impacts for surface water, and chemical quality diminution for surface water and nutrient pollution for groundwaters. For more information, see https://www.catchments.ie/data/#/dashboard/pressure?_k=i351zs.

Go to the Summary Information section to get significant pressure and issue data for At Risk waterbodies within the Corrib Catchment.

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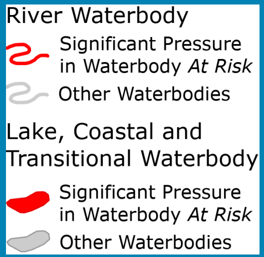
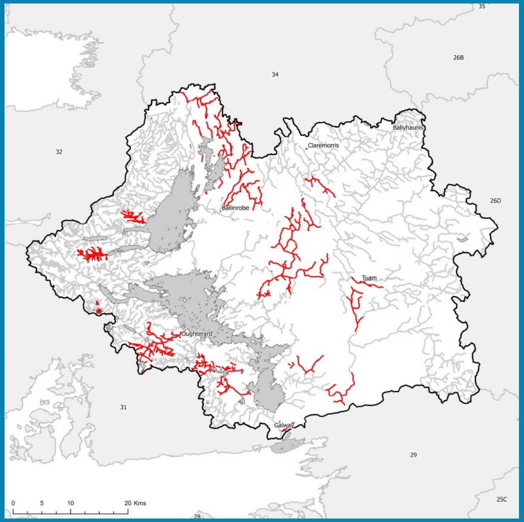
Significant Pressures

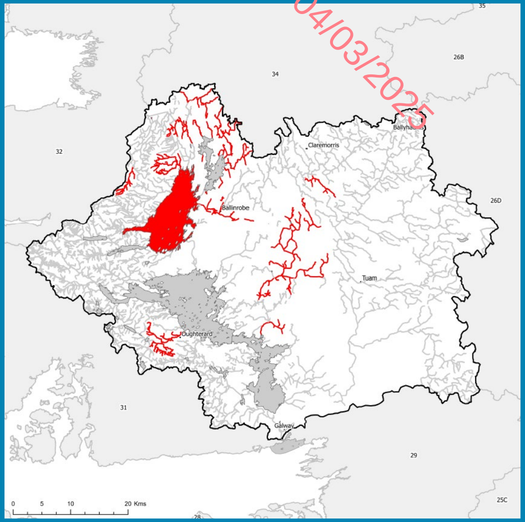


Hydromorphological pressures is the top significant pressure impacting 60% of the 35 *At Risk* waterbodies within the Corrib Catchment, followed by 49% impacted by agriculture and 11% by invasive species.

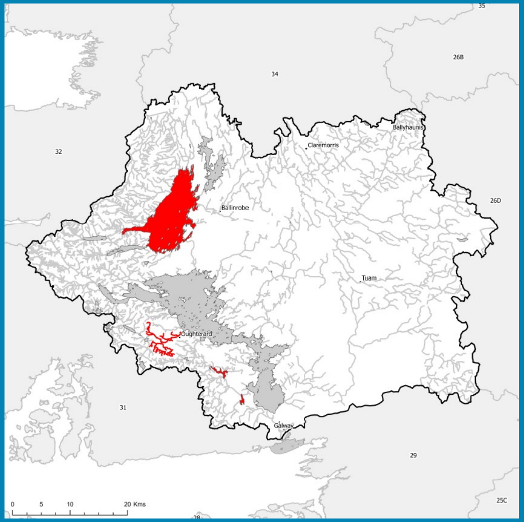
i



ii



iii



The catchments.ie dashboards will show all significant pressures identified for this catchment.

www.catchments.ie/data/#/dashboard/pressure

Go to the EPA Water Maps for the locations of all significant pressure types identified for this catchment

Locations of At Risk surface waterbodies impacted by i) Hydromorphological Pressures, ii) Agriculture and iii) Invasive Species.

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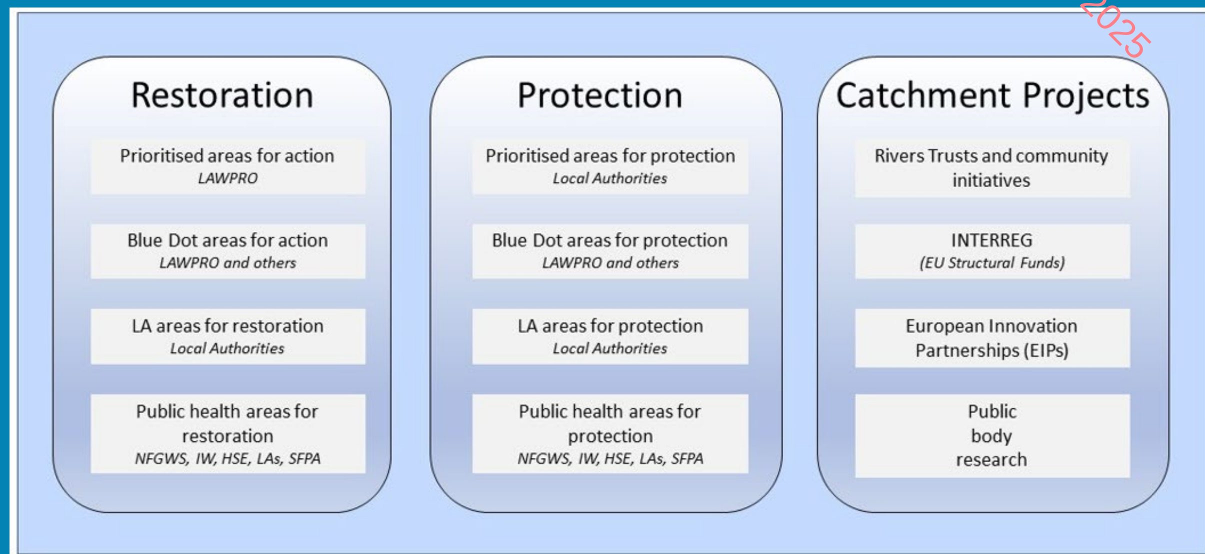
Priority Areas for Action

A number of waterbodies have been prioritised through the selection of Areas for Action. There were three Priority Areas for Action identified for the second river basin management planning cycle in the Corrib Catchment. This has increased to a total of 10 Areas for Restoration, nine Areas for Protection and three Catchment Projects for the third cycle. ***Go to the summary information section to get Area for Action information for waterbodies within the Corrib Catchment.***



Types of Areas for Action under the third cycle River Basin Management Plan

- View the current progress of Areas for Action and Summary Reports completed by LAWPRO, on catchments.ie and the EPA Water Map:
  - https://www.catchments.ie/data/#/areaforaction
  - https://gis.epa.ie/EPAMaps/default?easting=?&northing=?&lid=EPA:WFD_AreasForAction
- LAWPRO have also published detailed desktop studies on Prioritised Areas for Action (PAAs) which are available their website: https://lawaters.ie/desktop-studies/
- Information on Areas for Action for the second cycle is available in Cycle 2 Catchment Assessments which have been archived on catchments.ie: https://www.catchments.ie/download/cycle-2-catchment-assessments-published-september-2018/

Summary information for all waterbodies in the Corrib Catchment

The next page provides a table with a breakdown of key information for all waterbodies in this catchment. The key is provided below. Additional information for each waterbody is available on https://www.catchments.ie/data, including a breakdown of status, a monitoring schedule for monitored waterbodies and downloadable chemistry results, where available.

Protected Area categories	BW: Bathing Water DW: Drinking Water Fish: Salmonid Waters NSA: Nutrient Sensitive Areas SAC: Special Area of Conservation, Natura 2000 (water dependent habitats and species) SF: Shellfish Area SPA: Special Area of Protection, Natura 2000 (water dependent habitat and species)
Significant pressure* types categories ** For At Risk waterbodies only*	Ab: Abstractions Ag: Agriculture Aq: Aquaculture At: Atmospheric DWW: Domestic Wastewater For: Forestry HPS: Historically polluted sites HYMO: Hydromorphology Ind: Industry IS: Invasive Species M+Q: Mines and Quarries Peat: Peat Drainage and Extraction UR: Urban Run-Off UWW: Urban Wastewater Was: Waste WT: Water Treatment

Catchment Code	Waterbody (WB) Code	WB Name	WB Type	Local Authority	Protected Area	Status 10-15	Status 13-18	Status 16-21	Environmental Objective	Environmental Objective Date	WFD Risk 16-21	Significant Issue(s)	Significant Pressure(s)	Area for Action (AFA)	AFA (lead, type)	Link to WB page on catchments.ie	Link to WB on EPA Water Map
26B, 26D, 30	IE_SH_G_053	Castlerea	Groundwater	Roscommon County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
26B, 26D, 30, 34	IE_SH_G_224	Suck North	Groundwater	Roscommon County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
26B, 26C, 26D, 26E, 26G, 29, 30	IE_SH_G_225	Suck South	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31, 32	IE_WE_G_0004	Spiddal	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
26D, 30	IE_WE_G_0005	Dunmore	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29, 30, 31, 32	IE_WE_G_0006	Maam-Clonbur	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29, 30	IE_WE_G_0007	Loughrea	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29, 30	IE_WE_G_0008	Clarinbridge	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31	IE_WE_G_0009	Oughterard Marbles	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_G_0010	Ross Lake	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31, 32	IE_WE_G_0011	Recess	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31, 32	IE_WE_G_0012	Recess Marbles	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31	IE_WE_G_0014	Maamturks East Marbles	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31, 32	IE_WE_G_0016	Maamturks West Marbles	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31, 32, 34	IE_WE_G_0017	Clifden Castlebar	Groundwater	Mayo County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 32	IE_WE_G_0018	Killavally	Groundwater	Mayo County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 34	IE_WE_G_0019	Cong-Robe	Groundwater	Mayo County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	At risk	ChemicalQualityDiminution ForSW, Nutrients	Unknown, Ag			View WB Page	View WB on EPA Water Map
26D, 29, 30, 34	IE_WE_G_0020	Clare-Corrib	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 32, 34	IE_WE_G_0021	Aghagower	Groundwater	Mayo County Council	DWPA	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 32, 34	IE_WE_G_0022	Ballyhean	Groundwater	Mayo County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
26B, 26D, 30, 32, 34, 35	IE_WE_G_0033	Swinford	Groundwater	Mayo County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
26B, 30, 34	IE_WE_G_0063	Corrib Gravels	Groundwater	Mayo County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_G_0084	Waste Facility (W0013-01)	Groundwater	Galway County Council	DWPA; SAC	Poor	Poor	Poor	Good	2022-2027	At risk	ChemicalQualityDiminution ForSW, Nutrients	Was			View WB Page	View WB on EPA Water Map
26D, 30	IE_WE_G_0094	GWDTE-Glenamaddy Turlough (SAC000301)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
25C, 26D, 29, 30	IE_WE_G_0100	GWDTE-Rahasane Turlough (SAC000322)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	At risk	ChemicalQualityDiminution ForSW, Nutrients	DWTS, Ag			View WB Page	View WB on EPA Water Map
30	IE_WE_G_0102	GWDTE-Shrule Turlough (SAC000525)	Groundwater	Mayo County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_G_0103	GWDTE-Skealoughan Turlough (SAC000541)	Groundwater	Mayo County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
29, 30	IE_WE_G_0106	GWDTE-Lough Corrib Fens 3 & 4 (SAC000297)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30, 31	IE_WE_G_0109	GWDTE-Lough Corrib Fen 2 (SAC000297)	Groundwater	Galway County Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_G_0114	Dunmore Gravels	Groundwater	Galway County Council	DWPA; SAC	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_G_0119	GWDTE-Lough Corrib Fen 1 (Menlough) (SAC000297)	Groundwater	Galway City Council	DWPA; SAC (GWDTE)	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_215	Adrehid	Lake	Galway County Council	SAC;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_250	Derrew	Lake	Mayo County Council	SAC;	Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_260	Nagoyne	Lake	Mayo County Council	SAC;	Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_290	Menlough	Lake	Galway City Council	SAC;	Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_301	Carras	Lake	Mayo County Council		Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_303	Kip GY	Lake	Galway County Council	SAC;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_308	Kiltullagh	Lake	Galway County Council		Unassigned	High	Good	Good	2021 or earlier	Review			Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map

30	IE_WE_30_313	Loughaunieran Maam Cross	Lake	Galway County Council		Unassigned	Good	High	Good	2021 or earlier	Review			Failmore	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_315	Buffy	Lake	Galway County Council		Unassigned	Moderate	Good	Good	2021 or earlier	Review			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_322	Lee	Lake	Mayo County Council		Unassigned	Unassigned	High	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_325	Acogga	Lake	Galway County Council	SAC;	Unassigned	Good	Good	Good	2021 or earlier	Review			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_326	Shannagrena	Lake	Galway County Council	SAC;	Unassigned	High	High	Good	2021 or earlier	Review			Failmore	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_332	Coolin	Lake	Galway County Council	DWPA;	Unassigned	High	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_334	Agraffard	Lake	Galway County Council	SAC;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_335	Bofin GY	Lake	Galway County Council	SAC;	High	High	High	High	2021 or earlier	Not at risk			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_336	Parkyflaherty	Lake	Galway County Council	SAC;	Unassigned	High	Good	Good	2021 or earlier	Review			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_340	Ballyquirke	Lake	Galway County Council	SAC;	Moderate	Bad	Moderate	Good	2022-2027	At risk	Nutrients, OtherSignificantImpacts	IS, UWW	Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_341	Bekan	Lake	Mayo County Council		Unassigned	Unassigned	Good	Good	2021 or earlier	Review					View WB Page	View WB on EPA Water Map
30	IE_WE_30_342	Nafooey	Lake	Galway County Council		Unassigned	Good	High	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_343	Maumwee	Lake	Galway County Council	SAC;	Good	Good	Good	High	2022-2027	At risk	Morphological	HYMO	Failmore	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_344	Lettercraffroe	Lake	Galway County Council	SAC;	Moderate	Good	Good	Good	2021 or earlier	Review			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_345	Ross GY	Lake	Galway County Council	SAC;	Poor	Poor	Poor	Good	2022-2027	At risk	UnknownImpactType	IS	Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_346	Loughaphreaghaun	Lake	Galway County Council	SAC;	Unassigned	High	Good	Good	2021 or earlier	Not at risk			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_347	Carra	Lake	Mayo County Council	SAC; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_348	Loughanillaun Maam Cross	Lake	Galway County Council	SAC;	Good	Good	Good	High	2022-2027	At risk	Morphological	HYMO	Failmore	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_532	Aille	Lake	Mayo County Council		Good	Good	Moderate	Good	2022-2027	At risk	Nutrients	Ag	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_665a	Mask	Lake	Mayo County Council	DWPA; SAC; SPA;	Good	Good	Good	High	2022-2027	At risk	Nutrients	Ag, DWTS, IS	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30_665b	Mask Upper	Lake	Galway County Council	SAC; SPA;	Good	High	High	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_666a	Corrib Lower	Lake	Galway County Council	DWPA; SAC; SPA;	Moderate	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30_666b	Corrib Upper	Lake	Galway County Council	DWPA; SAC; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30A010028	ABBERT_010	River	Galway County Council		Good	Moderate	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30A010100	ABBERT_020	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30A010300	ABBERT_030	River	Galway County Council	SAC;	Moderate	Good	Good	Good	2021 or earlier	Not at risk			Coolourty Brierfield GWS. Brierfield and District GWS	LAWPRO, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30A010500	ABBERT_040	River	Galway County Council	SAC;	Moderate	Moderate	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30A020010	AILLE (MAYO)_010	River	Mayo County Council	SAC;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	Chemical, UnknownImpactType	Unknown, Ag	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30A020100	AILLE (MAYO)_020	River	Mayo County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30A020250	AILLE (MAYO)_030	River	Mayo County Council		Good	Good	Good	High	2022-2027	At risk	Hydrological, Morphological	Ag, For	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30A020400	AILLE (MAYO)_040	River	Mayo County Council	SAC; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30A030100	AGHINISH_010	River	Mayo County Council	SAC; SPA;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	Hydrological, Morphological, Organic	Ag, HYMO	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30A340980	ANNIES_010	River	Mayo County Council	SAC; SPA;	Unassigned	Moderate	Moderate	Good	2022-2027	At risk	Sediment, Hydrological, Morphological, Nutrients	Ag, HYMO	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30B010050	BEALANABRACK_010	River	Galway County Council	SAC;	Good	Good	High	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30B010200	BEALANABRACK_020	River	Galway County Council	SAC; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30B020200	BLACK (SHRULE)_010	River	Galway County Council	SAC;	Good	Good	Poor	Good	2022-2027	At risk	Sediment, Morphological, Nutrients	HYMO, Ag, Peat	Belmont GWS	NFGWS, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30B020300	BLACK (SHRULE)_020	River	Mayo County Council	SAC;	Moderate	Good	Moderate	Good	2022-2027	At risk	Sediment, Morphological, Nutrients	DWTS, Ag, HYMO			View WB Page	View WB on EPA Water Map
30	IE_WE_30B020600	BLACK (SHRULE)_030	River	Galway County Council	SAC; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30B030200	BALLINDINE_010	River	Mayo County Council		Poor	Poor	Poor	Good	2022-2027	At risk	Hydrological, Morphological, Nutrients, Organic	UWW, Ag, HYMO, For	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30B040300	BEAGH BEG_010	River	Galway County Council		Unassigned	Good	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map

30	IE_WE_30B050100	BALLINDUFF STREAM_010	River	Galway County Council	DWPA; SAC; SPA;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk			Cluide and Cahermorris GWS. Cahermorris and Glenrevagh GWS. Balroebuckbeg GWS.	NFGWS, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30B140100	BALLYCUIRKE_010	River	Galway County Council	SAC; SPA;	Poor	Moderate	Moderate	Good	2022-2027	At risk	Oxygetion, Morphological, Nutrients, Organic	UR, HYMO	Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30B870900	BOADAUN_010	River	Galway County Council		Unassigned	Good	Moderate	Good	2022-2027	Review			Rusheens GWS. Claretuam GWS. Belclare GWS.	NFGWS, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30C010100	CLARE (GALWAY)_010	River	Galway County Council	SAC;	Moderate	Moderate	Good	Good	2021 or earlier	Not at risk			Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C010300	CLARE (GALWAY)_020	River	Galway County Council	DWPA; SAC;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk			Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C010500	CLARE (GALWAY)_030	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30C010670	CLARE (GALWAY)_040	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30C010700	CLARE (GALWAY)_050	River	Galway County Council	SAC;	Good	Good	Moderate	Good	2022-2027	Review			Caherlea Gurrane GWS	NFGWS, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30C010800	CLARE (GALWAY)_060	River	Galway County Council	SAC;	Moderate	Moderate	Poor	Good	2022-2027	At risk	Morphological	HYMO	Clough Cummer GWS	NFGWS, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C011000	CLARE (GALWAY)_070	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk			Anbally GWS Carheenlea GWS. Currandrum GWS	NFGWS, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30C011100	CLARE (GALWAY)_080	River	Galway County Council	SAC;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	Hydrological, Morphological	HYMO	Carheenlea GWS	NFGWS, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C011200	CLARE (GALWAY)_090	River	Galway County Council	SAC;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	Hydrological, Morphological	HYMO			View WB Page	View WB on EPA Water Map
30	IE_WE_30C011300	CLARE (GALWAY)_100	River	Galway County Council	SAC; SPA;	Unassigned	Moderate	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
30	IE_WE_30C020300	CORRIB_010	River	Galway County Council	SAC; Fish; SPA;	Unassigned	Unassigned	Good	Good	2021 or earlier	Not at risk			Kilcoona GWS	NFGWS, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30C020600	CORRIB_020	River	Galway City Council	DWPA; SAC; Fish; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk			Corrib	Galway City Council, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30C030150	CREGG_010	River	Galway County Council		Moderate	Moderate	Poor	Good	2022-2027	At risk	Morphological	HYMO	Cregg River and Headford Stream	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C030200	CREGG_020	River	Galway County Council	SAC; SPA;	Unassigned	Moderate	Moderate	Good	2022-2027	Review			Cregg River and Headford Stream	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C040100	CAMMANAGH_010	River	Galway County Council	SAC; SPA;	High	Good	Good	High	2022-2027	At risk	Morphological	HYMO	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C050100	CLOGHBRACK STREAM_010	River	Galway County Council	SAC; SPA;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30C060300	CONG CANAL_010	River	Mayo County Council	SAC; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30C070900	CNOCNAGUR_30_010	River	Galway County Council	SAC;	Unassigned	Good	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
30	IE_WE_30C090100	CLOONDAVER STREAM (NORTH)_010	River	Mayo County Council		Moderate	Good	Moderate	Good	2022-2027	At risk	Sediment, Hydrological, Morphological, Nutrients	Ag, HYMO	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C110300	CLOONFAD_010	River	Roscommon County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30C120400	CLAUREEN (MAYO)_010	River	Mayo County Council		Poor	Poor	Poor	Good	2022-2027	At risk	Hydrological, Morphological, Nutrients	Ag, HYMO, M+Q	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30C120700	CLAUREEN (MAYO)_020	River	Mayo County Council		Moderate	Moderate	Good	Good	2021 or earlier	Review			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30D010200	DALGAN_010	River	Mayo County Council	DWPA;	Poor	Poor	Poor	Good	2022-2027	At risk	Organic	UR, UWW	Dalgan	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30D010300	DALGAN_020	River	Mayo County Council		Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30D010400	DALGAN_030	River	Mayo County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30D010500	DALGAN_040	River	Mayo County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30D010600	DALGAN_050	River	Mayo County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30D020100	DOOGHTA_010	River	Galway County Council	SAC;	Good	Good	High	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30D020200	DOOGHTA_020	River	Galway County Council	SAC;	High	High	High	High	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30D030600	DRIMNEEN_010	River	Galway County Council	DWPA; SAC; SPA;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30F010100	FAILMORE_010	River	Galway County Council	SAC;	Good	High	High	High	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30F020100	FOOEY_010	River	Galway County Council		Good	Good	Good	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30F030100	FINNY_010	River	Galway County Council	SAC; SPA;	Good	Good	High	High	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30F170810	FEAGH_EAST_010	River	Galway County Council		Unassigned	Good	Moderate	Good	2022-2027	Review			Feigh East and West GWS	LAWPRO, Protection	View WB Page	View WB on EPA Water Map
30	IE_WE_30G010250	GLENSAUL_010	River	Mayo County Council	SAC; SPA;	Poor	Moderate	Moderate	Good	2022-2027	Review			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30G020200	GRANGE (GALWAY)_010	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30G020400	GRANGE (GALWAY)_020	River	Galway County Council	SAC;	Good	Moderate	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map

30	IE_WE_30G020500	GRANGE (GALWAY)_030	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30G020700	GRANGE (GALWAY)_040	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30G040015	GLENNAMUCKA STREAM_010	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30G050025	GORTGARROW STREAM_010	River	Galway County Council	SAC;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	UnknownImpactType	Unknown	Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30G060100	GLENGAWBEG_010	River	Galway County Council	SAC;	High	Good	Good	High	2022-2027	At risk	Morphological	HYMO	Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30H010200	HEADFORD STREAM_010	River	Galway County Council		Unassigned	High	Moderate	Good	2022-2027	Review			Cregg River and Headford Stream	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30H010300	HEADFORD STREAM_020	River	Galway County Council	SAC; SPA;	Good	Moderate	Moderate	Good	2022-2027	At risk	Nutrients	Ag	Cregg River and Headford Stream	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30J010100	JOYCE'S_010	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30K010220	KILMAINE_010	River	Mayo County Council		Unassigned	Good	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
30	IE_WE_30K010300	KILMAINE_020	River	Mayo County Council	SAC;	Unassigned	Good	Good	Good	2021 or earlier	Review					View WB Page	View WB on EPA Water Map
30	IE_WE_30K020200	KNOCKAUNRANNY STREAM_010	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30K220930	KNOCKNAGEEHA_010	River	Mayo County Council	SAC; SPA;	Unassigned	Good	Moderate	Good	2022-2027	Review					View WB Page	View WB on EPA Water Map
30	IE_WE_30L010200	LOUGHKIP_010	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30L030400	LOUGH NACORRALEA STREAM_010	River	Mayo County Council		Moderate	Good	High	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30L070100	LEVALLY STREAM_010	River	Galway County Council	SAC;	Moderate	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30M330920	MOCORHA_010	River	Mayo County Council	SAC;	Unassigned	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30N010050	NANNY (TUAM)_010	River	Galway County Council		Unassigned	Good	Moderate	Good	2022-2027	Review			Nanny Galway	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30N010100	NANNY (TUAM)_020	River	Galway County Council		Good	Good	Moderate	Good	2022-2027	Review			Nanny Galway	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30N010300	NANNY (TUAM)_030	River	Galway County Council	SAC;	Moderate	Moderate	Poor	Good	2022-2027	At risk	Hydrological, Morphological	HYMO	Nanny Galway	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30O010050	OWENBRIN_010	River	Mayo County Council		Moderate	Good	Good	Good	2021 or earlier	Review			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30O010200	OWENBRIN_020	River	Mayo County Council	SAC; SPA;	Moderate	Moderate	Moderate	Good	2022-2027	At risk	Morphological	HYMO, For	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30O020070	OWENRIFF (CORRIB)_010	River	Galway County Council	SAC;	Good	Good	High	High	2021 or earlier	Not at risk			Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30O020200	OWENRIFF (CORRIB)_020	River	Galway County Council	SAC; SPA;	Good	Bad	Poor	High	2022-2027	At risk	Morphological, Nutrients, Organic, OtherSignificantImpacts	Ag, HYMO, IS	Owenriff (Oughterard)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30O030180	OWENWEE (CORRIB)_010	River	Galway County Council	SAC; SPA;	Good	Good	Good	Good	2021 or earlier	Not at risk			Failmore	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30R010030	ROBE_010	River	Mayo County Council		Moderate	Good	Good	Good	2021 or earlier	Review			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30R010200	ROBE_020	River	Mayo County Council		Good	Good	Good	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30R010310	ROBE_030	River	Mayo County Council		Moderate	Moderate	Good	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30R010400	ROBE_040	River	Mayo County Council		Moderate	Moderate	Good	Good	2021 or earlier	Review			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30R010600	ROBE_050	River	Mayo County Council		Moderate	Moderate	Moderate	Good	2022-2027	At risk	Morphological	HYMO	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30R010950	ROBE_060	River	Mayo County Council	SAC;	Good	Good	Moderate	Good	2022-2027	At risk	Nutrients	Ag	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30R220540	RATHMALIKEEN_010	River	Mayo County Council	SAC;	Unassigned	Good	Good	Good	2021 or earlier	Review			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30S010100	SINKING_010	River	Galway County Council	SAC;	Good	Moderate	Good	Good	2021 or earlier	Not at risk			Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30S010300	SINKING_020	River	Galway County Council	SAC;	Moderate	Good	Good	Good	2021 or earlier	Not at risk			Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30S010400	SINKING_030	River	Galway County Council	SAC;	Good	Moderate	Good	Good	2021 or earlier	Not at risk			Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30S020400	SRAH STREAM_010	River	Mayo County Council	SAC;	Bad	Good	Moderate	Good	2022-2027	At risk	Chemical, UnknownImpactType	Ag	Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30S030100	SRAHNALONG_010	River	Mayo County Council	SAC; SPA;	Moderate	Good	High	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30S040100	SCARDAUN_010	River	Mayo County Council		Good	Good	Good	Good	2021 or earlier	Not at risk			Lough Mask and Lough Carra	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30T010500	TERRYLAND_010	River	Galway City Council		Poor	Moderate	Moderate	Good	2022-2027	At risk	Morphological, Organic	HYMO, UR	Terryland	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
30	IE_WE_30T030300	TULLAGHAUN_010	River	Mayo County Council		Good	Good	Good	Good	2021 or earlier	Not at risk					View WB Page	View WB on EPA Water Map
30	IE_WE_30Y010055	YELLOW (SINKING)_010	River	Galway County Council	SAC;	Good	Good	Good	Good	2021 or earlier	Not at risk			Sinking and Upper Clare (Galway)	LAWPRO, Restoration	View WB Page	View WB on EPA Water Map
29, 30, 31	IE_WE_170_0700	Corrib Estuary	Transitional	Galway City Council	BW; SAC; SPA;	Good	Good	Moderate	Good	2022-2027	Review			Corrib	Galway City Council, Protection	View WB Page	View WB on EPA Water Map

Clarinbridge GWB Registered Abstractions (subset of information)

All details are contained in the EPA December 2024 Register of Abstractions.

https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/epa-water-abstraction-register---december-2024.php

Reg No	Abstraction Point Code	Organisation Name	Abstraction Type	Maximum Daily Volume Estimate for Abstraction (m3/d)	Cumulative Max. Daily Vol. Est. for Registration (m3/d)	Total Annual Volume (m3/yr)	County	Townland Name	Townland ID	Waterbody or Water Feature	Waterbody Code
R00307-01	APR000556	Galway Race Committee	Groundwater	570	830	11,360	Galway	Galway City	51205	Clarinbridge	IE_WE_G_0008
R00544-01	APR000891	Coshla Quarries Limited	Groundwater	350	350	120,000	Galway	BARRETTSPARK	30926	Clarinbridge	IE_WE_G_0008
R01384-01	APR002269	Brockagh Lisduff GWS	Groundwater	35	35	12,775	Galway	CAHERBULLIGIN	30988	Clarinbridge	IE_WE_G_0008
R01464-01	APR002391	Bon Secours Hospital Galway	Groundwater	50	50	15,600	Galway	Galway City	51205	Clarinbridge	IE_WE_G_0008
R01608-01	APR002624	Esker Readymix Unlimited Company	Groundwater	100	100	10,000	Galway	KILLASCAUL	30951	Clarinbridge	IE_WE_G_0008
					1,365	169,735					
					m3/d	m3/yr					

Clare Corrib GWB Registered Abstractions (subset of information)

All details are contained in the EPA December 2024 Register of Abstractions.

https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/epa-water-abstraction-register---december-2024.php

Reg No	Abstraction Point Code	Organisation Name	Abstraction Type	Maximum Daily Volume Estimate for Abstraction (m^3/d)	Cumulative Max. Daily Vol. Est. for Registration (m^3/d)	Total Annual Volume (m^3/yr)	County	Townland Name	Townland ID	Waterbody or Water Feature	Waterbody Code
R00079-01	APR000164	National Federation of Group Water Schem	Groundwater w	25	25	9,125	Galway	FEAGH WEST	26522	Clare-Corrib	IE_WE_G_0020
R00169-01	APR000299	Milltown Group Water Scheme Co-Operativ	River	265	265	96,725	Galway	DAWROS LOWER	25861	CLARE (GALWAY)_0	IE_WE_30C010300
R00177-01	APR000316	liskeavy/lisananey gws	Groundwater w	38	38	456	Galway	LISKEEVY	25890	Clare-Corrib	IE_WE_G_0020
R00195-01	APR000313	Cahermorris/Glenrevagh Group Water Sche	Groundwater w	107	107	39,055	Galway	CAHERMORRIS	27773	Clare-Corrib	IE_WE_G_0020
R00240-01	APR000427	Belclare Group Water Scheme Society Ltd.	Groundwater w	175	175	54,750	Galway	POLLDARRAGH	24813	Clare-Corrib	IE_WE_G_0020
R00300-01	APR000542	Kilcoona/Caherlistrane Group Water Schen	Groundwater w	1,142	1,142	324,850	Galway	LUIMNAGH EAST	24495	Clare-Corrib	IE_WE_G_0020
R00304-01	APR000545	Barnaderg Gortbeg Group Water Scheme C	Groundwater w	900	900	270,000	Galway	DANGANBEG	26471	Clare-Corrib	IE_WE_G_0020
R00328-01	APR000591	Balrobuck Group water scheme Co -op	Groundwater w	120	120	43,800	Galway	BALROBUCK BEG	27769	Clare-Corrib	IE_WE_G_0020
R00396-01	APR000700	Boyounagh Ballyedmond Group Water Sche	Groundwater w	168	384	35,040	Galway	WOODFIELD (BALL	25397	Clare-Corrib	IE_WE_G_0020
R00446-01	APR000774	Anbally & District Group Water Scheme Co-	Groundwater w	67	67	18,250	Galway	TAWNAGHMORE (	26313	Clare-Corrib	IE_WE_G_0020
R00465-01	APR000791	Harrington Concrete & Quarries UC	Groundwater w	365	365	91,615	Galway	ARDGAINEEN	26317	Clare-Corrib	IE_WE_G_0020
R00537-01	APR000879	Clough Cummer GWS	Groundwater w	61	61	20,075	Galway	POLLACOSSAUN EI	26310	Clare-Corrib	IE_WE_G_0020
R00550-01	APR000898	Carheenlea Group Water Scheme	Groundwater w	43	43	15,695	Galway	CAHERATEEMORE I	26499	Clare-Corrib	IE_WE_G_0020
R00918-01	APR001575	Uisce Éireann	Groundwater w	628	628	192,294	Galway			Clare-Corrib	IE_WE_G_0020
R01364-01	APR002247	Transitions Optical Ltd	Groundwater w	70	70	8,000	Galway	DEMESNE	30668	Clare-Corrib	IE_WE_G_0020
R01379-01	APR002265	Brierfield and District Group Water Scheme	Groundwater w	91	91	28,888	Galway	WINDFIELD DEMES	26558	Clare-Corrib	IE_WE_G_0020
R01381-01	APR002267	Kilconieron GWS Co-Operative Society Ltd	Groundwater w	110	110	26,280	Galway			Clare-Corrib	IE_WE_G_0020
R01412-01	APR002302	Rusheens Caherhugh GWS	Groundwater w	100	100	36,500	Galway	CULLEEN	26290	Clare-Corrib	IE_WE_G_0020
R01523-01	APR002476	Corrib Farming Limited	Groundwater w	65	65	21,000	Galway	BARNACURRAGH	26435	Clare-Corrib	IE_WE_G_0020
R01610-01	APR002627	Clada Mineral Water Company Limited	Groundwater w	50	50	18,000	Galway	Galway City	51205	Clare-Corrib	IE_WE_G_0020
					4,806	1,350,398					
					m3/d	m3/yr					

Appendix 8.9 Flood Risk Report (Envirologic, 2025) & Hydro-G Consultation Notes.

ENVIROLOGIC

HYDROGEOLOGICAL · HYDROLOGICAL CONSULTING

Site-Specific Flood Risk Assessment

LOCATION:	Coshla, Carnmore and Barrettspark, Athenry, Co. Galway
PREPARED FOR:	Coshla Quarries Ltd.
PREPARED BY:	Colin O Reilly PhD (Hydrology)
DATE:	February 2025
REFERENCE:	3121_3

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1 STATEMENT OF COMPETENCY

Dr. Colin O'Reilly has over 20 years of professional experience as a hydrogeologist coupled with a doctorate degree in hydrology awarded by the Centre for Water Resources Research, School of Architecture, Landscape and Civil Engineering, UCD, while a recipient of a Teagasc Walsh Fellowship. Colin is a current and active member of Engineers Ireland and International Association of Hydrogeologists (Irish Group).

Colin is the principle of Envirologic Ltd., a consultancy practice he established in 2010 which operates out of Baldoyle in Dublin. Envirologic has key competencies in hydrogeology and hydrology, with particular expertise in flood risk assessments. Envirologic have completed over 100 flood risk assessments in Ireland, along with multiple Section 50 applications to OPW seeking permission to upgrade structures such as culverts and bridges in river channels. These assessments utilise industry-specific software to perform 1D or 1D/2D linked modelling to quantify flood risk.

Examples of recent relevant projects completed by Envirologic include:

1. Flood alleviation scheme to obtain a discharge license for a limestone quarry in County Galway. Design specifications were approved in principle by OPW.
2. Flood risk assessment to inform site layout design for a commercial development in Dundalk, Co. Louth. Involved development of a 1D/2D linked hydraulic model with catchment-derived and coastal flow-head boundary conditions. River sections were surveyed using a boat mounted echosounder tied to a GPS VRS system.
3. Flood risk assessment to inform site layout design of a 250 ha solar farm development in Co. Offaly. Involved development of a 1D/2D linked hydraulic model across two catchments.
4. Flood risk assessment for development works in a heavily karstified landscape prone to groundwater flooding near Ballyvaughan, Co. Clare.

Envirologic also compile EIAR chapters (i) Land, Soils & Geology, and (ii) Water for quarry developments in a range of hydrogeological settings.

Envirologic holds the required Professional Indemnity Insurances, Employers and Public Liability Insurances.

2 INTRODUCTION

This report was prepared in order to complete the suite of assessments and EIA documentation for a planning application to Galway County Council. The applicant is Coshla Quarries Ltd. and the proposed development relates to the continuation of existing site quarrying, concrete manufacturing activities and lateral extension of the quarry void all within the existing 27.5ha site, within a previously authorised area.

The existing extraction area is permitted to extract rock to an elevation of -5mOD. The development proposal is to extend the area of the excavation laterally to the same -5m OD elevation that is already permitted. The proposed lateral extension of the excavation is on lands within the current footprint of the established overall quarry site. It is proposed to continue extraction laterally for a small area in the direction of the northern and southern total site area boundaries and over a c.1ha triangle to the south west of the permitted void area and over c.3ha to the east of the permitted void. The total additional extraction area amounts to c.4.6 hectares to bring exiting land level to the same final floor elevation of -5mOD that is the current floor. The total final area of the excavation will be 13ha of the total 27.5ha site. The footprint of the quarry will not get bigger. It is the footprint of the rock excavation within the quarry that is proposed for expansion.

Coshla Quarries Ltd. is permitted to operate the site as a quarry, with associated and complimentary activities, under Galway County Council Planning References 09/1958 and 20/499. There is a considerable body of information available for review on the planning files and there are flood components reported in those planning files. Envirologic has reviewed all documentation relating to previous planning permission applications, An Bord Pleanala details, Galway County Council statements of the understanding of no flood risk and consultant reports for the wider area.

Of specific note to this Flood Risk Assessment, in relation to information on file for a previous application (PL 20/499), the Environment Section of Galway County Council wrote, in a report dated the 30th of September 2020, as follows:

- *Having reviewed the Stage II Flood Risk Assessment, the Environment Section are satisfied with the response made to the points previously raised in relation to groundwater and potential flooding.*
- *Section 2.3 states that 'the quarry is mapped within a regionally important karstified limestone aquifer, however the rock in which the current extraction area and proposed extension is located is solid and is not karstified as proven by site investigations. The deeper rock below the quarry is karstified and this has been avoided by the quarry design.'*
- *Nor if planning permission is granted should there be an increased risk of flooding in the area as Section 3.2.3 states 'there are no natural surface water features within the quarry site itself or nearby. Effective rainfall that lands on the site ground surface infiltrates to ground (recharge) while the rainfall that lands in the extraction area and surrounding catchment gathers in sumps in the quarry.' Their Discharge License daily discharge limit is 360 m^3/d. The recorded daily average pumping rate during 2019 was 150 m^3/d.*

Further, Galway County Council concluded in their Planning Report that "*An assessment of local sensitive receptors with regard to flood risk and the local hydrological regime, determined that the quarry operation poses no risk to the identified receptors.*"

Also of relevance to this assessment is that the site is regulated by Discharge License W/469/13 (granted in August 2013), which stipulates that the discharge volume shall be limited to a maximum rate of 360 m^3/d. Information presented in the EIAR for the PL 20/499 application reported that flowmeter records between December 2018 and January 2020 suggested an average daily discharge of 142 m^3/d. Information collected in the last four years suggests an average discharge volume of c.180 m3/d. In both the PL 20/499 and current assessment by Hydro-G, handed over to Envirologic in scoping, a discharge volume of <200 m^3/d is rainfall derived and contains no groundwater arising from a karst conduit setting. There is no discharge of untreated process waters.

3 FLOOD RISK ASSESSMENT STRUCTURE

The Flood Risk Management Guidelines (2009) provide the required methodology for flood risk assessment (FRA). The Guidelines (2009) specify what is appropriate to the scale and nature of the development and the risks arising. The FRA outlined herein is sufficiently detailed to quantify the risks and effects of any flooding, necessary mitigation measures, together with recommendations on how to best manage any residual risks. As per 'The Planning System and Flood Risk Management (2009)', the FRA will consist of the following sections:

- Site description
- Site layout
- S-P-R model; sequential approach; justification test
- Determination of flood level
- Mitigation measures
- Conclusions

4 CONSULTATION

The project's hydrogeologist responsible for assessment and the preparation of the EIAR is Dr. Pamela Bartley of Hydro-G. In order to properly scope this FRA project, in advance of handover to Envirologic, Dr. Bartley consulted with the following experts:

- Dr Ted McCormack, Senior Geologist at the Geological Survey of Ireland (GSI). Dr. McCormack is the lead author of the GSI publication entitled *GWFlood Project: Monitoring, Modelling and Mapping Karst Groundwater Flooding in Ireland* (McCormack et al., 2020). Dr. Bartley consulted with him regarding the source of information for the GSI mapped groundwater flood extent to the north of the quarry. Dr. Bartley conveyed her confusion to Dr. McCormack regarding the fact that the western area of the quarry and lands to the north of the quarry as far as the R339 road (and Greaney Glass) was mapped on the GSI Groundwater Flood mapping system as a 'Maximum Historic Groundwater Flooding' area (deep purple shading) BUT the same area was currently not mapped as having any Groundwater Flood Probability in the future: neither High nor Medium nor Low Probability. In addition, Dr. Bartley's review of historic aerial photography showed no flooding during the worst national experience of groundwater flooding nationally (2015/2016). Dr McCormack referred Dr. Bartley to work completed by Ryan Hanley Consulting Engineers and a report dated 2010.
- Mr. Johnathan Reid and Mr. Michael Joyce, chartered civil engineers and hydrological experts of the Galway engineering consultancy Ryan Hanley Consulting Engineers who were commissioned by the OPW to

complete the Flood Relief Works in Claregalway, the Clare-Corrib FRMP and other significant flood schemes. Mr. Reid and Mr. Joyce were authors of the work entitled 'Study to Identify Practical Measures to Address Flooding at Carnmore / Cashla. Information has been used in the assessment of potential impacts and in the context of FRA. Mr. Reid shared information and photographs of the subsequent construction activities of the OPW on the R339 near Greaney Glass, which are believed to play a part in the cessation of flooding in the area. However, more interestingly, Mr. Michael Joyce shared that the installation of the 'Flood Eye' at Claregalway is believed to have provided flood benefit to large areas of land in East Galway, including the Cashla / Carnmore area to the north of the quarry.

- Dr Caoimhe Hickey, Senior Geologist specialising in karst hydrogeology, Geological Survey of Ireland (GSI). Dr. Bartley consulted with Dr. Hickey regarding the nature of pre M6 works flooding along and to the south of the M6 and the role of geological and karst processes in that general geographical area.
- Professor Paul Johnston, Senior Hydrogeologist, Trinity College Dublin (TCD). Groundwater flooding or surface water flooding: that is the question that Dr. Bartley and Professor Johnston discussed. In addition, risks posed by the quarry were discussed. It was noted and agreed that the conduit system transmitting groundwater was very deep and significantly deeper than the quarry and given that the quarry was operating above the conduit system then protection was afforded by the massive structure and low permeability limestone between the quarry and the conduits. Professor Johnston advised contacting Dr Owen Naughton who has studied groundwater flooding in the East and South East area of County Galway. However, Dr. Naughton was not available to respond.
- Dr. Catherine Coxon, Senior Lecturer and specialist karst hydrogeologist at Trinity College Dublin (TCD). Catherine and Pamela discussed the uncertainties and changes likely between seasons in karst groundwater flow.
- Mr Donal Daly, catchment scientist retired from the GSI and EPA. Pamela consulted with Donal on the matter of groundwater flow across Hydrometric Area divides. It was concluded that karst aquifers continued to provide challenges but that the information and conclusions arrived at with Paul and Catherine were as robust as any person could reasonably require.

All of the information obtained by Dr. Bartley was handed over to Dr. Colin O'Reilly of Envirologic with a Project Brief that a Department Guided Flood Risk Assessment (2009) should be completed as a matter of standard protocol. Whilst Galway County Council, HES and MKO (2020) and An Bord Pleanala have previously concluded no Flood Risk, the 2025 application project team decided to commission Envirologic to complete a new and independent Flood Risk Assessment in which the Department required justification and sequential testing protocol could be presented.

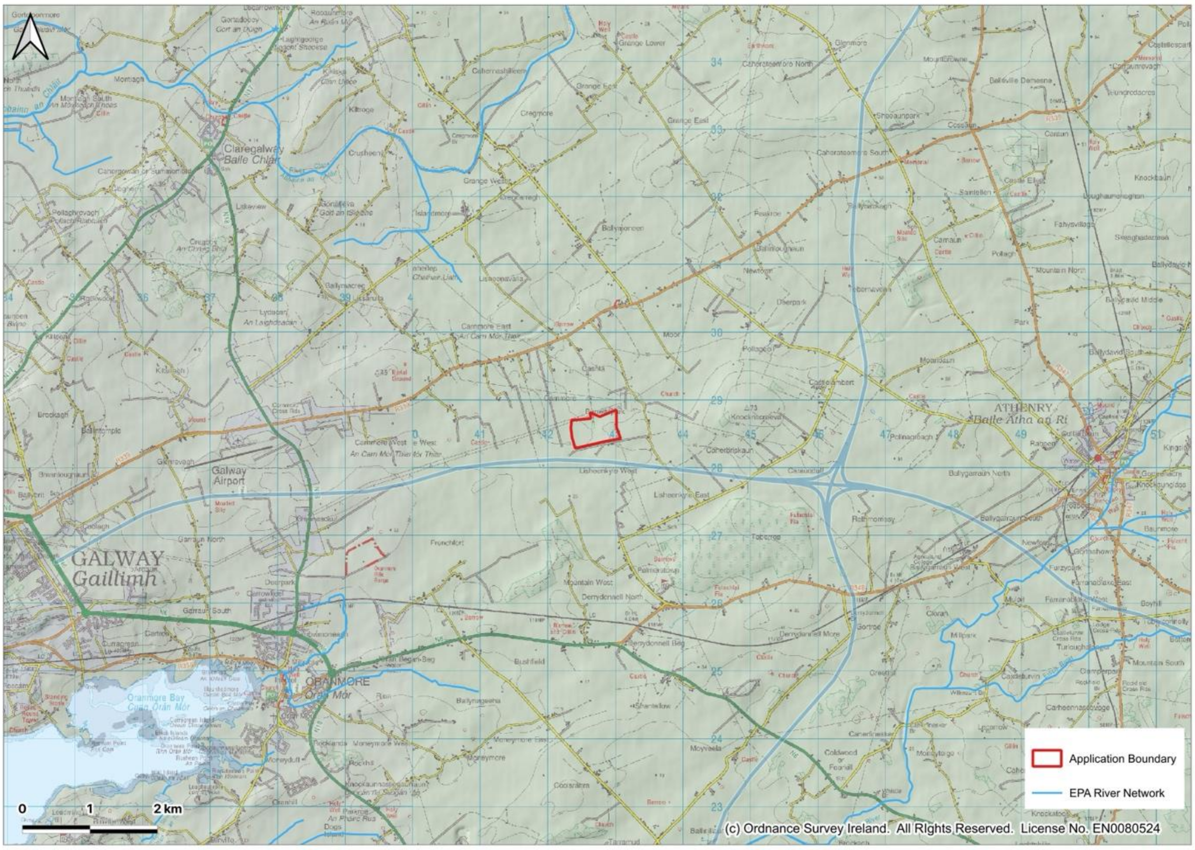
5 SITE DESCRIPTION

5.1 SITE LOCATION & TOPOGRAPHICAL POSITION

The subject site lies in the townland of Barrettspark, approximately 5.7 km northeast of Oranmore and 7 km west of Athenry, Co. Galway (Figure 1). The site is accessed from the R339 (Monivea Road) *via* a local access road that connects to the northern site boundary. The R339 indirectly connects the site to the M6. The M6 Motorway, connecting Galway City with Dublin, passes in a west-east direction 150 m to the south of the application site. This section of the M6 Motorway was constructed in the period 2008 – 2011.

OS 1:50,000 Discovery Maps show that lands slope towards the site from a relatively low hill at Knocknacreeva (73 mOD), 2 km to the east. Gradients shallow out on approach to the site with a short ridge-type feature (30 mOD contour) protruding across the eastern site boundary. Elevations continue to fall across the site, to 20 mOD on the western site boundary. Continuing west the landscape drops into a north-trending shallow valley floor which passes through Carnmore, crossing the R339, and through Caherlea, with topography flattening out further on approach to the Clare River, 5 km to the northwest. To the south and southwest of the site lands are relatively flat, with a marginal gradient falling southwest towards the coastline at Oranmore.

Figure 1 - Site Location & Topography



5.2 SITE LAYOUT

The application site has an area of 27.5 ha. The application site is broadly rectangular in shape with a southwest-northeast length of 690 m running parallel to the M6 and a perpendicular width of 420 m. Refer to Figure 2. The overall quarry site area is 27.5ha, the quarried void at -5mOD is proposed to extend this -5mOD floor laterally by an area of c.4.6ha: comprised of small areas extending towards the northern and southern overall site boundaries and a small triangle to the southwest of the excavation but the majority of the total proposed 4.6ha lateral expansion is proposed in the direction of the eastern boundary of the existing overall site. It is the proposed extension of the void to the east that will necessitate minor lateral extensions to the north and south of the established void and within the current overall site's footprint. This is required for the correct design and execution of the slopes of quarry wall faces.

The actively quarried area is in the central to eastern half of the site where the working quarry floor is at -5 mOD. The proposed extension area has current ground elevations of 20 to 24 mOD. It is proposed to bring the lateral extension area down from its current ground elevation of 20 to 24 mOD to the same -5 mOD as the existing floor.

The western half of the site contains related activities and facilities such as concrete batching plant, blockyard, dirty water lagoon (recirculated), wheelwash, weighbridge and workshop. The site's offices are close to the site entrance mid-way across the northern boundary of the quarry.

As permitted in the site's Section 4 Licence, in order to maintain a safe and dry working environment all waters arising in the quarry void's sump is pumped to a settlement tank and oil interceptor as a mitigation measure for sediment entrapment and hydrocarbon retention, if present. Treated waters are discharged to ground *via* a stone-filled infiltration area positioned inside the southwestern corner of the application site. The discharge area is supposed to be a lagoon but there is not enough water encountered at the site to keep the discharge area saturated as a lagoon water body.

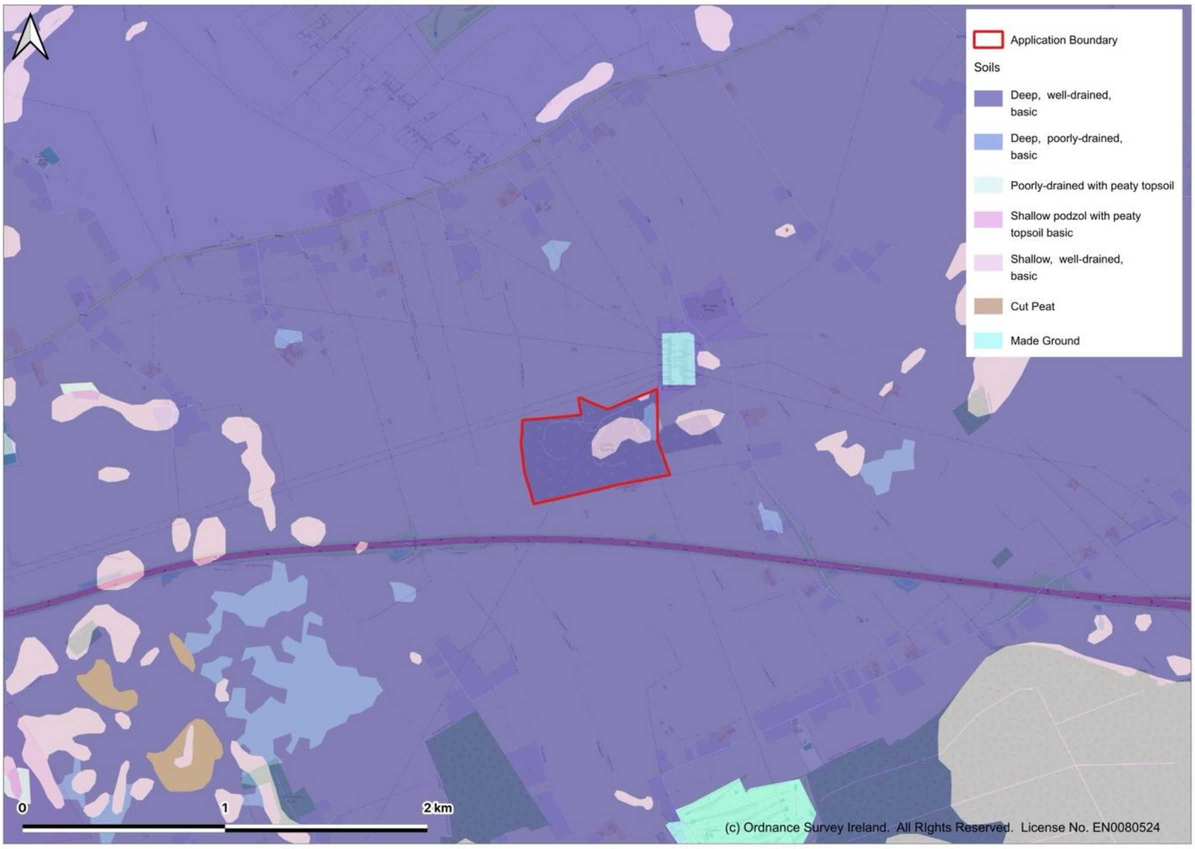
Figure 2 - Aerial Image of application site showing monitoring well locations

5.3 SOILS & GEOLOGY

5.3.1 Soils

Teagasc soil classification, as accessed on the GSI Groundwater Viewer, show that soils at the site, where present, are generally deep and well-drained, with a basic chemical signature (Figure 3). Smaller pockets of shallower soils are mapped in and around the site. Soil Associations of Ireland (Gardiner and Radford, 1980) show that these are mainly dry mineral soils which consist primarily of shallow brown earths.

Figure 3 - General Soils Classification

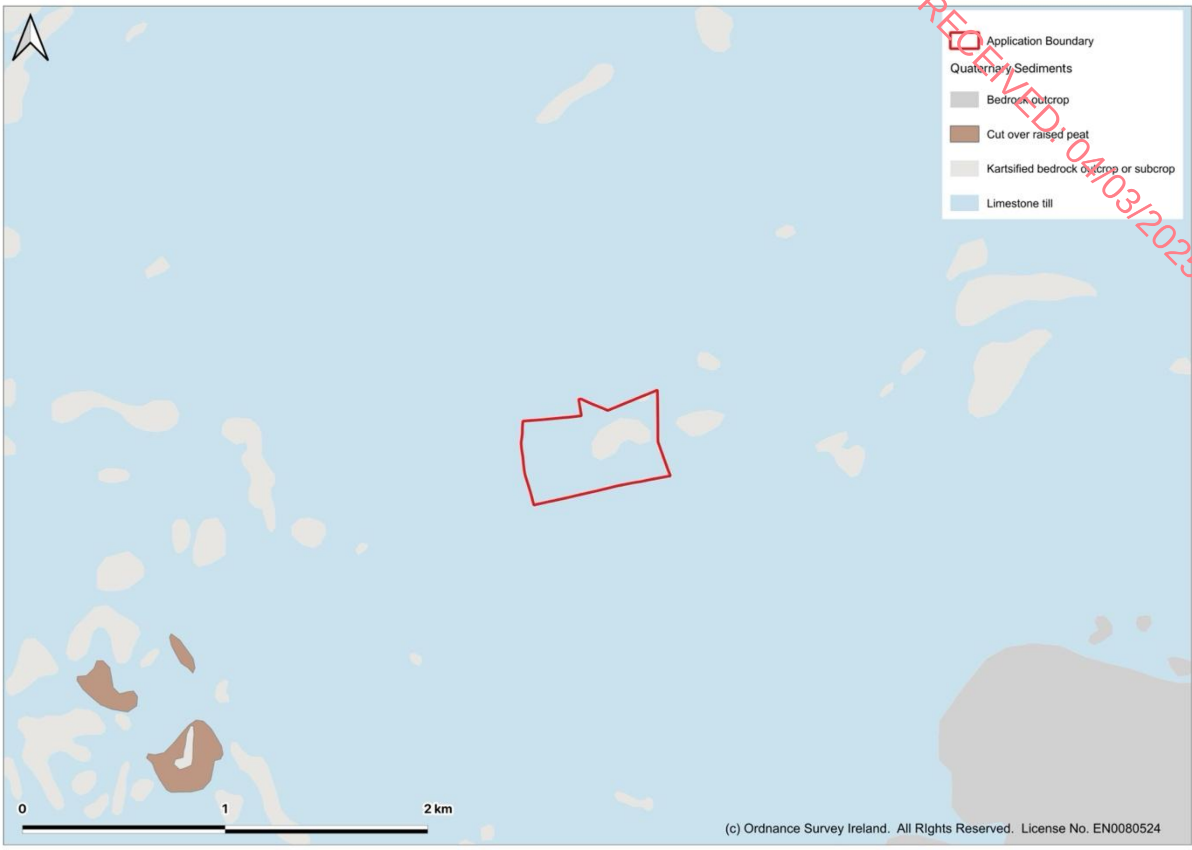


5.3.2 Quaternary Deposits

The quaternary period encompasses the last 1.6 million years and deals with the subsoils and sediments that were deposited over the bedrock described below. The Pleistocene (1.6 million years – 10,000 years ago) is commonly known as the last Ice Age, which was a period of intense glaciation separated by warmer inter-glacial periods, and it is during this period that the quaternary sediments seen today were deposited. Large amounts of ponded water were present at this stage resulting in considerable fluvioglacial sedimentation.

Where present, quaternary deposits are mapped by the GSI as till derived from limestone (Figure 4). It is a free-draining sandy till and is generally thin where present. Mapping shows bedrock is exposed at surface within the application site and in small pockets in the surrounding area.

Figure 4 - Quaternary Deposits



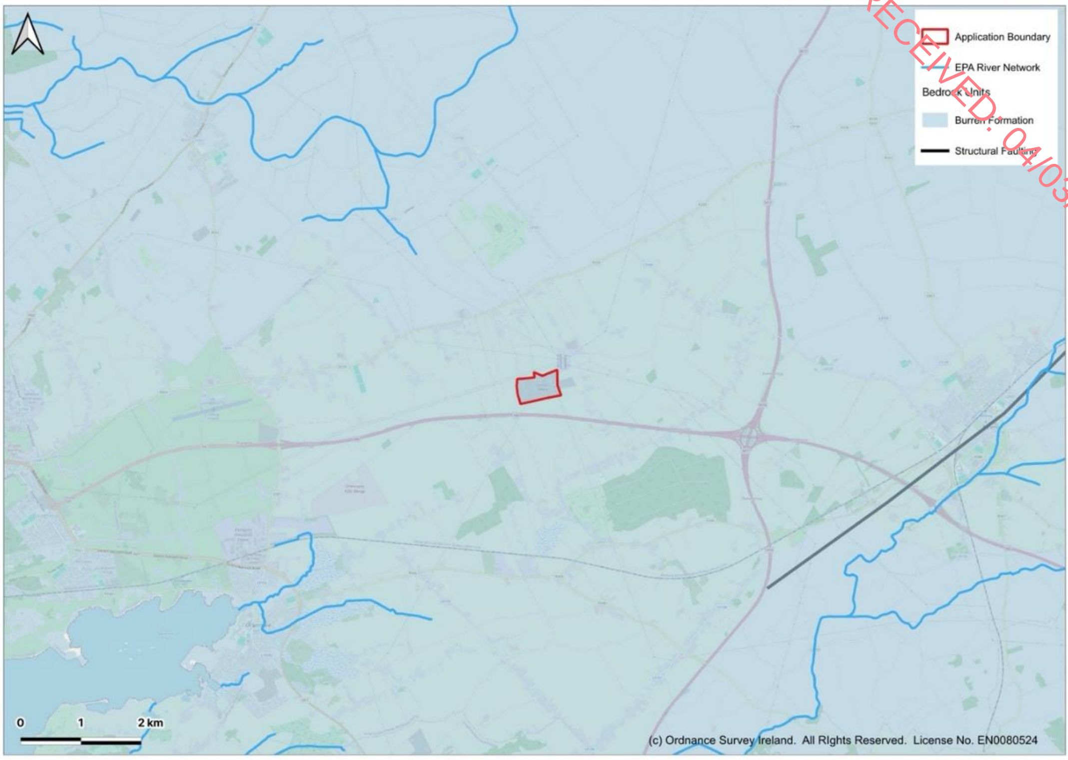
5.3.3 Bedrock & Structural Geology

The site is underlain by the Burren Formation, which is primarily composed of pale grey skeletal limestone (Figure 5). The underlying bedrock geology is characterised as a Dinantian Pure Bedded Limestone.

Records of historical drilling on the planning file show that the lithology profile can generally be described as an upper 5 m weathered bedrock layer underlain by competent limestone bedrock to a depth of at least -10 mOD. The upper weathered bedrock, which although reported by HES (202) as not being epikarst, could be reasonably considered as such by karst specialists but it is of no significance in terms of which label is used: the broken top of rock in limestone landscapes provides a shallow, lateral, subsurface flow pathway for rainfall to infiltrate the subsurface in a diffuse manner.

No karstification, fracturing or epikarst has been observed within the excavated limestone walls of the quarry.

Figure 5 - Bedrock & Structural Geology



5.4 HYDROGEOLOGY

5.4.1 Aquifer Classification

Bedrock underlying the site is classified as a regionally important karst aquifer, dominated by conduit flow (Rkc). Karstification is the process whereby limestone is slowly dissolved away by percolating waters. It most often occurs in the upper bedrock layers and along certain fractures, fissures and joints, at the expense of others. Karstification frequently results in the uneven distribution of permeability through the rock, and the development of distinctive karst landforms at the surface (e.g. swallow holes, caves, dry valleys), some of which provide direct access for recharge/surface water to enter the aquifer.

The lack of surface water features infers that the landscape is characterised by largely underground drainage, with shallow subsurface flow transmitted through permeable weathered bedrock and deeper subsurface flows occurring in solutionally-enlarged, interconnected fissure/conduit zones, which may be several kilometres long. Groundwater velocities may be high in these deeper conduits.

5.4.2 Karst Features

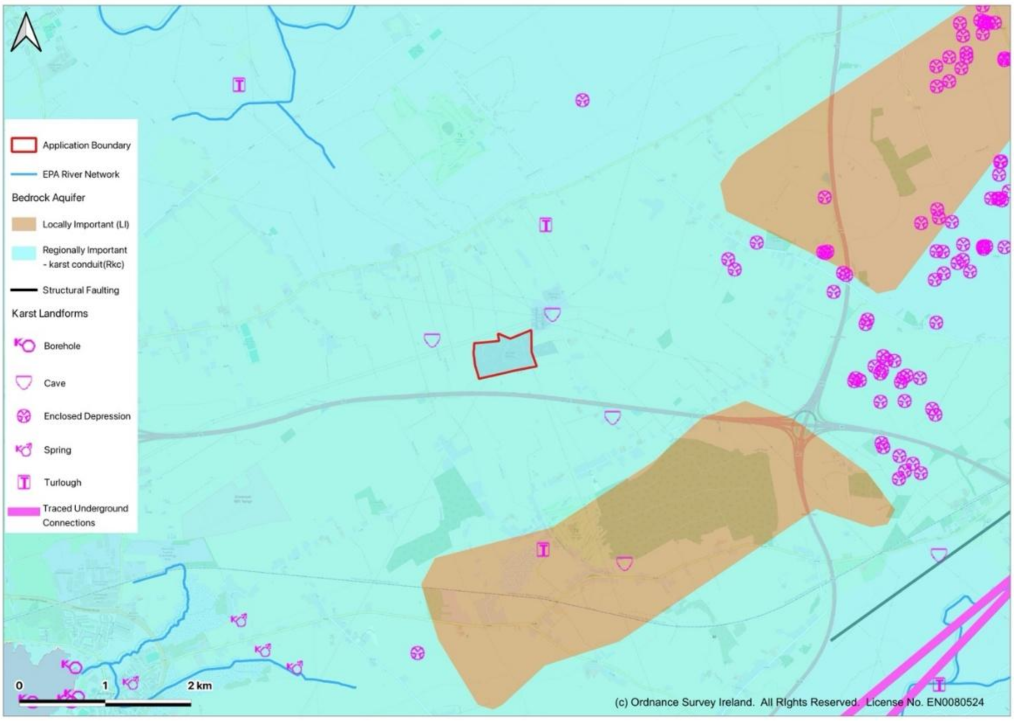
Figure 6 shows that the there are no karst features mapped within the application boundary. The nearest karst features mapped by the GSI are three caves: (i) 500 m to the west, (ii) 300 m to the northeast, and (iii) 1,000 m to the southeast. Mapping of these features by the GSI was based on historical 6 inch OSi maps. The presence of these caves today is unconfirmed.

In terms of groundwater flow turloughs are regarded as important karst features. Turloughs typically contain swallow holes where rainfall-runoff can drain to the aquifer, and where rising groundwater can emerge at the surface. Drew (2018) has recently defined a turlough as '*a karst depression which is periodically flooded by groundwater*'. The two nearest turloughs are located at:

- Kiltullagh, 1250 m to the north;
- Derrydonnell North, 2,150 m to the south. GSI noted that this rarely drains completely but drainage point is a swallow hole.

The remainder of karst features in the wider area are mapped as enclosed topographical depressions (dolines). There are no confirmed traces proving karst groundwater flowpaths in the area

Figure 6 - Aquifer Classification & Karst Features



5.4.3 Water Framework Directive Groundwater Body Units

The site is mapped by the GSI and EPA as being within and underlain by the Clarinbridge Groundwater Body. Reference was made to the Clarinbridge Groundwater Body Description (GSI, 2004) from which the following key points are noted:

- Land surface is low-lying and relatively flat with elevations ranging from sea level to 60 mOD.
- Both point and diffuse recharge occur. Most groundwater flows are in an epikarstic layer a couple of metres thick and in a zone of interconnected solutionally-enlarged fissures and conduits below this.

- The pure-bedded limestones are generally devoid of intergranular permeability with groundwater flowing through fissures, faults, joins and bedding planes.
- Overall, groundwater flow directions are to the west and south west.
- Much of the current stream network is a wet runoff system that is inactive during summer months.
- The two main rivers (Lavally and Dunkellin) drain much of the area and prior to the arterial drainage of the nineteenth century they never maintained an overland course to the sea. For most of the year the rivers sink in turloughs and in wetter conditions the turloughs overflow allowing the artificial channels to conduit water to the sea.

5.5 GROUNDWATER FLOW REGIME

Drilling conducted as part of site investigation works carried out in 2007, 2018-2020 and 2024 showed that the limestone bedrock is competent to a subsurface elevation of -5 mOD. The limestone is low permeability and the walls of the void show no evidence of karst. It is possible that karst groundwater flow paths are present beneath the -5m OD floor elevation at the site but these conduits would have a limited role in transmitting rainfall-runoff at the application site. The deeper, karstic system may be recharged on raised grounds to the east where there is a larger area of bedrock at or close to surface.

In the area surrounding the site the quaternary deposits are underlain by a relatively shallow and permeable strata of weathered bedrock. Given that this weathered zone sits directly above competent, low-permeability bedrock it is likely that rainfall-runoff flows laterally along this shallow layer.

Water pumped from the quarry is discharged into this upper weathered layer. Therefore, there is flow from the site: most probably a combination of vertical and horizontal. There are no wells downgradient in the direction of likely groundwater flow towards the coast.

5.5.1 Summer (Low Level) Groundwater Flow Regime

Contour maps for east Galway were devised by Coxon and Drew (1986) and later presented again by Drew and Daly (1993). The summer groundwater flow regime shown in Figure 7 demonstrates that groundwater flow direction is southwest towards the intertidal springs on approach to Oranmore.

5.5.2 Winter (High Level) Groundwater Flow Regime

Under a winter groundwater flow regime Coxon and Drew (1986) and Drew and Daly (1993) suggested that the groundwater flow contours change slightly such that groundwater flow direction through the application site trends more west/southwest (Figure 8).

Figure 7 - Summer (Low Level) Groundwater Flow Regime (Drew & Daly, 1993)

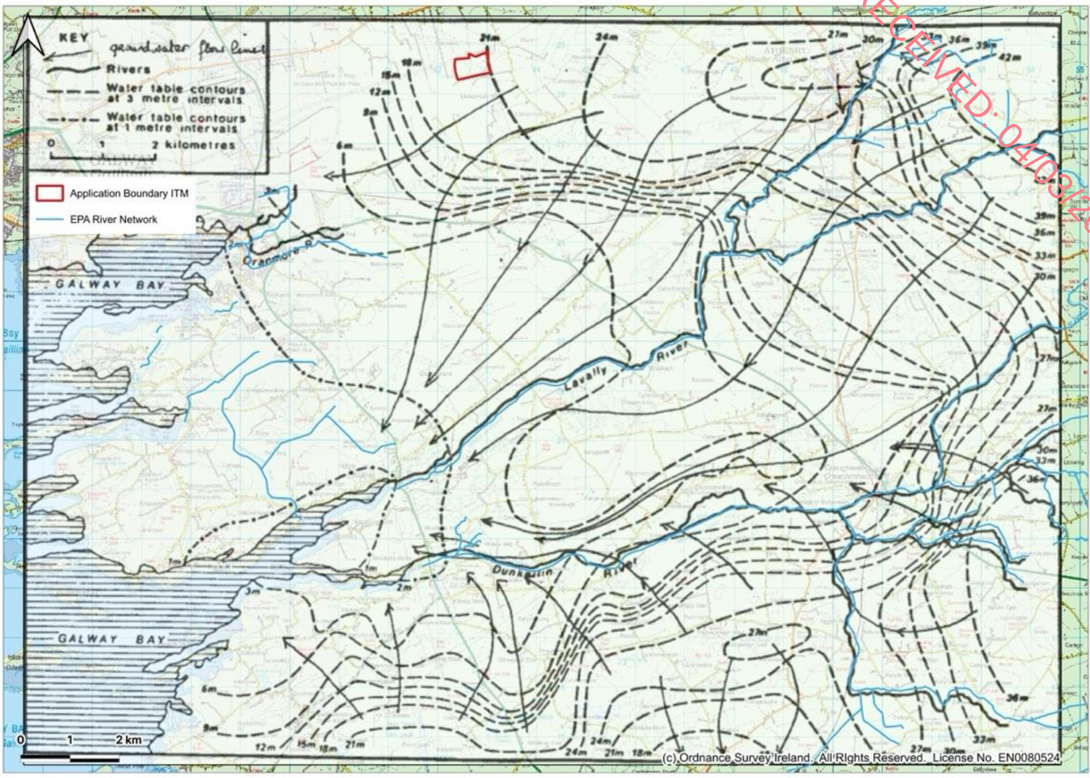
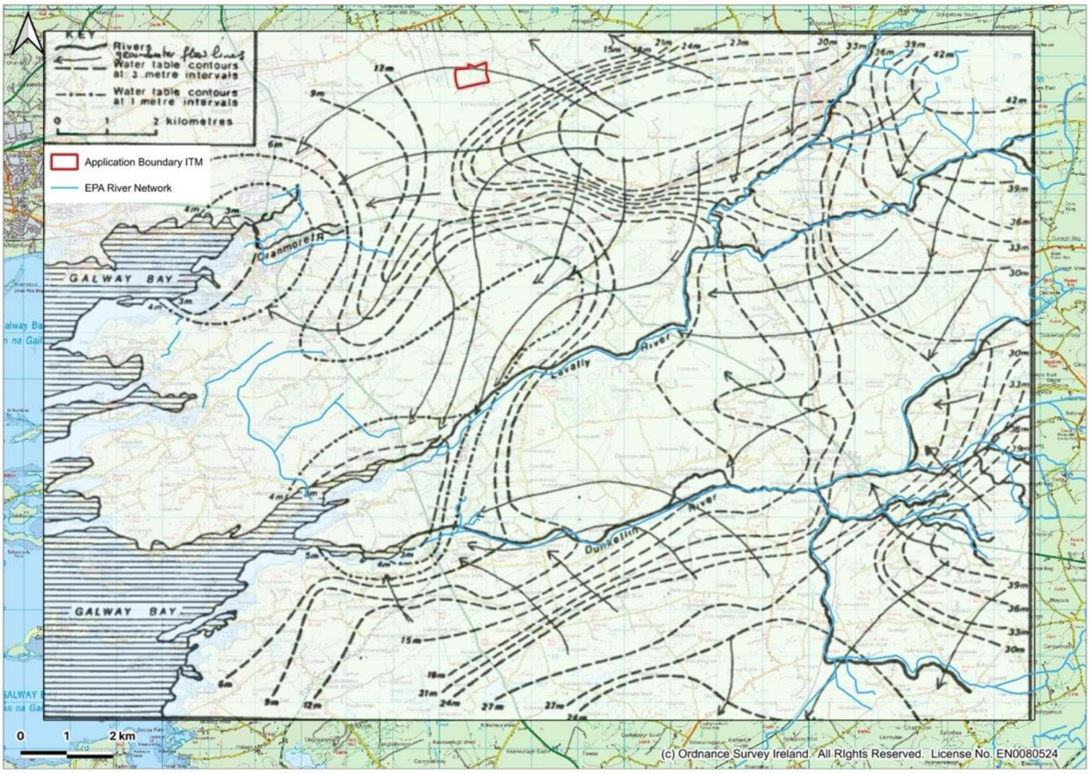


Figure 8 - Winter (High Level) Groundwater Flow Regime (Drew & Daly, 1993)



5.6 HYDROLOGY

5.6.1 Arterial Drainage

Drainage in the central and northern County Galway area has been heavily influenced by historical arterial drainage works. Of note is a large body of water which has since been drained along the current route of the Clare River (Figure 9). Both prior to, and following, these drainage works there have been no surface water channels within close proximity to the application site.

Figure 9 - Pre-arterial drainage in karstic limestones in western Ireland (Coxon and Drew, 1986).

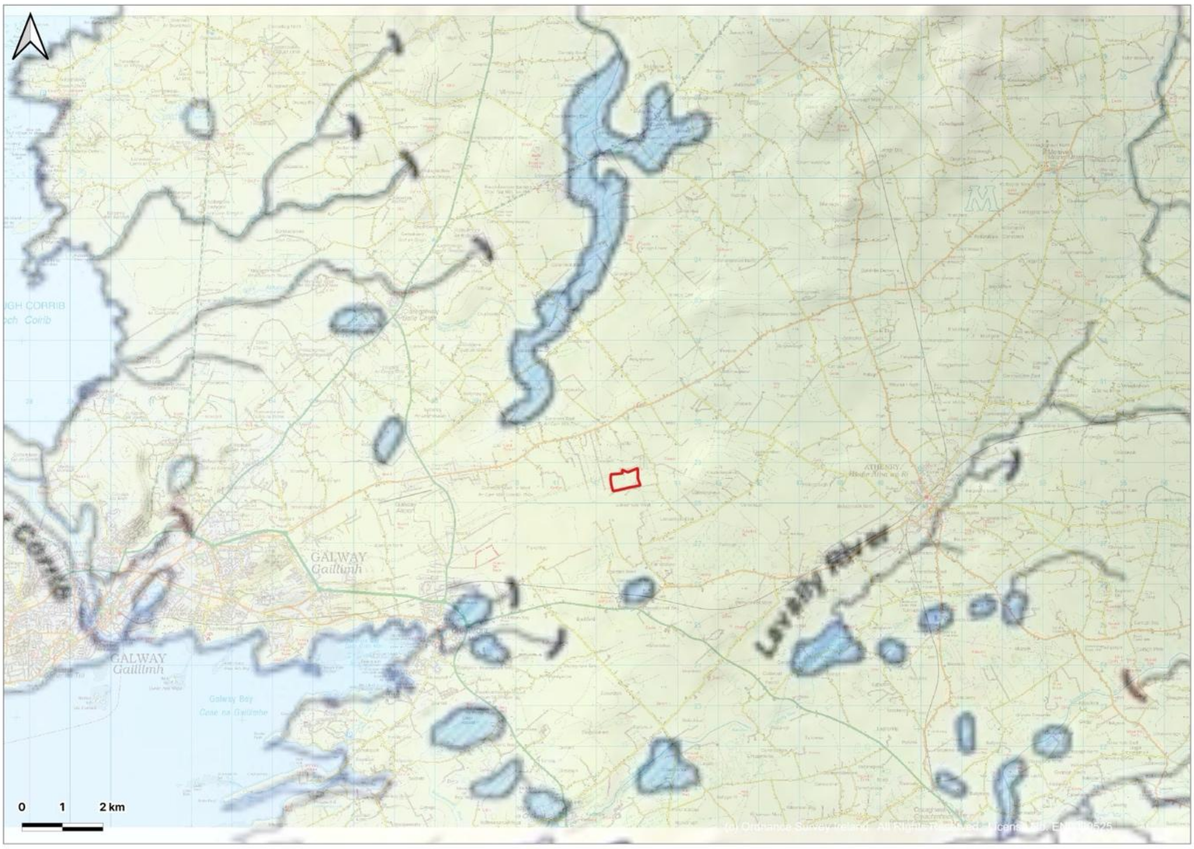
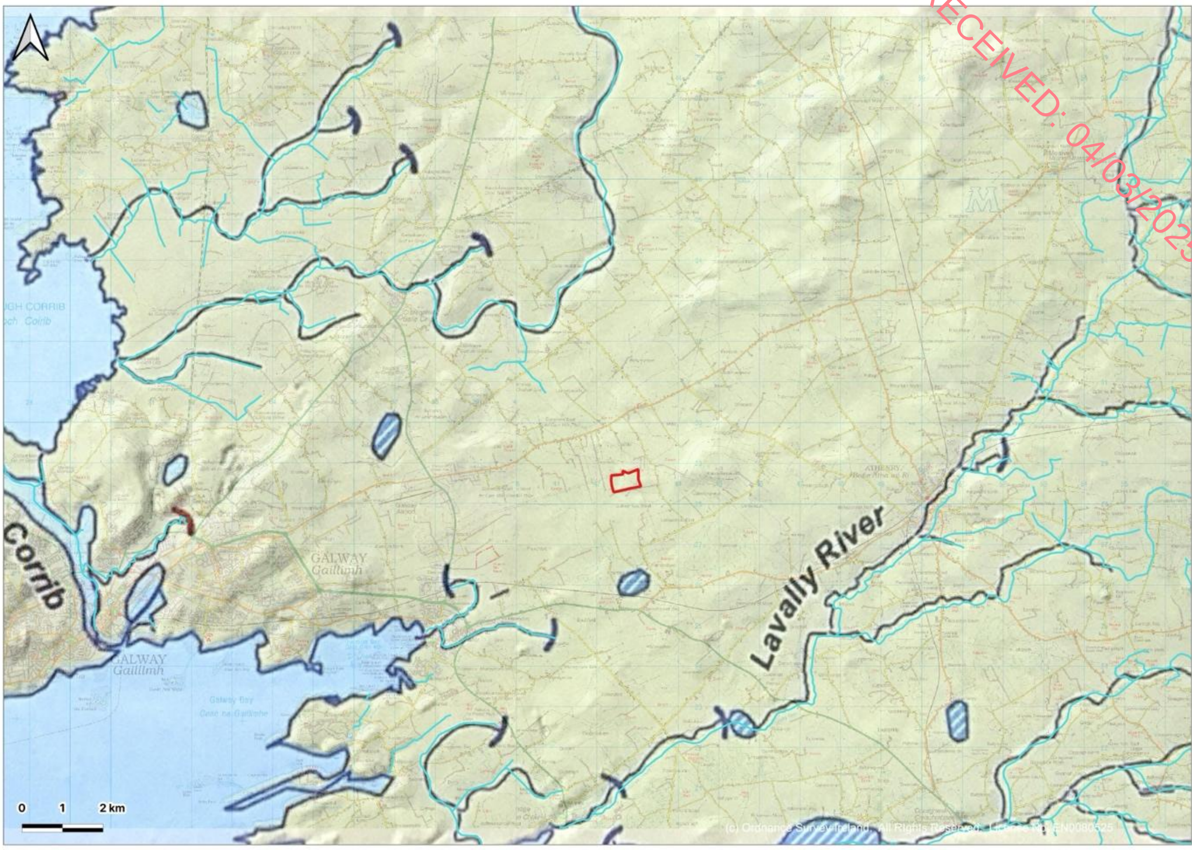


Figure 10 - Post-arterial drainage in karstic limestones in western Ireland (Coxon and Drew, 1986).



5.6.2 Watercourses

Reference to Figure 1 shows that there is a distinct lack of surface watercourses or surface waterbodies in the area. There is also a notable lack of open drains along field boundaries.

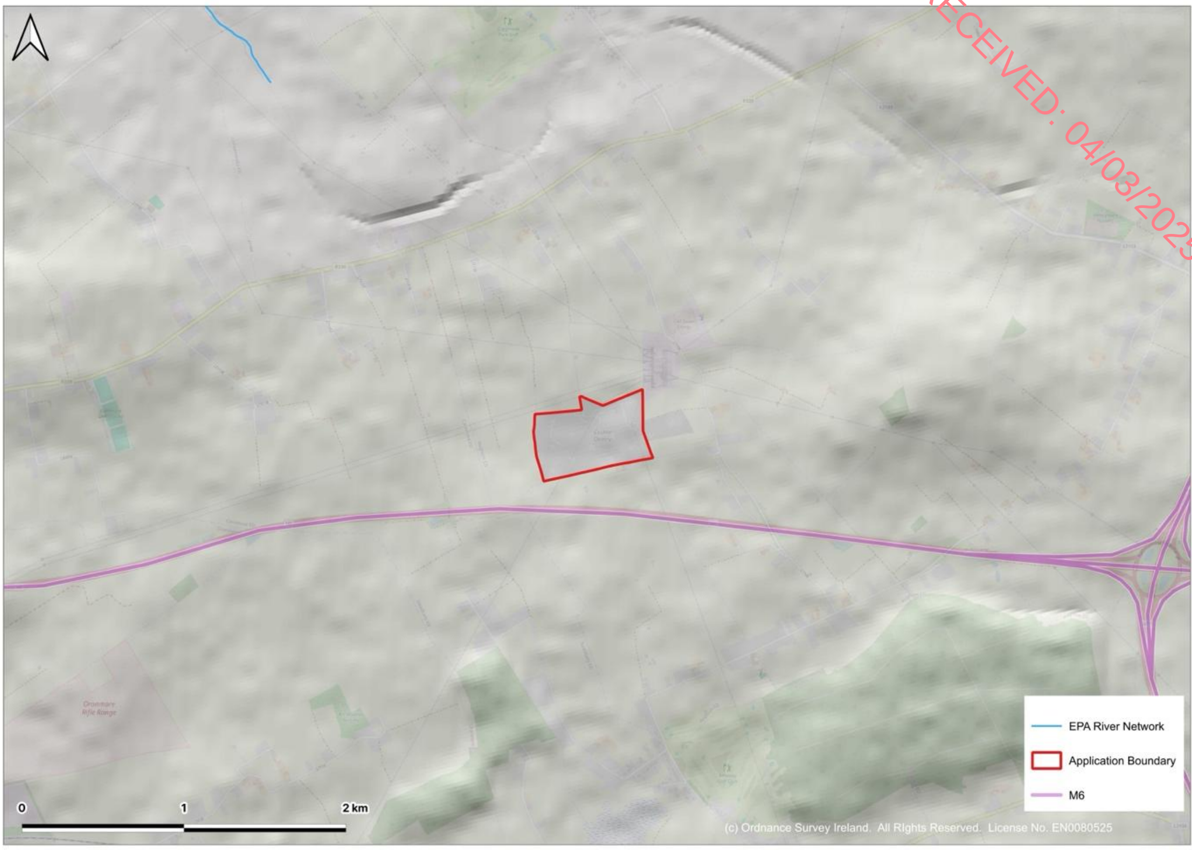
First order tributaries indicate that the two nearest river systems to the site are (i) Carrowmoneash Stream which rises 4 km to the southwest and outfalls to the sea at Oranmore, and (ii) the River Clare catchment to the north, which flows through Claregalway.

With respect to the latter, northern system, a first order stream known as Kenny's Drain rises 2.6 km northwest of the site. It flows northwest for 1 km before joining the Islandmore Stream which subsequently outfalls to the Clare River 4.4 km northwest of the site.

The European Digital Elevation Model (EU-DEM) is a topographical dataset derived from LIDAR data at a 25 m grid resolution. Envirologic used this data initially to generate a hillshade map of the surrounding area (Figure 11). The image shows hills to the south, southeast and southwest, though they are not interconnected by raised ridges. Of note is a meandering linear feature approximately 2 km to the north of the site that appears to terminate at Kenny's Drain. The topographical data suggests that this is a continuous channel (or embankment). However, there is no clear evidence of this linear feature on aerial photography or historical OSI maps.

Upon further inspection from mapping it is apparent that the meandering feature in Figure 11 coincides with the southern boundary of the wetted area present in pre-arterial drainage works north of the site, as shown in Figure 9.

Figure 11 - Surface Topography shown as Hillshade



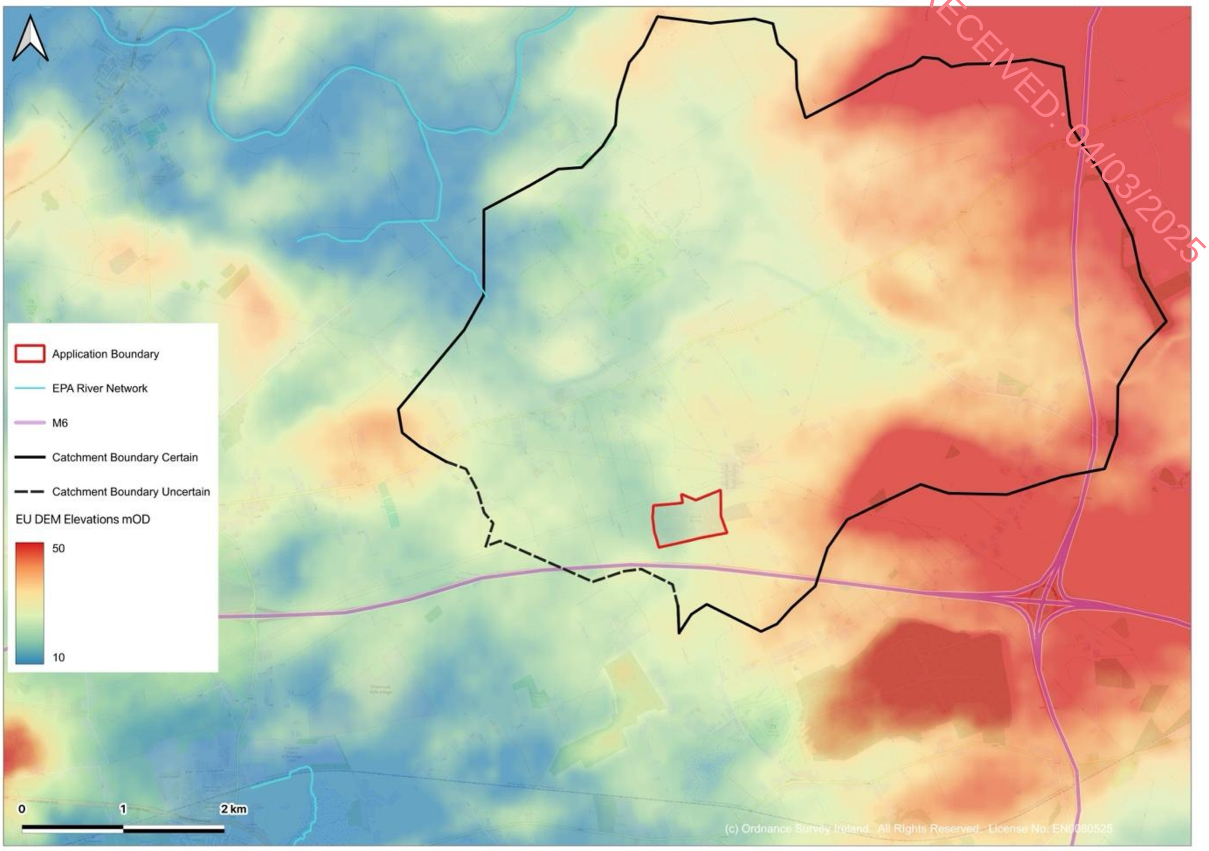
5.6.3 Catchment Delineation

The 1:50,000 OS Discovery maps do not show any clear topographical catchment boundaries between the two river systems listed above. In a further effort to delineate the surface water catchment within which the site lies Envirologic obtained Transport Infrastructure Ireland (TII) LIDAR data which has a grid resolution of 2 m and vertical accuracy of 150 mm. The LIDAR data was used to generate a shaded relief map for the area (Figure 12).

Envirologic have used the topographical boundaries to delineate a surface water catchment map to Kenny's Drain. The eastern and western boundaries of the catchment to Kenny's Drain are relatively straightforward to define. The southern catchment boundary however is less clear and may have been influenced by construction of the motorway which would have utilised cut-and-fill approach to raise the road surface, thereby creating a barrier to pre-construction shallow subsurface and surface flow pathways. If this is the case then it is likely that pre-motorway construction any accumulation of surface waters west of the site may have overflowed towards the south, rather than accumulating to depths causing flooding to properties in Carnmore.

Based on the delineation shown the application site is within a surface water catchment that drains northwards. There is only a negligible area of contributing catchment upgradient of the site.

Figure 12 - Shaded Topographical Contour Map



5.6.4 Hydrometrics

The nearest hydrometric stations to the site are in place at the following locations:

- Oranmore Bridge, 5 m southwest of the site. Listed by OPW as measured spring discharge; shown on EPA maps to be on Carrowmoneash Stream; 29C05). Water levels at this station are in the range 1.3 – 3.75 mOD since recording commenced in 2004. Water levels at this gauging station are assumed to be tidally influenced.
- Caherfinesker (29014), 7 m southeast of the site. Lavally River. Water levels at this station are in the range 14.7 – 18.1 mOD since recording commenced in 1984.

This hydrometric data is acknowledged but of limited relevance to this study.

6 INDICATIVE FLOOD RISK MAPS

6.1 BENEFITTING LANDS

The application site does not lie within an area classified as OPW benefitting lands. Benefitting land maps were prepared to identify areas that would benefit from land drainage schemes and typically indicate low-lying land near rivers and streams that might be prone to flooding. The emphasis of these schemes was the improvement of agricultural land. The significance of the fact that the site was not identified by the OPW as benefitting lands is that there was seen to be no need to improve land drainage.

The nearest tributaries to the north, Kenny's Drain (OPW Ref. F799/1 and F799/2) and the Islandmore Stream (OPW Ref. C3/7), which outfall to the Clare River (Plate 1) are maintained as part of the Corrib West arterial drainage scheme.

Plate 1 - Benefitting Land Maps

6.2 PFRA MAPS

Preliminary Flood Risk Assessment (pFRA) maps were issued by the Office of Public Works (OPW) in 2009. The maps were intended to serve as a screening tool to guide requirement for site-specific flood risk assessment. These maps are no longer available as they were deemed to be unsuitable for informing planning decisions in terms of predicted flood risk.

pFRA Map 227 for the area is presented in Figure 13 and highlights areas at risk of pluvial flooding during extreme rainfall events. The pluvial flood risk areas were estimated from simulating rainfall depths derived from extreme events (Q_{100}) onto a national DTM. Pluvial risk areas are attributed to topographically enclosed depressions where rainwater is likely to accumulate. The mapping is limited by not taking into account the influence of hydraulic structures and low resolution of soil drainage characteristics.

The pFRA map shows that small pockets in and around the site are deemed to be potentially at risk of pluvial flooding, along with an area that extends northwest from the site towards the R339.

Figure 13 - pFRA Map (OPW, 2009)

Circular PL 2/2014 as issued by the Department of Environment, Community and Local Government in 2014 contains the following note of relevance regarding appropriate use of pFRA maps:

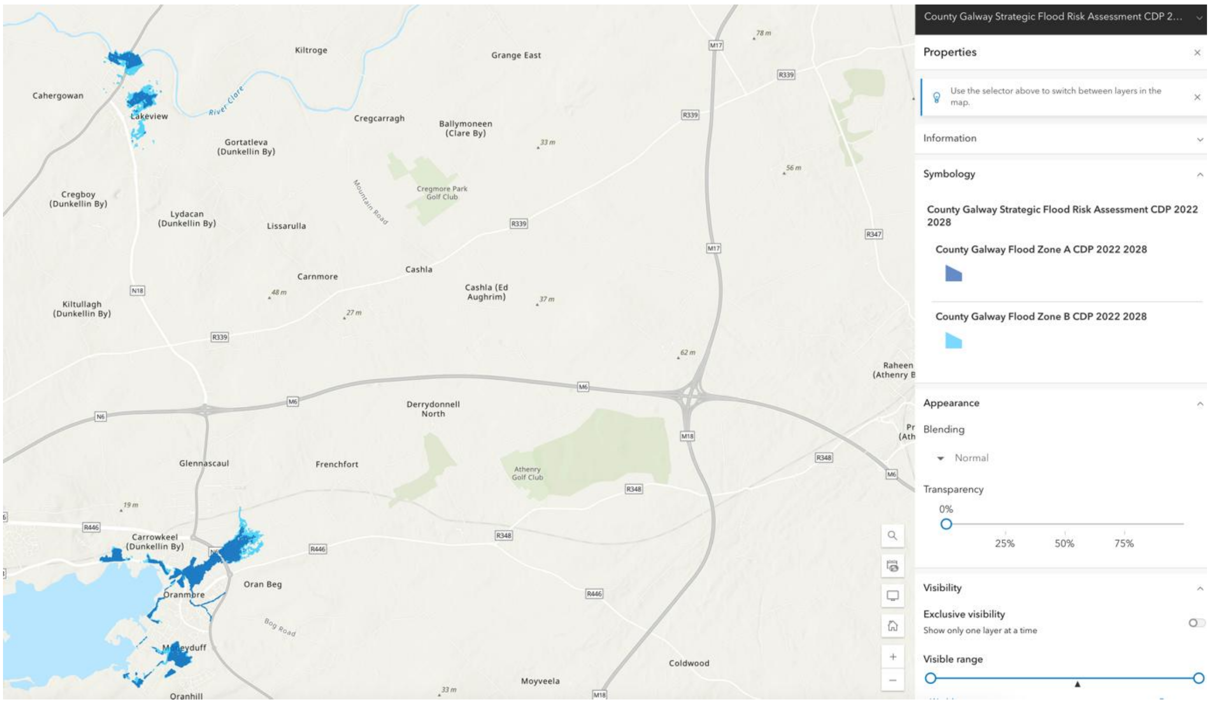
- *In essence, planning authorities are requested to be prudent in the use of the draft PFRA or CFRAM flood maps as the sole basis for deciding on planning applications (i.e. to refuse applications), to make use of site inspections and/or knowledge of local areas, to request a site-specific flood risk assessment by an appropriately qualified engineer where appropriate and to also generally use their professional judgement in this regard.*
- *The approach to be adopted by planning authorities in assessing planning applications as outlined in section 6.4 of the 2009 DECLG Guidelines still continues to apply:*
    - *"Planning authorities must strike a fair balance between avoiding flood risk and facilitating necessary development, enabling future development to avoid areas of highest risk and ensuring that appropriate measures are taken to reduce flood risk to an acceptable level for those developments that have to take place, for reasons of proper planning and sustainable development, in areas at risk of flooding.*

6.3 GALWAY COUNTY DEVELOPMENT PLAN 2022 – 2028 & STRATEGIC FLOOD RISK ASSESSMENT (SFRA)

The Galway Count Development Plan's Strategic Flood Risk Assessment (SFRA) reinforces the content of the Flood Risk Management Guidelines (DoEHLG, 2009). **It is noted that the application site is not within any of the flood risk areas mapped for Galway as included in the Galway County Development Plan 2022 – 2028 SFRA.**

As per Plate 2, in accordance with the Galway County Development Plan 2022 – 2028 SFRA there are no areas within close proximity to the site in Flood Zone A or Flood Zone B.

Plate 2 - Galway County Development Plan 2022 – 2028 SFRA



6.4 NATIONAL INDICATIVE FLUVIAL MAPPING (NIFM)

The National Indicative Flood Mapping does not cover this area because there are no rivers near the site. HES made this point in 2020 and it was accepted in 2020 by Galway County Council and accepted in 2023 by An Bord Pleanala. Nothing has changed in the landscape, there are still no rivers, there is still no fluvial flood risk.

6.5 CFRAM

Given the lack of surface watercourses the site area has not been covered by the more detailed OPW CFRAM mapping system. The Western CRAM Study has covered the three local watercourses referenced above at Claregalway, Oranmore and Athenry.

The CFRAM model predicted Q_{100} and Q_{1000} year flood elevations in the three watercourses referenced above at their nearest mapped channels to the site:

- Clare River upstream of Claregalway. Q_{100} = 11.86 mOD; Q_{1000} = 12.69 mOD;
- Carrowmoneash at Ballynageeha. Q_{100} = 6.06 mOD; Q_{1000} = 6.34 mOD.

6.6 GROUNDWATER FLOOD RISK MAPS - PREDICTIVE GROUNDWATER FLOOD PROBABILITY MAPS

Groundwater floods occur when the water stored beneath the ground rises above the land surface. In Ireland, the most extensive form of groundwater flooding is related to prolonged rainfall causing a rise in groundwater levels in the limestone lowland areas in the west of the country (www.GSI.ie).

The GSI's predictive groundwater flood map presents the probabilistic flood extents for locations of recurrent groundwater flooding in lowland karst regions. It consists of a series of stacked polygons at each site representing the flood extent for specific AEP's mapping floods that are expected to occur every 10, 100 and 1000 years (AEP of 10%, 1% and 0.1%, respectively). The GSI's predictive groundwater flood map is focussed primarily on flooding at seasonally inundated wetlands known as turloughs. GSI evaluation and monitoring sites were chosen for inclusion in the predictive map based on existing turlough databases as well as manual interpretation of SAR imagery.

The GSI's mapping process tied together the observed and SAR-derived hydrograph data, hydrological modelling, stochastic weather generation and extreme value analysis to generate predictive groundwater flood maps for over 400 qualifying sites.

The GSI predictive groundwater flood maps, accessible to all using the Groundwater Flood Data of the publically available 'Groundwater Data and Maps' option and https://dcenr.maps.arcgis.com/apps/MapSeries, **predict no groundwater flooding at the site or the surrounding area.** The nearest predicted groundwater flood event is 2 km to the south of the site at a GSI mapped turlough. This is considered to be in a different mapped catchment to the application site.

7 FLOODING HISTORY

7.1 HISTORICAL OSI MAPS

Reference was made to the historical 6" (1837-1842) and 25" OSI maps, presented below as Plates 3 and 4, respectively. These maps do not contain any indicators that suggest the application area or surrounding area was historically at risk of flooding or prone to seasonal wetness.

Plate 3 - Historical First Edition 6" OSI maps (1830 – 1930)

Plate 4 - Historical 25" OSI maps (1830 – 1930)

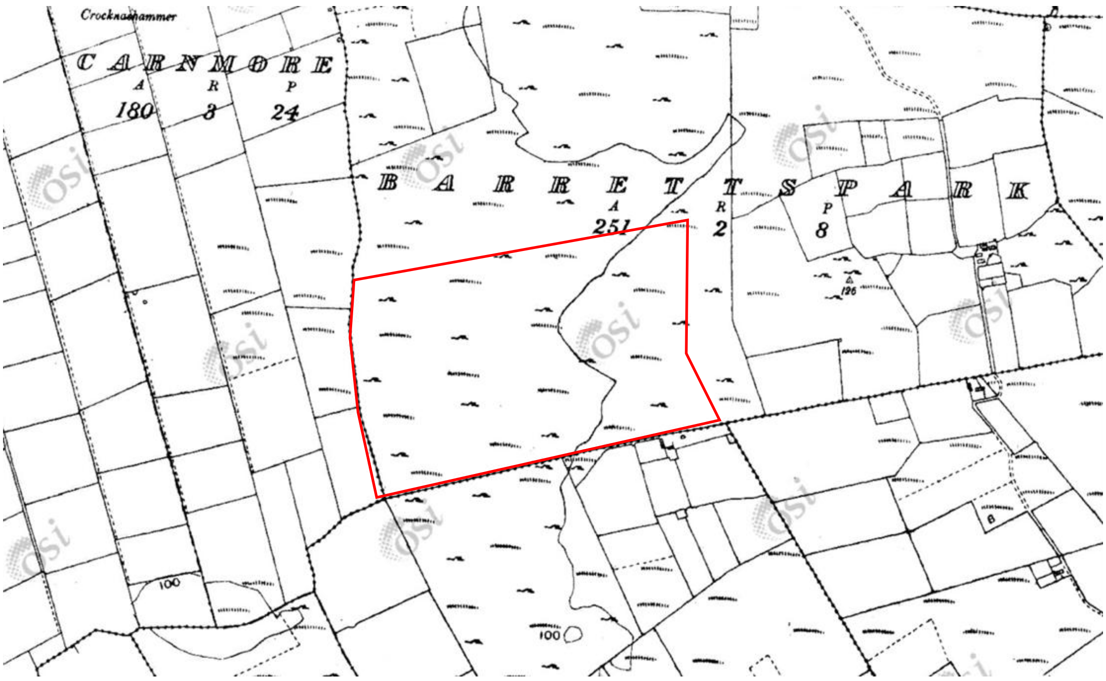
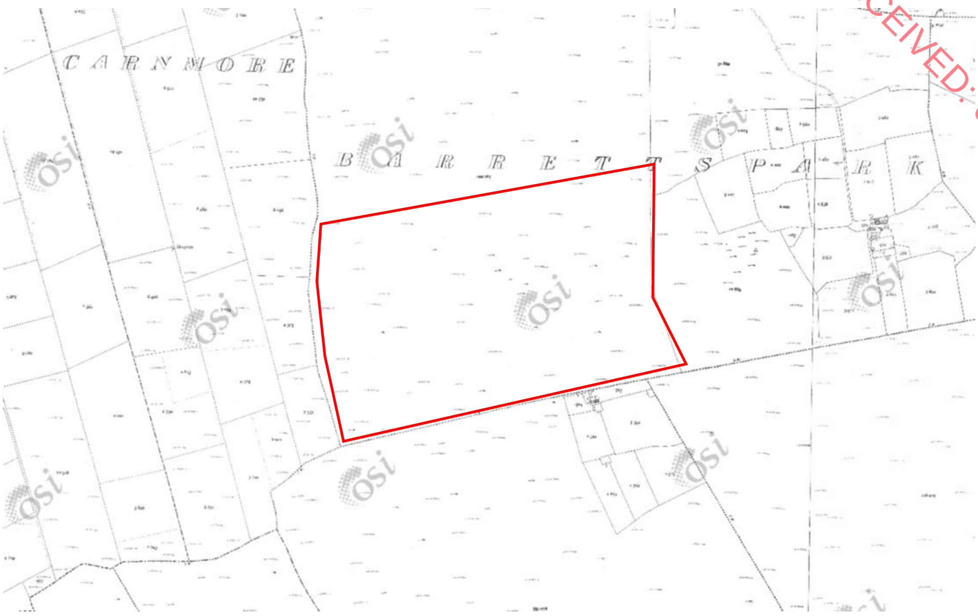


Plate 5 - Historical Final Edition 6" OSI maps (1830 – 1930)



7.1.1 OPW Flood Hazard Mapping

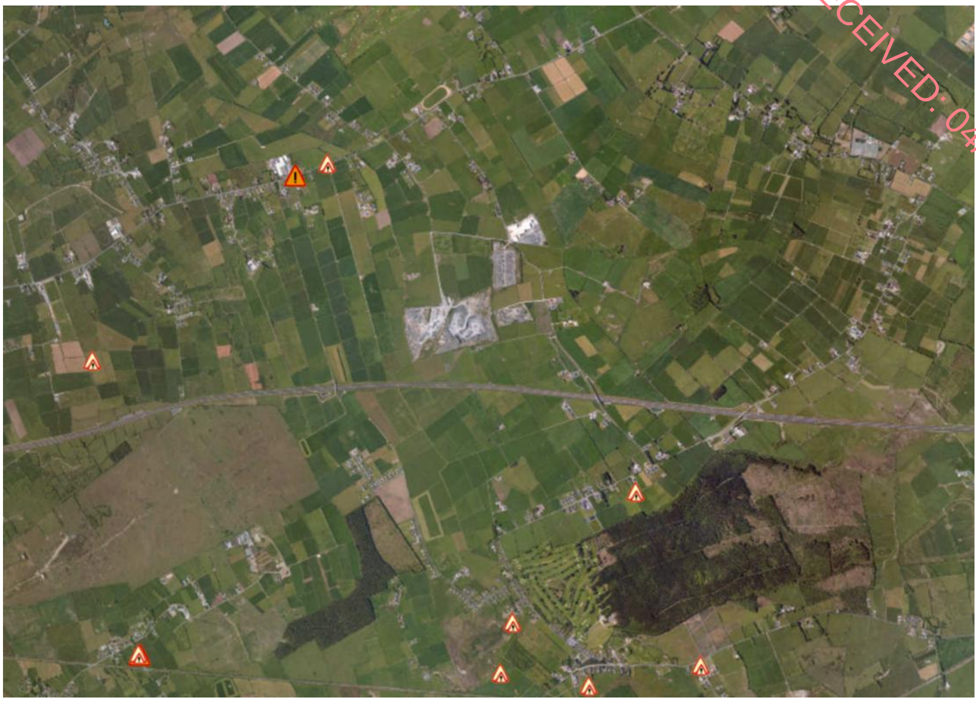
Consultation of the OPW flood hazard mapping tool shows no flooding events recorded at the application site (Plate 6).

The nearest mapped flood events on the OPW database are as follows:

1. 1,150 m to the northwest at Carnmore East (Galway Co. Co. meeting minutes, **01/04/2005**). R339 can be prone to flash flooding after heavy rain. The road is in the bottom of a valley.
2. 1,250 m to the northwest at Carnmore, 2009. Houses were damaged and roads were blocked for some weeks.
3. 1,500 m to the southeast at Lisheenkyle East. Recurring flooding of low-lying lands.
4. 2,250 m to the south at Derrydonnell North Turlough. This was recorded in a local authority report dated 2002.

These records confirm that flooding did occur on the R339 in 2005 prior to commencement of any development works at the application site or for the M6 Motorway.

Plate 6 - Historical Flood Events (OPW Database)



7.1.2 Ryan Hanley Study into Flooding at Carnmore

Following the November 2009 flood event at Carnmore, Ryan Hanley Consulting Engineers were commissioned by the OPW in March 2010 to undertake an assessment of sources of flooding along the Clare River and Abbert River, and to explore potentially mitigation measures. The initial report was entitled:

- '*Study to identify practical measures to address flooding on the Clare River*' (Ryan Hanley, June 2010).

In light of the findings of that report a supplementary study was commissioned to focus the townlands of Carnmore East and Cashla:

- '*Study to identify practical measures to address flooding* at Carnmore/Cashla' (Ryan Hanley, November 2010).

This latter report includes photographs which highlight the flood extents in the Carnmore area in 2009, reproduced here as Plate 7 and Plate 8.

Information supplied by Ryan Hanley to Dr. Pamela Bartley of Hydro-G was that the November 2010 Ryan Hanley report was followed by the OPW's installation of roadside flood relief drains on both sides of the R339 road between Greaney Glass and the access road from the R339 to the quarry. The roadside flood relief drains are visible from the road and the progression of aerial photographs and their construction was completed between March and June 2019.

Plate 7 - Flooding at Carnmore, November 2009. Application site in foreground (Source Ryan Hanley, 2010b).

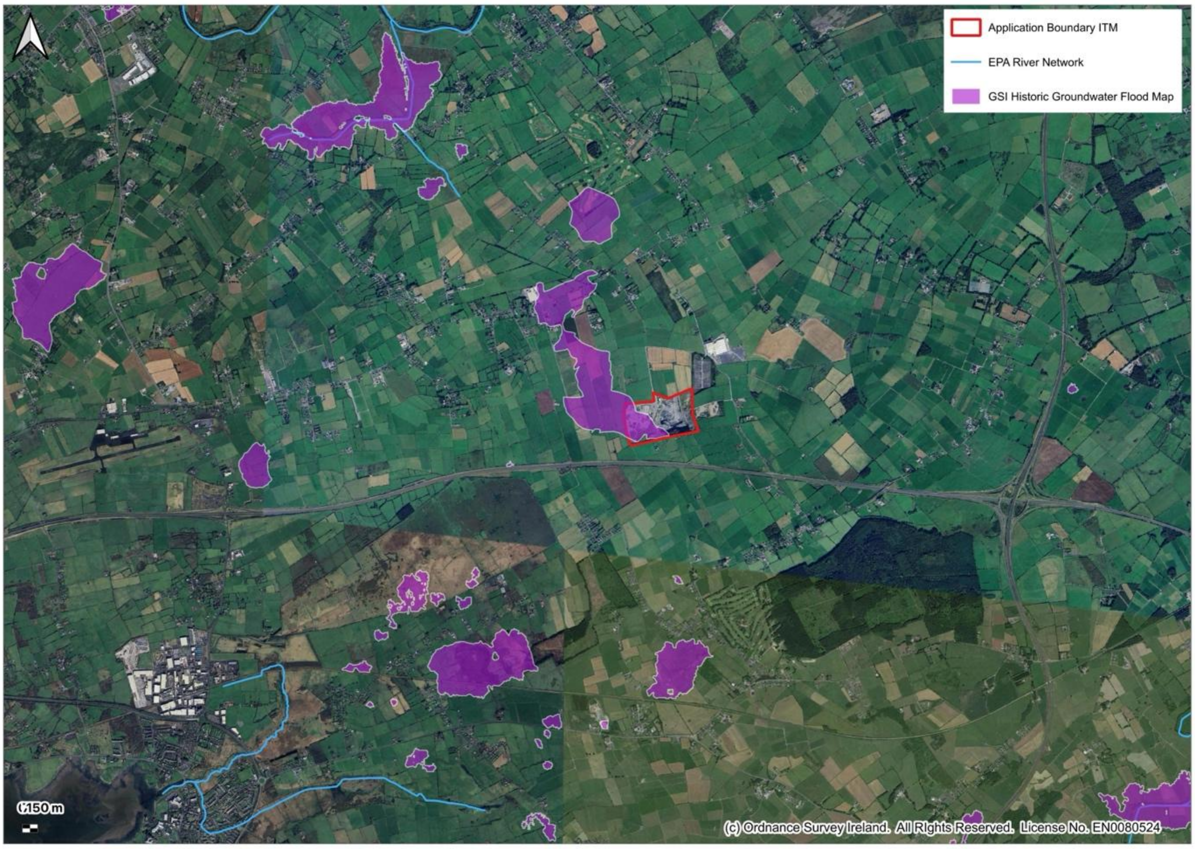
Plate 8 - Flooding at Carnmore, November 2009. This photo was taken approximately 1 km north of the application site, facing west. A flooded Greaney Glass factory is observed (Source Ryan Hanley, 2010b).

7.2 GSI HISTORIC GROUNDWATER FLOOD MAPPING

7.2.1 GSI Historic Groundwater Flood Event Mapping

The historic groundwater flood map (GSI) shows maximum observed peak flood extents for groundwater. It was generated using satellite images (Copernicus Programme Sentinel-1), field data, aerial photos, as well as flood records from the past. The historical flood event in relation to the site is shown in Figure 14.

Figure 14 - Historic Groundwater Flood Map (GSI)



With reference to Figure 14, the groundwater flood polygon displayed coincides with the 2009 flood extents shown in Plate 7.

Ground elevations (as 10 mOD contours) across the affected area fall from south to north which suggests that the site is at the upgradient end of the flood zone. This would assume that groundwater flow direction through the site, and immediately downstream, is from south to north. However, this would be contrary to expert karst hydrogeologist's presentation of the groundwater flow direction as shown in Figure 7 and Figure 8 (Drew and Daly 1993), which was shown to be from the east to the coast at Oranmore in summer with some slight deflections to the north in winter but ultimately groundwater flow is always to the coast at Oranmore.

The facts of the landscape are actually, as follows:

- The maximum historic groundwater flood extent polygon for the area represents saturation excess overland flow. This overland flow occurs when the permeable epikarst, which sits on competent, and essentially impermeable, limestone bedrock becomes saturated with rainfall. When the epikarst layer reaches saturation the excess water intersects the ground surface. Where this excess water intersects the surface typically becomes apparent in lower-lying parts of the landscape. For clarity, there is no discernible vertical interaction between this epikarst and the deeper groundwater system, within which groundwater flow is dominated by conduit pathways.

Shallow groundwater levels in the epikarst tend to be controlled by hydraulic boundaries such as downstream river levels (in this case the River Clare, which itself is an artificial channel) aswell as shallower, field-scale artificial drainage channels.

7.2.2 SAR Seasonal Flood Maps

The Synthetic Aperture Radar (SAR) Seasonal Flood Map, available on the Groundwater Flood Data of the publically available 'Groundwater Data and Maps' option and https://dcenr.maps.arcgis.com/apps/MapSeries, presents observed peak flood extents which took place each year between Autumn 2015 and Summer 2021.

The maps were made using Synthetic Aperture Radar (SAR) images from the Copernicus Programme Sentinel-1 satellites. SAR systems emit radar pulses and record the return signal at the satellite. Flat surfaces such as water return a low signal. Based on this low signal, SAR imagery can be classified into non-flooded and flooded (i.e. flat) pixels. Flood extents were created using Python 2.7 algorithms developed by Geological Survey Ireland and then refined using a series of post processing filters.

The SAR flood maps depict flood extents which have been observed. A lack of flooding in any part of the map only implies that a flood was not observed. It does not imply that a flood cannot occur in that location at present or in the future.

Each polygon has information on the return period of the mapped flood extent (high, medium or low), defined as follows:

- **GW Flooding High Probability map** = expected flood extent of groundwater flooding in limestone regions for annual exceedance probabilities (AEP's) of 10%, which correspond with a return period of every 10 years.
- **GW Flooding Medium Probability map** = expected flood extent of groundwater flooding in limestone regions for annual exceedance probabilities (AEP's) of 1%, which correspond with a return period of every 100 years.
- **GW Flooding Low Probability map** = expected flood extent of groundwater flooding in limestone regions for annual exceedance probabilities (AEP's) of 0.1%, which correspond with a return period of every 1000 years.

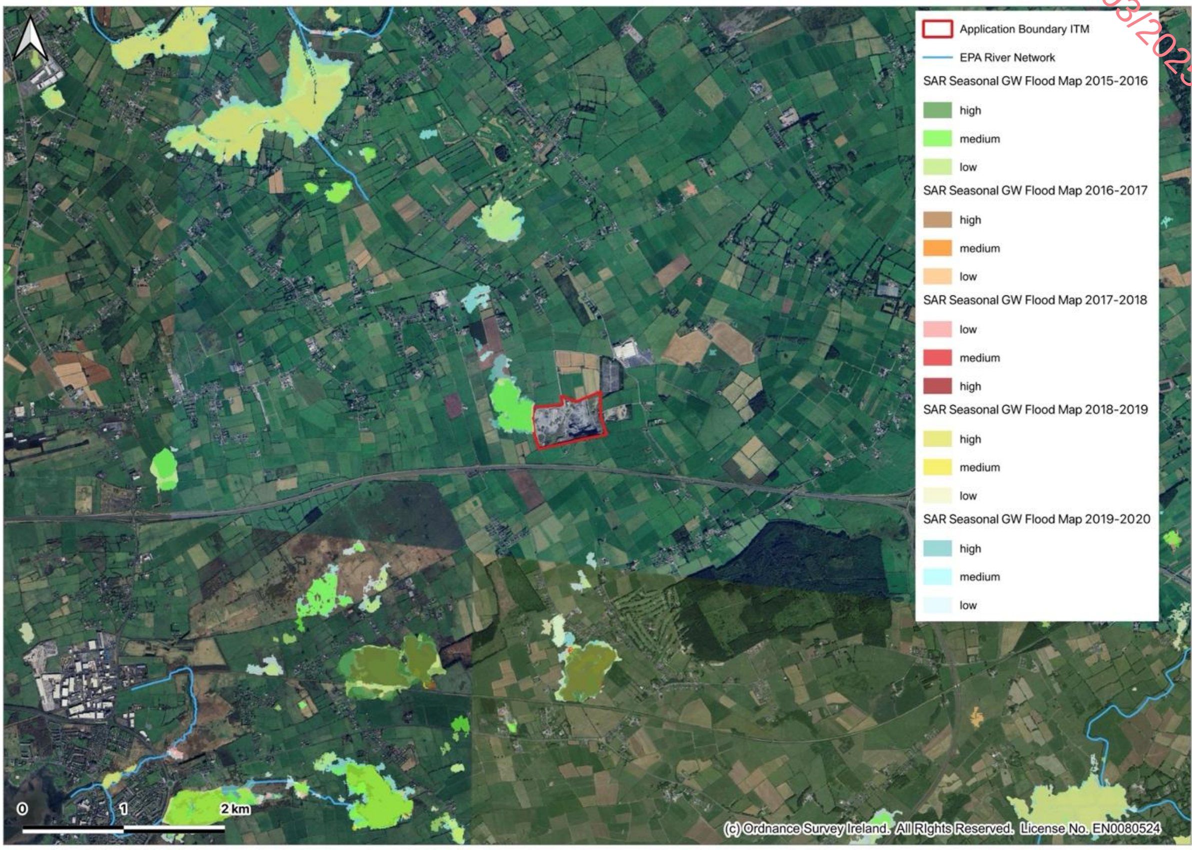
Figure **15** shows that the application site did not flood between 2015 and 2021 (the monitoring period). The low-lying lands to the west of the application site are shown to have flooded as follows:

- 2015/2016 = medium confidence
- 2019 – 2020 = high confidence

The 2015 to 2019 SAR mapped flood extents did not extend as far north as Greaney Glass Ltd. as had occurred in November 2009. The reason for no manifestation of flooding to the extent previously experienced, even though

2015 / 2016 were very problematic flood periods, presented by expert hydrologist and flood specialist Mr. Michael Joyce, of Ryan Hanley Consulting Engineers, was the provision of the Flood Eye at Claregalway in 2011.

Figure 15 - SAR Seasonal Groundwater Flooding (GSI)



8 SEQUENTIAL TEST & VULNERABILITY MATRIX

8.1 SEQUENTIAL APPROACH

The 'Planning System and Flood Risk Management Guidelines for Planning Authorities (2009)' require the planning system at national, regional, and local levels to:

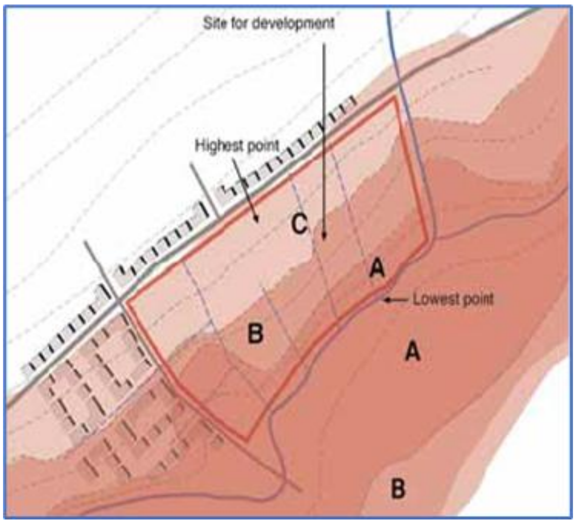
- Avoid development in areas at risk of flooding by not permitting development in flood risk areas, particularly floodplains, unless where it is fully justified that there are wider sustainability grounds for appropriate development and unless the flood risk can be managed to an acceptable level without increasing flood risk elsewhere and where possible, reducing flood risk overall.

- Adopt a sequential approach to flood risk management based on avoidance, reduction and then mitigation of flood risk as the overall framework for assessing the location of new development in the development planning processes; and

- Incorporate flood risk assessment into the process of making decisions on planning applications and planning appeals.

The sequential approach is used to assess flood risk at the site and, where there is variability, to assign appropriate zones in accordance with the Guidelines (DoEHLG, 2009). As shown in Plate 9, Zone A, applied to areas with a high probability of flooding, defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100). Development in this zone should be avoided and/or only considered in exceptional circumstances. Development should only be permitted in areas at risk of flooding when there are no alternative, reasonable sites available in areas at lower risk that also meet the objectives of proper planning and sustainable development. Zone B is applied to areas with a moderate probability of flooding from rivers. (i.e. a 0.1% to 1% probability or between 1 in 100 and 1 in 1000), with Zone C having a low probability of flooding.

Plate 9 - Schematic map showing use of the Sequential Approach to assign Flood Risk Zones (DoEHLG, 2009)



8.2 VULNERABILITY MATRIX

Clause 2.16 of the Flood Management Guidelines (OPW, 2009) states: ‘The classification of different land uses and types of development as highly vulnerable, less vulnerable and water-compatible is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings.’

The Planning System and Flood Risk Management guidelines provide three vulnerability categories based on the development type. The proposed works fall into the following vulnerability categories as follows:

- Highly vulnerable = residential, hospitals, schools, essential infrastructure, emergency service facilities.
- Less vulnerable = buildings used for retail, warehousing, commercial, industrial and non-residential institutions, **mineral working and processing**.
- Water-compatible development = amenity open space, outdoor sport and recreation.

Different types of development are appropriate in each of the Flood Zones, based on their vulnerability to flood risk. Hence:

- Highly vulnerable: requires Justification test in Flood Zone A and Flood Zone B, appropriate in Flood Zone C;
- Less vulnerable: requires Justification test in Flood Zone A; appropriate in Flood Zone B and Flood Zone C;
- Water-compatible = appropriate in Flood Zones A, B and C.

The proposed development is considered to be ‘mineral working and processing’ and therefore comes under ‘less vulnerable development’, which is considered appropriate in C, but requires a Justification Test in Flood Zones A and B.

Based on desktop information collected to this point the site is deemed to contain Flood Zones A, B and C. Given the presence of a mapped flood event extending across the site boundary a conservative approach is being applied and the assessment will proceed to quantitative evaluation of flood mechanisms.

8.3 S-P-R MODEL

The flood risk assessment is carried out using the source-pathway-receptor (S-P-R) model, as outlined below. The S-P-R model is used to identify the sources of flood water, the people and assets affected by potential flooding, and the pathways by which the flood water reaches those receptors. Consideration will be given to the predominant sources, pathways and receptors in terms of the influence they have on site flooding, or the manner in which they may be impacted. The primary water sources on site are as follows:

Sources	Pathways	Receptors
Short-term rainfall	Infiltration excess overland flow	Application site
Long-term rainfall	Saturation excess overland flow	Third party agricultural lands
Shallow subsurface flow	Shallow subsurface flow	Third party dwellings
Bedrock aquifer	Deeper groundwater flow in karst conduits	Third party business properties
Fluvial flow	Kenny’s Drain / Islandmore Stream	Clare River

The information collated to date suggests that the primary source of flooding is groundwater or pluvial flooding linked to extreme rainfall events. The pluvial flooding is likely influenced by shallow subsurface water.

9 FLOOD MECHANISMS & ANALYSIS

9.1 RAINFALL

Three significant flood events have been documented in Galway over the past 20 or so years, these being winter 2009, winter 2015 and spring 2020, with each of these being largely driven by rainfall. The dynamics of rainfall inputs contributing to these flood events are outlined below.

9.1.1 November 2009 Rainfall

Met Éireann issued a climatological note in February 2010 to serve as an analysis of rainfall that caused widespread nationwide flooding in November 2009. Key points to note from the Met Eireann (2010) report are as follows:

- Rainfall totals for November were the highest on record at most stations;
- Two-day falls of over 100 mm were recorded in parts of the west. Some two-days totals in the Galway region had return periods in excess of 100 years;
- From 4 to 25-day durations, the estimated return periods increase in the areas of highest rainfall, in many cases exceeding the 500-year recommended limit on the accuracy of the return period model.
- The application site is within part of the country where the 4-day and 25-day return period were the highest recorded.
- Return periods for rainfall at UCG were estimated as follows for November 2009:
    - 1 day = 1 in 29 year
    - 2 day = 1 in 134 year
    - 4 day = 1 in 293 year
    - 8 day = 1 in 306 year
    - 18 day = 1 in 272 year
    - 25 day = 1 in 251 year

Items to note from the Ryan Hanley consulting engineers for the OPW (2010b) report in relation to November 2009 rainfall are as follows:

- By 10th November 2009 soil moisture deficit = 0, i.e. saturated ground conditions. This would imply that any subsequent flooding was pluvial in nature;
- Total monthly rainfall at NUI Galway was 465 mm;
- Peak daily rainfall at NUI Galway was 61 mm on 17th November 2009. This is the highest daily rainfall on record at this station. Given the saturated ground conditions all of this rainfall would have generated overland flow (runoff).

These return periods suggest that flooding was caused by a combination of 24-hour rainfall events with a high return period occurring within a prolonged rainfall event which itself had a return of 250 years when measured over 25 days.

9.1.2 2015 Rainfall

A significant rainfall event occurred between 12th November 2015 and 5th January 2016, heavily influenced by three successive storm events. This prolonged rainfall caused flooding in parts of County Galway. Water levels at Ballindooly Lough, 10 km to the west of the application site, peaked on 2nd January 2015, indicating the highest flood levels in at least 50 years within the River Corrib system.

The Met Éireann rainfall gauge at Athenry recorded 500 mm of rainfall on November and December 2015 (double the average rainfall for this period over the years 2013 – 2018).

A review of academic literature found that due to large uncertainties and the atypical nature of the flood (succession of events), no return periods have been calculated for the 2015 event.

A report by Naughton et al. (2017) stated that greater than 600 mm fell during this period, making it the wettest winter on record in a rainfall time series stretching back to 1850. December was also the wettest month on record in Ireland.

9.1.3 2020 Rainfall

A report by Ryan Hanley in 2021 calculated that the February/March 2020 rainfall event had a return period of approximately 1 in 10 - 20 years (10% - 5% AEP) in South Mayo.

9.2 FLUVIAL FLOODING

None of the indicative flood maps suggest that fluvial flooding is a source of flood risk to the application site or the surrounding area.

Kenny's Drain, Islandmore Stream and Clare River have been prone to flooding in the past. The following recent measures have mitigated risk of fluvial flooding emanating from these channels:

- Channel widening of the Clare River to a point 900 m upstream of Crusheen Bridge;
- Cleaning and limited re-grading of Islandmore Drain;
- Modifications to the bridges in Claregalway (see Plate 10 below) and Crusheen.

Plate 10 – New bridge 'Flood Eye' installed to increase conveyance capacity for the Clare River at Claregalway.

Rivers and streams typically act as baseflow sinks, i.e. they act as the drainage outfall for perpendicular groundwater flows. Fluvial flooding in river channels acting as baseflow sinks can prop up groundwater levels in adjacent areas. In the Carnmore area this dynamic can occur when flood levels on the Clare River prevent the Islandmore Stream and Kenny's Drain from emptying. As a consequence fluvial water levels in these channels can then restrict drainage of the upstream area where shallow surface flow/pluvial flow occurs. The shallow subsurface flow/pluvial waters can only drain fully when the downstream surface levels recede. Prior to mitigation works such as that shown in Plate 10 the Clare River was prone to frequent fluvial flooding and had a slow recession phase due to a laggy response on Lough Corrib. This may have slowed the recession of the flood waters in Carnmore in 2009.

9.3 COASTAL FLOODING

Given the distance between the application site and the coastline, and the difference in elevations at both locations, coastal flooding is not considered to be a source of flooding to the application site or surrounding area. Coastal flooding is not considered to influence other flood mechanisms in the area.

9.4 GROUNDWATER FLOODING

This report has already discussed how there may be two independent groundwater systems in Carnmore, as follows:

(i) A deeper karst conduit aquifer system within which groundwater flows are routed in the ultimate direction of the coastline, and

(ii) A shallow subsurface flow system in the upper weathered bedrock which is close to surface. Bedrock between these two systems has been shown to be a solid dry mass of limestone of low permeability meaning that the two systems are separate.

Following high rainfall rates in the months preceding November 2009, the near-surface weathered bedrock layer (epikarst) filled up with infiltrating precipitation. As a result the shallow subsurface water in this weathered bedrock system progressively rose until ultimately they intercepted the surface. According to the definition provided previously, this event in 2009 could have been regarded as groundwater flooding because the shallow subsurface epikarst flow system cannot drain into the bedrock vertically, due to its competent solid nature, and at that time epikarst could not drain to river systems because of fluvial flood levels.

9.5 PLUVIAL FLOODING

Surface overland flow, or put more simply the movement of water across the ground surface, is controlled by one of two mechanisms:

1. Infiltration excess overland flow, which occurs when rainfall intensity exceeds soil infiltration rate. This dynamic is associated with short duration / high intensity rainfall events. It is not overly common on mineral soils in Ireland, being more prominent in arid regions where slaking of high clay soils can cause surface sealing.

2. Saturation excess overland flow, which occurs when the soil is saturated and rainfall is rejected at soil surface. Typical of long duration / medium intensity rainfall events.

With respect to the study area, rainfall infiltrates vertically through the soil surface and the upper weathered bedrock (epikarst). This vertical infiltration becomes impeded upon encountering effectively impermeable limestone bedrock. The rainfall that infiltrates the ground surface can be termed shallow groundwater or interflow. Given the permeable nature of the epikarst this shallow groundwater can flow laterally and can intersect the ground surface and accumulate in low-lying areas. Shallow groundwater that does not flow laterally, due to downstream saturation, will accumulate and rise towards the surface. When this active shallow subsurface zone becomes saturated, any additional rainfall will be rejected at surface and flow overland from that point, as saturation excess overland flow.

Based on these descriptions Envirologic would characterise the flooding that previously occurred at Carnmore as a combination of pluvial flooding, due to saturation excess overland flow, and groundwater flooding, due to emergence of shallow groundwater in depressed areas.

Envirologic asserts that the flooding experienced in this area was driven from top down, i.e. it is rainfall driven. Pluvial flood waters, or shallow groundwater intersecting the ground surface, will accumulate in topographically enclosed depressions, up to a level whereby relief is provided by a drain invert or a spillover threshold (natural or artificial).

It is important to clarify that flooding in the area is not considered to be caused by vertical accumulation of groundwater in the deeper, regional, conduit-driven karst aquifer. The proportion of groundwater vs pluvial mechanisms driving historical flooding at Carnmore is not deemed critical to the conclusion of this FRA relating to the continued operation of a quarry to an elevation of -5m OD in the current configuration of the landscape.

9.5.1 November 2009 Pluvial Flood Dynamics

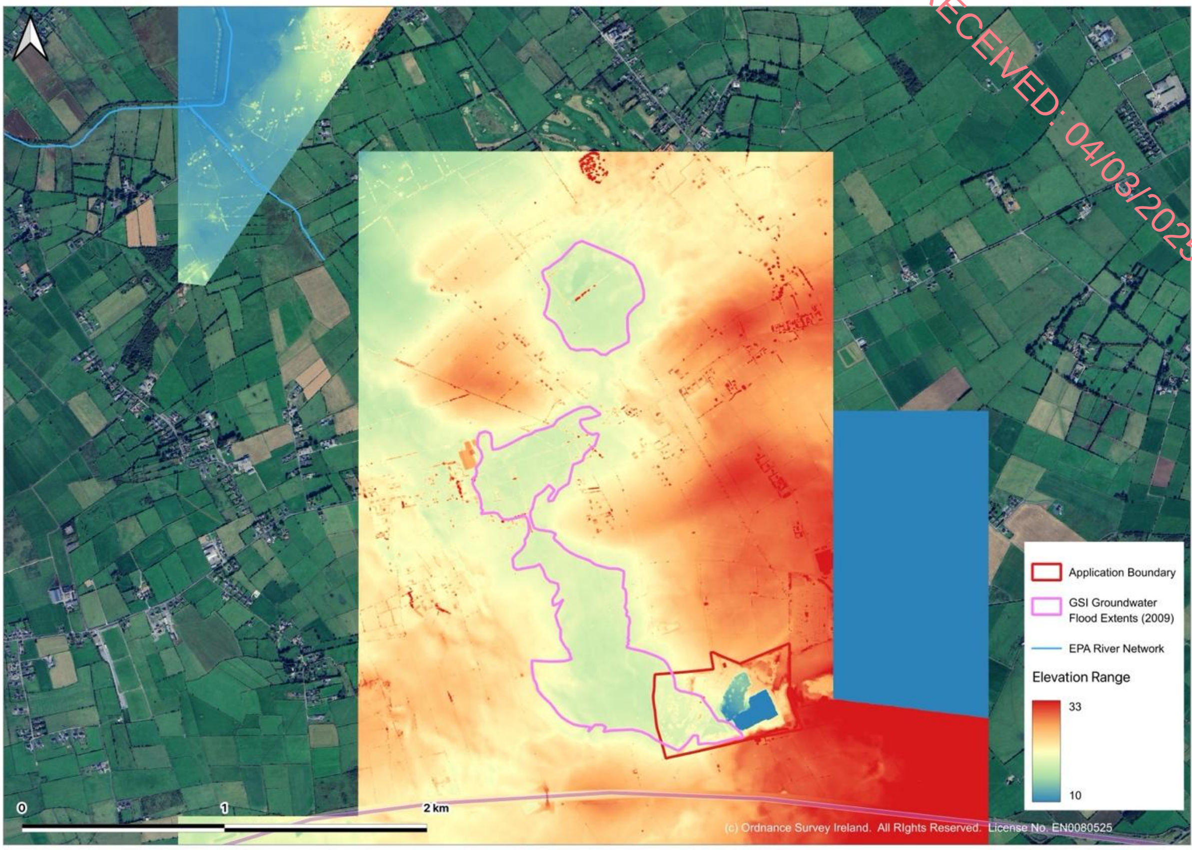
Envirologic have utilised TII LIDAR data to generate additional topographical relief map in an effort to aid understanding of the flood dynamics in 2009. Figure 16 shows a shaded relief map for elevations in the range 10 to 33 mOD. The interpretation will focus on the larger mapped flood extent that impacted the quarry site.

The mapped groundwater flood extent correlates with the valley floor, which is enclosed topographically to the east, west and south. Topography at the southern end of the mapped flood extent may have been raised during M6 Motorway construction but this is difficult to confirm. The northwestern corner of the mapped flood extent coincides with the buildings and dwellings in and around Greaney Glass. It is difficult to ascertain whether there was a pre-development topographical divide here or whether M6 development works have severed natural surface/subsurface flow paths.

Ryan Hanley (2010) described how the northern and southern parts of this polygon only merged once both areas had become inundated independent of one another. Ryan Hanley (2010) used their own topographical survey data and ground truthing to confirm the maximum flood level was 20.1 mOD.

The peak volumes of water in the active flood plain are not considered of high importance and having been calculated by Ryan Hanley (2010b) are not repeated here.

Figure 16 - Shaded relief map showing elevations in the range 10 – 33 mOD

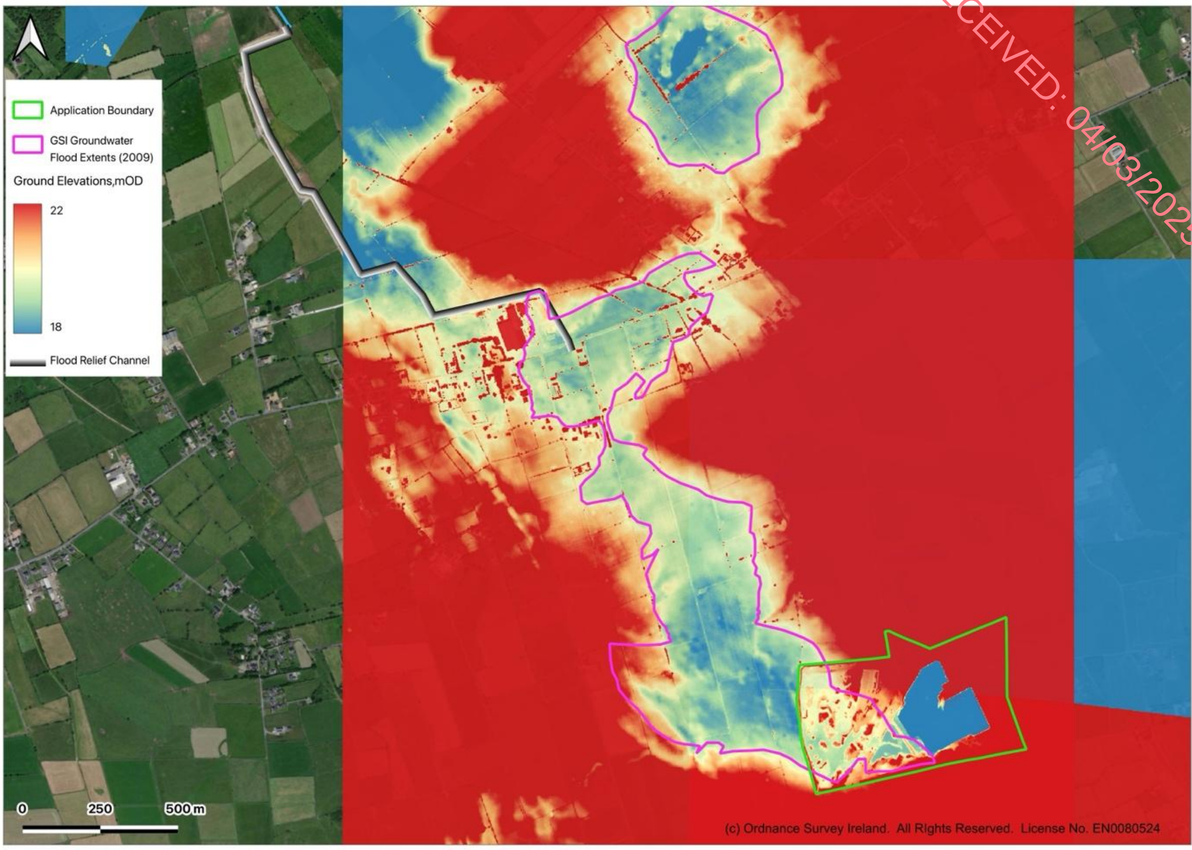


The topographical relief map was altered to only show elevations within the range 18 – 22 mOD (see Figure 17). This serves to exaggerate the differences in elevation on the colour scale and suggests that the maximum flood elevation reached in 2009 may be closer to 19.9 mOD. It also implies that the mapped flood extent has been slightly overestimated in the southwest corner.

The landscape area to the west of the quarry site is the lowest lying (18.0 – 19.0 mOD) and it is likely to accumulate pluvial floodwaters first. At the northern end of the groundwater flood polygon the lowest elevations are between 18.5 and 19.0 mOD and being topographically enclosed one would expect pluvial waters to accumulate in this area also. This is in line with the Ryan Hanley Engineer's for the OPW (2010b) description. Critically, these two pluvial floodplains merge when water levels rise above 19.5 mOD, this being the overflow threshold between the two areas, which can be clearly seen at the pinch point separating the two.

It is not entirely clear if development at the northwestern corner of the flood polygon have impeded pluvial floodwaters from draining northwest towards lower ground on approach to Kenny's Drain. The dark red polygons and lines indicating buildings and stone walls, respectively, suggest this may have been a contributing factor. Ground elevations in the processing area of the quarry are shown to be above 19.3 mOD which confirms that portions of this area would have been inundated during the 2009 event. The lower parts of the lands to the west would have had to have filled to a level of 19.3 before inundation of parts of the quarry commenced. Flood waters entering the western part of the application site would have likely spilled over into the main quarry sump, providing additional capacity for temporary storage of floodwaters. Examination of Plate 7 highlights that water levels in the quarry sump were lower than in the lands west of the application site during the November 2009 event.

Figure 17 - Shaded relief map showing elevations in the range 18 – 22 mOD.



10 MITIGATION

Given the evidence of historical flooding at the site and the surrounding area it is usually necessary to evaluate the need for mitigation measures that could be implemented in order to prevent future flooding at the application site and of nearby lands and/or properties. The two general approaches are control of flood levels via flood relief (such as enhanced drainage) or flood defence (such as flood barriers, embankments, etc).

10.1 FLOOD RELIEF CHANNEL

Following an appraisal of options (e.g. flood warning system, site-specific flood defences), Ryan Hanley consulting engineers advising the OPW (2010b) selected a flood alleviation drain as the optimal solution for Carnmore/Cashla historic flood experiences. Such a drain was advised as having the ability to either transfer accumulated flood waters northwards to the Clare River or southwest towards Oranmore. For logistical reasons a channel connecting to Kenny's Drain was selected. The route of the flood alleviation channel is illustrated in Figure 17.

10.1.1 Associated Works

This option was only feasible once additional mitigation measures to reduce peak water levels on the Islandmore Drain had been completed. These measures included the following:

- Channel widening of the Clare River to a point 900 m upstream of Crusheen Bridge;
- Modifications to the bridges in Claregalway and Crusheen;
- Cleaning and limited re-grading of Islandmore Drain.

10.1.2 Design Specifications

The design flow for the relief channel was 1.0 m^3/s. The relief channel is comprised of a 1.05 m diameter concrete pipe for the initial 1,500 m, followed by a 370 m length of open channel. This channel has been sized for the design flow plus an increase of 20% to allow for growth in flows due to climate change. Analysis showed that Kenny's Drain and Islandmore Drain have minimum conveyance capacities of 1.7 m^3/s which was increased following cleaning as part of the flood relief scheme.

The invert of the flood relief channel at the inlet is 19.0 mOD, equivalent to R339 road level and 520 mm below lowest FFL of surrounding houses.

The additional flow in the drain of 1 m^3/s was deemed acceptable in terms of potential to increase risk to downstream receptors. This is because the design changes to the bridges at Claregalway and Crusheen provided an additional 220 m^3/s flow capacity on top of what was available at the time of the November 2009 event.

10.1.3 Implications for Local Properties

The OPW's relief pipeline limits flood levels to 19.0 mOD in the northern portion of the mapped polygon that represented the 2009 flood extents. Only a small portion of the northern area that previously flooded is below 19.0 mOD and there are no finished floor levels of local dwellings below this level. Flooding on the R339 may reach a depth of c. 200 mm which is considered acceptable.

The pinch point between the northern and southern historical expression of flood has a minimum ground elevation of 19.5 mOD. Hence relief is provided to the southern area when flood levels exceed this elevation. This means there will still be pluvial flooding in the field west of the application site, to a maximum depth of approximately 1.5 m. This is a natural feature because of the natural topography bowl type landscape to the west. The lowest finished floor of dwellings in the area is 19.52 mOD and hence this property will not flood in future.

10.1.4 Implications for Application Site

The boundaries of the overall site have minimum continuous elevations that are higher than the OPW limit of 19.0 mOD. On the western and northern boundaries of the site there is a continuous berm elevation of at least

21m OD. Hence the quarry site will not flood from lands to the north or west in future. On the southern boundary the continuous berm elevation is 21m OD in the southwest and 32m OD in the south east. Along the eastern boundary of the site the heights extends from 29m to 22m OD. Hence the quarry will not flood from any surrounding lands in the future. In addition, and as stated earlier, the OPW's design measures have ensured that local homes will not flood in future, regardless of the quarry.

10.1.5 Validation

The extents of the extreme flood event that occurred in 2015/2016 (Figure 15) are markedly different to that of 2009 and this may reflect the success of the regional flood alleviation scheme. No significant flooding was observed in the northern half of the area that flooded in 2009. Pluvial flooding occurred in 2015 on lands adjoining the western quarry boundary, however these did not breach the western embankment and no flooding was observed in the western half of the quarry. This validates the flood alleviation scheme design.

10.1.6 Galway County Council SFRA 2022 - 2028

The flood relief channel was completed under the Corrib-Clare FRMP and is described in the Galway County Council Development Plan 2022 – 2028 SFRA as follows:

- *The Clare River (Claregalway) Flood Relief Scheme includes a Flood Eye at Claregalway Bridge with associated channel deepening upstream under and downstream of the bridge and flood eye; a new bridge at Crusheeny; Channel widening from downstream of Crusheeny Bridge for 1.3 km upstream; new embankment upstream of the confluence with the Islandmore drain for 0.7 km with a non-return valve on the Islandmore drain; embankment at the Nine Arches Bridge; Increasing capacity of two culverts on the Kiniska drain; drainage for floodwater via pipeline from Lakeview to the Clare River; drainage for floodwater from Carnmore / Cashla area via pipeline to Islandmore drain; maintenance of the stretch of the Clare River and tributaries within the Scheme; road raising at Miontagh South. The scheme will protect against the 100-year flood (1% Annual Exceedance Probability).*

The scheme includes a maintenance programme to eliminate risk of blockage with debris at the grated inlets.

10.2 ATTENUATION IN QUARRY VOID

The OPW's regional and local flood alleviation schemes, now constructed, protects the quarry from future flooding. Given the amount of attenuation storage available in the quarry sump the quarry has the ability to provide additional mitigation. This mitigation measure is only required to become active in the event that (i) the OPW's system's inlet(s) at Cregmore become partially or fully blocked with debris, or (ii) the narrow topographical feature connecting the southern and northern flood risk areas was to become blocked.

Given the historical evidence of the obvious visual expression of expansion of the pluvial floodplain directly west of the quarry, and the lag time of about a week for this floodplain to expand as far as the western boundary of the application site, there is no necessity for provision any flood relief measures because impediments to flow at the

OPW Flood Relief features would be obvious and would be cleared in the interest of road safety and preventing hazard to motorists.

10.3 STORAGE OF HYDROCARBONS

Storage of hydrocarbons, in the usual bunded facilities, provides all protections necessary.

10.4 PUMPING REGIME

All pumping of waters accumulating in the sump should be in accordance with Discharge License W/469/13.

11 JUSTIFICATION TEST

Based on the information above the proposed development works will take place within Pluvial Flood Zone B and C. The Clare-Corrib flood relief scheme was designed for a 1 in 100 year return period. As it is not considered to be a flood defence measure the probability of structural failure does not have to be taken in to account when assigning flood zones post completion of the alleviation scheme.

Revisiting the Planning System and Flood Risk Management Guidelines (2009), mineral working and processing is characterised as 'less vulnerable' activity in terms of flood risk. Less vulnerable development is considered appropriate in Flood Zone B and Flood Zone C. Nevertheless, in taking a conservative approach the Justification Test shall be applied.

11.1 DEVELOPMENT MANAGEMENT JUSTIFICATION TEST

The Development Management Justification Test is used at the planning stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

The Development Management Justification Test is an assessment of whether a development proposal within an area at risk of flooding meets specific criteria for proper planning and sustainable development and demonstrates that it will not be subject to unacceptable risk nor will it increase flood risk elsewhere. According to the County Galway Land Use Zonings Map for County Development Plan 2022 – 2028 the application area is not zoned. Demonstration that the proposed development on the application site passes the Justification Test for Development Management is shown in Table 1.

In line with the Flood Risk Guidelines (DoEHLG, 2009) where a planning authority is considering proposals for new development in areas at a high or moderate risk of flooding that include types of development that are vulnerable to flooding and that would generally be inappropriate, the planning authority must be satisfied that the development satisfies all of the criteria of the Justification Test as it applies to development management outlined in Table 1.

Table 1 - Requirements of the Justification Test.

Requirement		Site Specific Response
Part 1		
	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of the flood risk guidelines.	Planning permission for quarrying at this site has been approved in the past. In accordance with the Galway County Development Plan 2022 – 2028 the application site at Barrettspark, Athenry, Co. Galway is not zoned. This lack of zoning is standard.
Part 2		
(i)	The development proposed will not increase flood risk elsewhere and, if possible, will reduce overall flood risk.	The flood risk assessment demonstrates that development can take place on the site without increasing flood risk elsewhere. There will be no infilling within a potential flood risk area, hence no reduction in potential flood plain storage.
(ii)	The development proposal includes measures to minimise flood risk to people, property and the economy and the environment as far as reasonably possible.	As concluded by Galway County Council's Planning Report on PL20/499, "An assessment of local sensitive receptors with regard to flood risk and the local hydrological regime, determined that the quarry operation poses no risk to the identified receptors.' This currently reported assessment completed by Envirologic also concludes that 'measures to minimise flood risk' are not deemed necessary. However, as a precautionary measure: if there is a flood event locally, the quarry could stop pumping its discharge waters to its licensed groundwater infiltration area.
(iii)	The development proposal includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures of the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.	Overall, the only mitigation measure required within the development site is that pumping of waters from the quarry void to the licensed groundwater infiltration area in the south west of the site will cease during potential flood events and the lower floor area allowed to flood. The proposed development will not increase risk of flooding to local properties including dwellings and business premises. The mitigation measures will ensure that these is no restriction to access/egress of emergency vehicles to/from the site during an extreme flood event. The proposed development will not sever any existing flow pathways.
(iv)	The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	As per the Galway County Council Development Plan 2022 – 2028 SFRA permitting the proposed development will avoid any unnecessary restriction of national, regional or local economic and social growth.

12 SUMMARY

This Site Specific Flood Risk Assessment relates to proposed development works at an existing quarry located in Cashla, Athenry, Co. Galway. Proposed works involve continued operation of the existing quarry and all associated uses and activities, as well as for a lateral extension to the existing quarry void's extraction area.

Whilst there is clear evidence of a significant flood event in the Cashla/Carnmore area in November 2009, this local experience was not repeated when other parts of the region experienced more significant groundwater and surface water flooding events in 2015/2016. The 2009 event resulted in some inundation into the application site. The key contributing factors to the 2009 flood event were (i) rainfall intensities over an 8-day period having a return period greater than 1 in 300 years and (ii) elevated peak flood levels in the nearest arterial drainage channels (Kenny's Drain, Islandmore Stream and Clare River). Flood extents and flood depths caused damage to properties in the wider area but not in the vicinity of the quarry.

Ryan Hanley (2010b) prepared a report which includes photographic evidence of the November 2009 event, estimates peak flood levels and presents an appraisal of mitigation options. The key mitigation measure advised by Ryan Hanley (2016b) was that the OPW should construct a flood relief channel connecting the Cashla/Carnmore area north of the quarry, *i.e.,* the northern part of the 2009 flood extent, with Kenny's Drain. Additional measures which complemented this channel were cleaning of open channels downstream and increasing bridge conveyance capacity on the Clare River at Claregalway. All OPW Flood Relief Measures were implemented and no flood experience or risk exists today. The peak flood level reached in 2009 was 20.1 mOD. The new flood relief channel has an invert level of 19.0 mOD, 500 mm below the lowest finished floor level of previously affected properties. These measures shall ensure that flood levels in the northern affected area, along the R339, will be limited to below 19.0 mOD. Due to a small topographical feature flood levels in the southern affected area, west of the quarry, will reach a maximum of 19.5 mOD before spilling over into the northern area and entering the relief drain. Minimum elevations along the western boundary of the application area are 19.5 mOD which means that the application site will not be at risk of flooding. Any extreme rainfall accumulating in the lands west of the quarry, to a level greater than 19.5 mOD, will spill into the quarry void for short-term attenuation, until the impediment is removed. The quarry will stop pumping its licensed discharge until the extreme flood waters have assimilated into the soils, subsoils, rock and *via* the OPW's local and regional flood relief structures.

The outcome of this FRA study is that the OPW Flood Relief scheme, which involved construction of structures at multiple locations to the north of the Cashla/ Carnmore 2009 event site, have been proven in subsequent extreme events to have mitigated flood risks. Again, it is reiterated that the national experience of extreme flood damage in 2015/2016 was not experienced in the vicinity of the quarry.

The proposed works will not result in any net loss of potential flood plain storage. It can be concluded that the proposed development will not have a negative impact, in terms of flood risk, on the local drainage network, on local private property, or to the surrounding environment and human health. The proposed development, and continued operation of the quarry is in full compliance with the Galway County Council Development Plan 2022 – 2028 and its Strategic Flood Risk Assessment (SFRA).

The site and proposed development works were deemed to have passed both Part 1 and Part 2 of the Development Management Justification Test. Overall, the only mitigation measure required within the development site is that pumping of waters from the quarry void to the licensed groundwater infiltration area in the south west of the site will cease during potential flood events and the lower floor area allowed to flood.

The overall conclusion of this site-specific Flood Risk Assessment concurs with Galway County Council's Planning Report on PL20/499, which concluded that "An assessment of local sensitive receptors with regard to flood risk and the local hydrological regime determined that the quarry operation poses no risk to the identified receptors." An Bord Pleanala concluded similarly in 2023. There is no risk posed by the continued operation of the site as a bedrock quarry.

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This report refers, within the limitations stated, to the condition of the site(s) at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the sites(s). The report is based on a visual site inspection and the physical investigation as detailed. Envirologic take no responsibility for conditions that have not been revealed due to lack of access. Whilst every effort has been made to interpret the conditions observed, such information is only indicative, and liability cannot be accepted for its lack of accuracy in representing geological/hydrological/hydrogeological conditions.

<u>Cashla/Carnmore Flooding 2009 but never since.</u>

<u>Dr. Pamela Bartley</u>

1. The purple shading on the GSI's Groundwater Flooding Website is for the **2009 flood event**. There was flooding in 2009.

2. HOWEVER, the 2009 event adjacent to Coshla was **<u>not repeated</u>** in the worst national flood experience of 2015/2016. The GSI flood maps relate to the 2009 event but the CURRENT Groundwater Flood Risk Maps present no risk. The 2015/2016 GSI Flood mapping shows no flood experience in the vicinity of the quarry or local townlands.

3. The OPW core hole SI reported in the Ryan Hanley (2010) study of the lands to the immediate north of the quarry, *i.e.* the 2009 flood lands, was not included in the National Groundwater Level Monitoring Programme because the area is not likely to be important anymore.

4. The GSI maps the SAR risk as Medium confidence. There is no current story. This has been addressed in the wider Flood Relief efforts completed by the OPW in the wider environment.

5. It is entirely as possible that the quarry's continued excavation provides some flood attenuation and relief. However, the real relief has been provided by two 'turlough buster' devices at the northern and southern road boundaries on the R339. The Flood Relief at Claregalway in 2011 also provides Flood Relief.

6. The quarry has a Section 4 Discharge Licence in which all waters arising are permitted to be discharged back to the groundwater environment in a controlled way. The Emission Limit Value for Discharge is controlled. There is no risk posed by the operation of the quarry.

7. OPW commissioned an assessment by Ryan Hanley, and this was reported in 2010. Since then, the evidence is clear that the OPW have installed drainage constructions on the road between Greaney Glass and Greaney Gutters on the R339.

    a. Google Earth Pro images suggest that these were installed between March and June 2018.

    b. Given the 2018 date of installation, it follows then that THOSE 2018 installations (drains) were not what prevented flooding in Coshla during the national experience of flood in the 2015/2016 events.

    c. ON a Regional Scale, relief was provided by the Claregalway Flood Relief Scheme alterations to regional drainage in 2011 (See photographic image at end of this note). Therefore, the 2011 Claregalway works are likely to have allowed rainfall to get away easier from soils and subsoils and similar to many other wares to the east of Claregalway, there was no flood at Coshla. The 2018 installations at Coshla R339 in combination with the Claregalway Flood Relief Scheme, now provide future resilience.

8. The capacity of the road side drainage systems is not the issue either, going forward, the issue in Flood Relief is always the Downstream Defender or Constraint – and this has been sorted in Claregalway.

1. Google Street view 2022

Google Earth images in the vicinity of the "Turlough Busters"

2. 2017 no construction evidence

3. March 2018 – no evidence of Road side drains

4. June 2018 = evidence of the drains

RECEIVED: 04/03/2025

5. Google Street view July 2018 = works recently completed.

Info from Senior Hydrological Engineer Ryan Hanley 2010 Coshla Study

From: Ryan Hanley
To: Pamela Bartley <pamela@hydro-g.com>
Subject: RE: Coshla Flood Relief

Pamela,

Following the 2009 flood which caused extensive flooding at Claregalway and east of the town and flooding of houses at Lisheenavala, we designed a managed a flood relief scheme at Claregalway which involved the construction of a 12 metre wide flood eye at Claregalway Bridge by the OPW (see attached photo) which has since prevented further flooding of the town and areas to the east of the town.

Michael Joyce

Photo from M Joyce Claregalway Flood Eye (2011) installation = has provided Flood Relief for the entire east Galway area and relief at Coshla.

Appendix 8.10 K Test Site Investigation Information & Summary of Understanding

APPENDIX: BEDROCK PERMEABILITY TESTING

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1 STATEMENT OF EXPERTISE

This Technical Advice Note is based on field work and analyses completed by Dr. Colin O'Reilly and his team of hydrologists and hydrogeologists at Envirologic.

Dr. Colin O'Reilly has a doctorate degree in soil's systems and hydrology. He has over 20 years of professional and field-based experience as a hydrogeologist coupled with a doctorate degree in hydrology, awarded by the Centre for Water Resources Research, School of Architecture, Landscape and Civil Engineering, UCD, while a recipient of a Teagasc Walsh Fellowship.

Envirologic is a leading environmental consulting firm dedicated to providing innovative and sustainable solutions to complex environmental challenges. It has key competencies in hydrogeology (groundwater) and hydrology (surface water). Expertise is delivered to a varied customer base in both private and public sectors. The practice offers a wide range of solutions to meet client specific needs and to satisfy environmental and planning legislation. Envirologic prides itself on using the most up to date hardware and software to achieve practical solutions, with the commercial presentation of the business centred around a sound scientific knowledge of hydrogeology and hydrology. The practice is dedicated to delivering a high quality service in a cost-effective and time-efficient manner to its clients. Details of projects completed can be found at https://www.envirologic.ie/projects.

2 INTRODUCTION

There are no existing site-specific permeability data for bedrock formations underlying the application site at Coshla Quarries Ltd., Barrettspark, Athenry, Co. Galway. Aquifer testing was therefore carried out with the aim of:

i. Establishing the hydraulic properties of the key geological formation in terms of transmissivity, specific capacity, Hydraulic Conductivity and storage coefficient; along with

ii. Informing the conceptual understanding of the groundwater regime at the site.

The tests completed included:

1. Constant rate pumping test = The constant discharge test is used to determine hydraulic properties of the well, and to investigate the potential for drawdown in nearby wells. Transmissivity is the rate water is transmitted through an aquifer in terms of a unit width and a unit hydraulic gradient. It equals the aquifer's Hydraulic Conductivity (permeability) multiplied by the aquifer thickness. The higher the transmissivity, the more prolific the aquifer is considered.

2. Recovery test = Analysis of groundwater levels following completion of test pumping phase can facilitate the application of formulae without any potential interference from the pump and the act of pumping to further characterise the groundwater body.

3 METHODOLOGY

A series of small-scale pumping tests were performed at Coshla Quarries Ltd. on the 27th and 28th of November 2024 to estimate the permeability of the underlying geology encountered across the site. Monitoring wells tested were MWA, MWB and MWC. Borehole diameter was c. 150 mm with the inner HDPE casing have a diameter of 50 mm.

A Grundfos MP1 submersible pump was temporarily installed, generally pumping at a rate of 9 l/min (13.0 m^3/d) with flowrates being measured manually at intermittent intervals. Pumping continued until the groundwater level in each well reached the pump inlet. Groundwater levels were recorded with an automatic pressure transducer type groundwater level logger at 15 second intervals during the pumping phase and for approximately 24 hours following cessation of pumping.

General information for the installed wells is included in Table 1, with well locations illustrated in Figure 1.

Table 1 – Survey information for each monitoring well

Well ID	Easting (m)	Northing (m)	Ground Elevation (mOD)	Top of Outer Casing (mOD)	Top of Inner Casing (mOD)	Well Depth, mbgl	Base Elevation of Well (mOD)
MWA	542,987	728,617	25.34	26.02	25.98	52.6	-27.26
MWB	542,621	728,629	22.22	22.65	22.57	49.1	-26.88
MWC	542,685	728,390	21.16	21.51	21.42	48.7	-27.54

Figure 1 – Monitoring Well Locations tested: MWA, MWB, MWC

Summary information regarding pumping durations and pumping rates are stated in Table 2.

Table 2 – Summary pumping test input data

Well ID	Pre-pumping GW Level (mbtoc inner)	Pumping Rate (m^3/s)	Pumping Duration (mins)	Saturated Aquifer Thickness (m)
MWA	38.17	0.00015	10	14.44
MWB	20.33	0.00015	13.75	28.74
MWC	21.00	0.00015	5.75	27.70

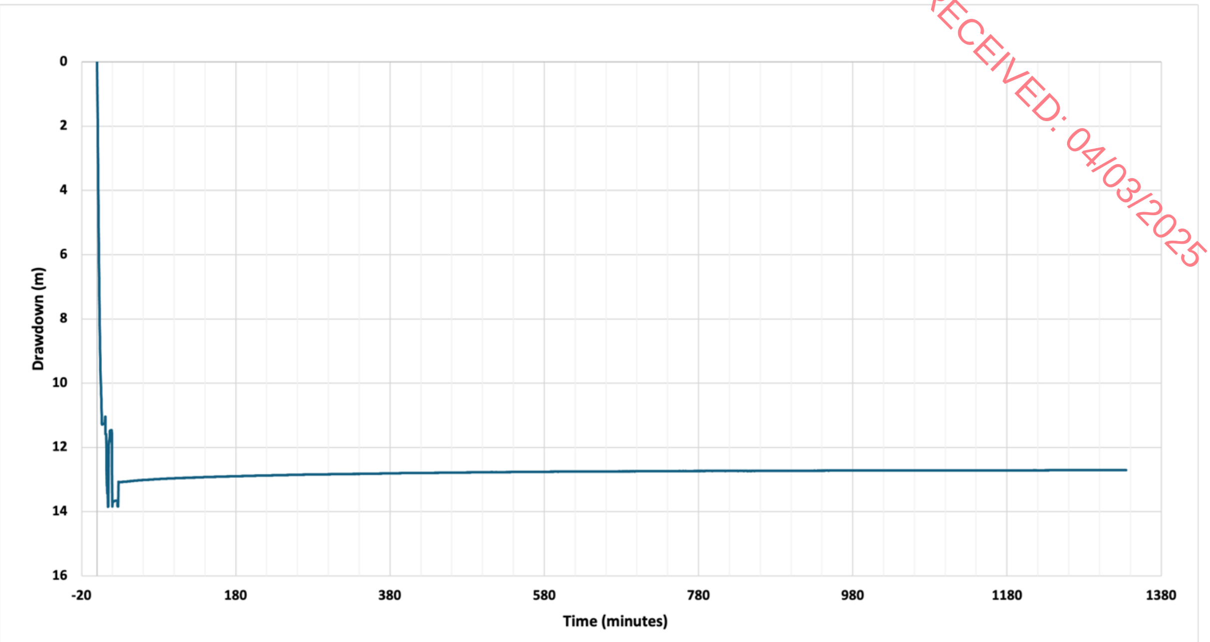
Upon completion of field work, results were analysed in the office.

4 PERMEABILITY TESTING ANALYSIS

4.1 MWA

Drawdown invoked during the pumping and recovery phase at MWA is shown in Graph 1. The data shows that following cessation of pumping and removal of pump there was negligible drawdown for the 19 hours monitored thereafter.

Graph 1 – Small-scale pumping test drawdown and recovery over time at MWA

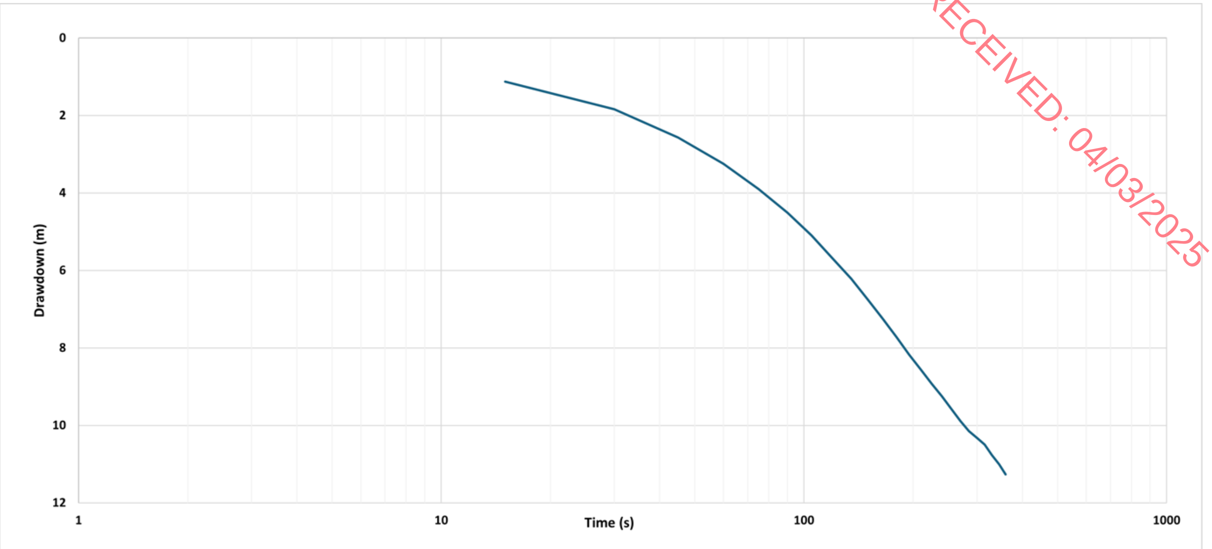


4.1.1 Pumping Phase

Drawdown of 11.25 m was reached over a pumping period of 10 minutes and steady-state drawdown conditions were not reached by the time water level had reached the pump inlet. The volume of water in the HDPE casing (50 mm) prior to start of test was 28 l. Approximately 90 l was removed by pumping, with the difference attributed to water stored in the gravel pack between the inner and outer casing. These figures, along with the straight-line nature of drawdown over such a short timeframe suggests that the borehole was merely dewatered by pumping and that there was negligible recharge to the well during this phase. This would initially suggest very low permeability values.

Drawdown was plotted against time on a log scale (Graph 2) which shows drawdown over one log cycle to be 9.03 m.

Graph 2 – MWA small-scale pumping test drawdown plotted against time on a log scale



Transmissivity can be calculated using the Cooper Jacob Method (Cooper & Jacob, 1946):

$$T = (2.30\,Q) / (4\,\pi\,\Delta s)$$

where: Q = discharge = 0.00015 m^3/s

Δs = drawdown over one log cycle = x – y (30 - 300 secs) = 9.03 m

$$T = \frac{2.3 \times 0.00015}{4 \times \pi\,(9.03)}$$

$$T = 0.00000304\ m^2/s$$

$$T = 0.263\ m^2/d$$

The saturated thickness for the screen section of well MWA was 14.44 m at the start of testing, resulting in a Hydraulic Conductivity value for the pumping phase of:

$$K = T / \text{Saturated Thickness}$$

$$= 0.263\ m^2/d / 14.44\ m$$

$$K = 0.0182\ m/d$$

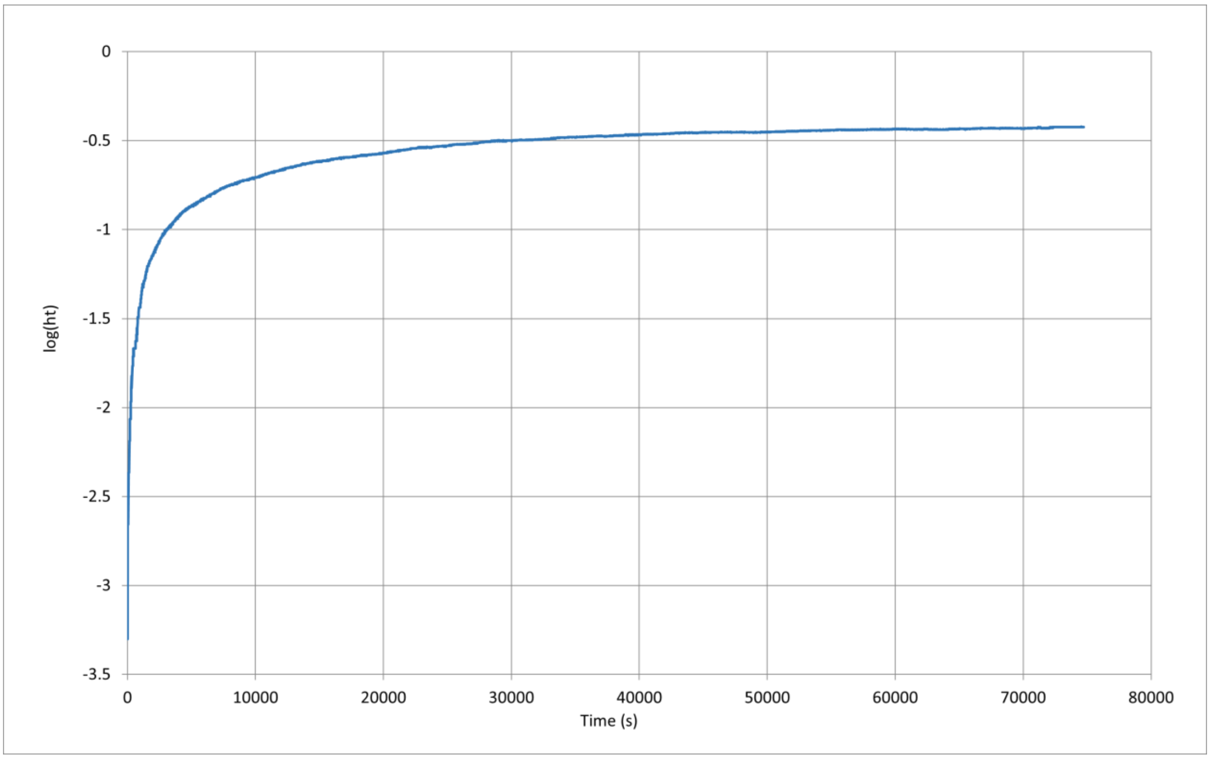
$$K = 2.11 \times 10^{-7}\ m/s$$

4.1.2 Recovery Phase

Groundwater level recovery at MWA was monitored following the end of the constant rate test. The response of residual drawdown did not recover to pre-test levels over the 20 hours for which it was monitored.

Given the slug-like nature of water removal during pumping the Bouwer-Rice Method was considered to be the most suitable approach to estimate aquifer properties. This procedure involves calculating the difference in water level after cessation of the pumping phase for a fixed time step (i.e. 15 seconds). The log of the change in drawdown (ht) is plotted against time (s) and a tangent is fitted to the curve. Using the slope of this tangent along with variables such as well depth, well radius, screen depth and distance from the base of the well to the screened section, a Hydraulic Conductivity value is calculated. The recovery curve is shown in Graph 3**Error! Reference source not found.**.

Graph 3 – MWA small-scale pumping test recovery log(ht) plotted against time



Bouwer-Rice analysis yielded the following Hydraulic Conductivity value:

$$K = \left(\frac{(r_c^2)(\ln(\frac{Re}{rw}))}{2Le}\right)\left(\frac{1}{t}\right)\ln\left(\frac{Y_0}{Y_t}\right)$$

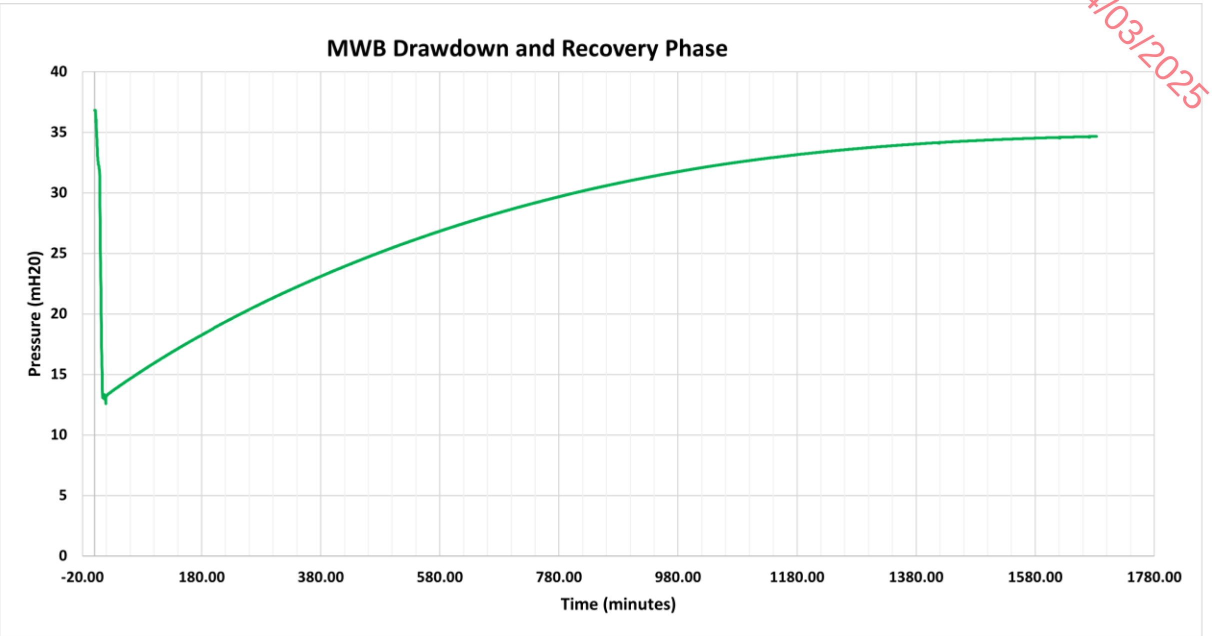
K = 0.00229 m/d

K = 2.65 x 10^{-8} m/s

4.2 MWB

Drawdown invoked during the pumping and recovery phase is shown in Graph 4.

Graph 4 – MWB small-scale pumping test drawdown and recovery over time



4.2.1 Pumping Phase

Drawdown of 23.76 m was observed over a pumping period of 13.75 minutes. As per MWA the removal of water from the well screen was rapid. Drawdown was plotted against time on a log scale which showed drawdown over one log cycle as being equivalent to 21.1 m (Graph 5).

Transmissivity can be calculated using the Cooper Jacob's Method (Cooper & Jacob, 1946):

$$T = (2.30\ Q) / (4\ \pi\ \Delta s)$$

where: Q = discharge = 0.00015 m^3/s

Δs = drawdown over one log cycle = x – y (75 - 750 secs) = 21.11 m

$$T = \frac{2.3 \times 0.00015}{4 \times \pi\ (21.11)}$$

$$T = 0.000001301\ m^2/s$$

$$T = 0.1123766\ m^2/d$$

Given the saturated thickness of well MWB was 28.74 m at the start of testing, the Hydraulic Conductivity value of the well arrived at for the pumping period is obtained from:

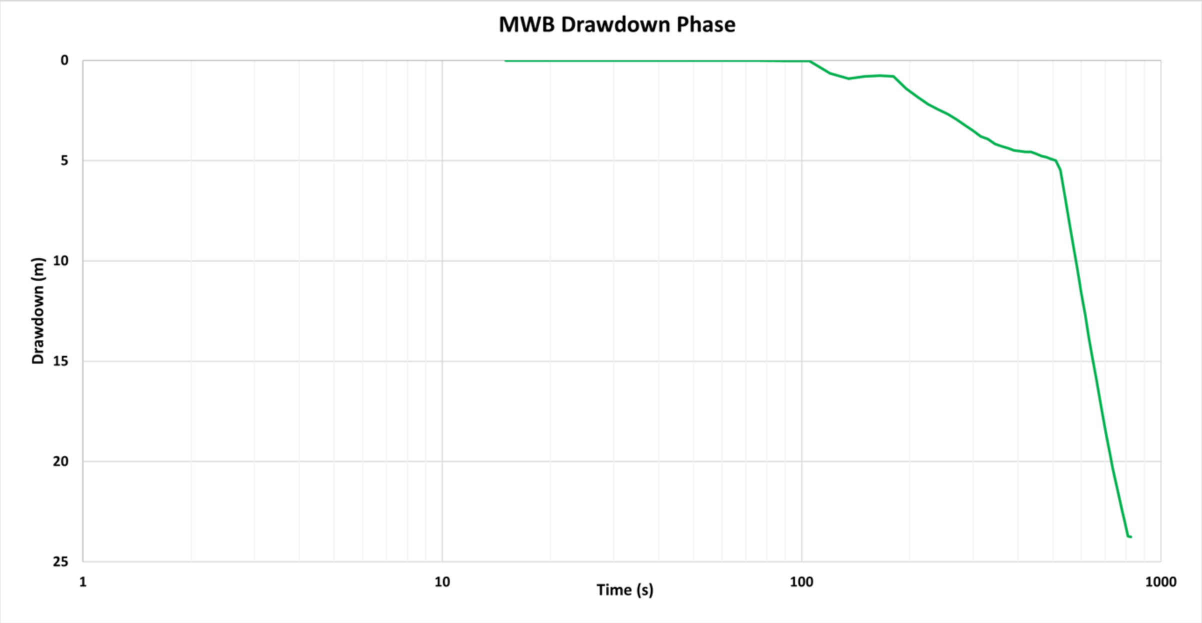
$$K = \frac{T\ (m^2/d)}{\text{Saturated Thickness (m)}}$$

$$= \frac{0.1123}{28.74}$$

$$K = 0.00391\ m/d$$

$$K = 4.53 \times 10^{-8}\ m/s$$

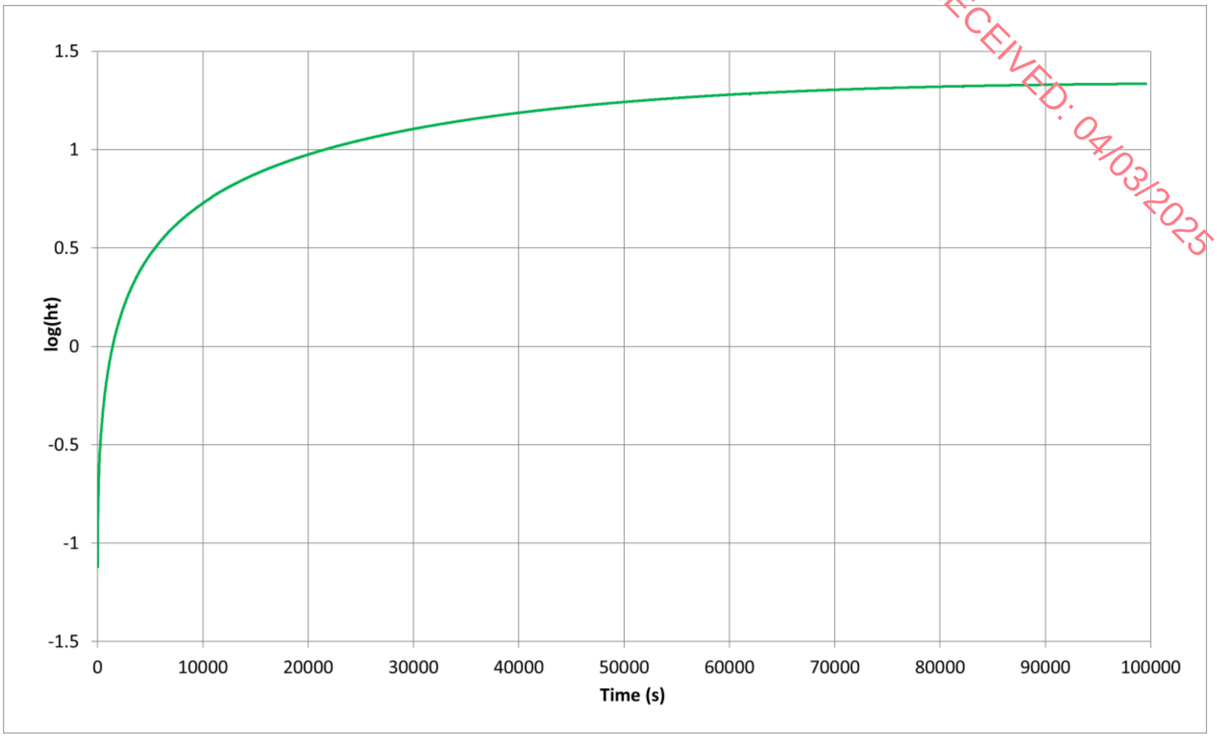
Graph 5 – MWB small-scale pumping test drawdown plotted against time on a log scale



4.2.2 Recovery Phase

Groundwater level recovery at MWB was monitored after the end of the constant rate test. The response of residual drawdown did not recover to pre-test levels over the 20 hours for which it was monitored. The recovery curve is shown in Graph 6**Error! Reference source not found.**. The Bouwer-Rice Method was used to estimate aquifer properties.

Graph 6 – MWB small-scale pumping test recovery log(ht) plotted against time



Permeability analysis was performed on water levels recorded during the recovery period using the Bouwer-Rice method:

$$K = \left(\frac{(r_c^2)(\ln(\frac{Re}{rw}))}{2Le}\right)\left(\frac{1}{t}\right)\ln\left(\frac{Y_0}{Y_t}\right)$$

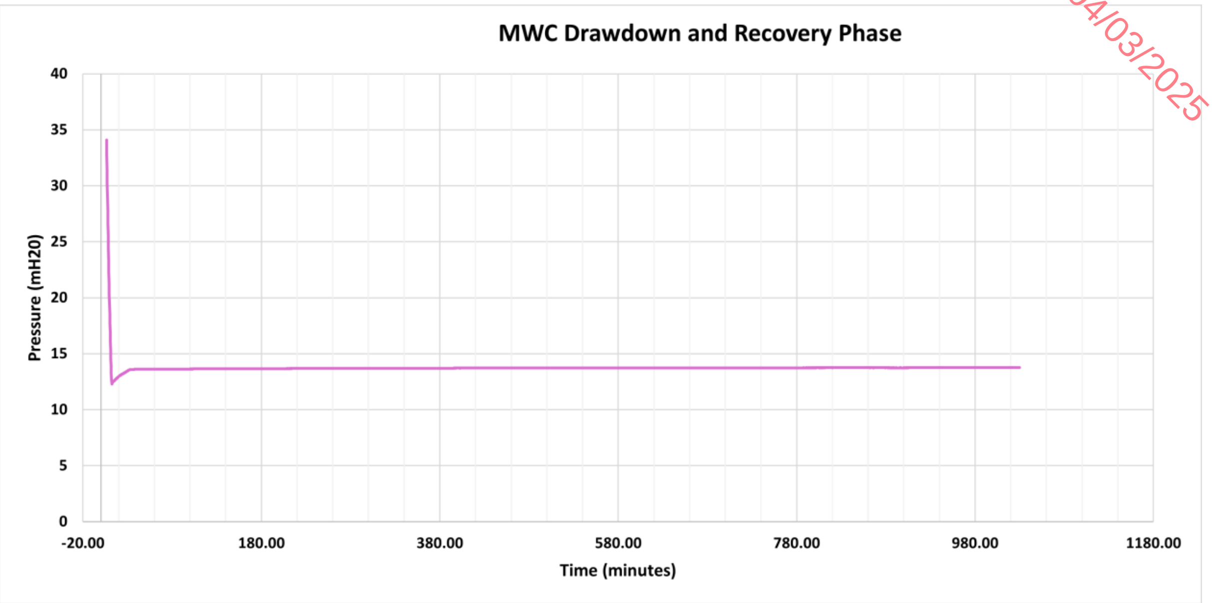
K = 0.000762 m/d

K = 8.82 x 10^{-9} m/s

4.3 MWC

Drawdown invoked during the pumping and recovery phase is shown in Graph 7.

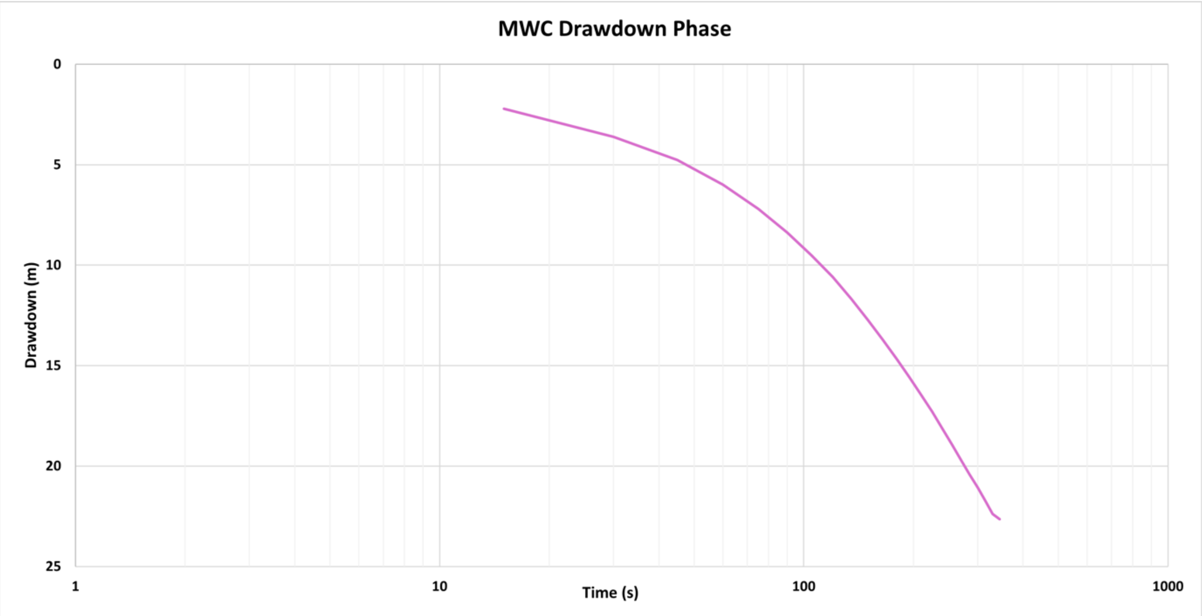
Graph 7 – MWC small-scale pumping test drawdown and recovery over time



4.3.1 Pumping Phase

Drawdown of 22.64 m was reached over a pumping period of 5.75 minutes. Drawdown was plotted against time on a log scale which showed drawdown over one log cycle as being equivalent to 17.44 m (Graph 8).

Graph 8 – MWC small-scale pumping test drawdown plotted against time on a log scale



Transmissivity was initially calculated using the Cooper Jacob's Method (Cooper & Jacob, 1946):

$$T = (2.30\ Q) / (4\ \pi\ \Delta s)$$

where: Q = discharge = 0.00015 m^3/s

Δs = drawdown over one log cycle = x – y (30 - 300 secs) = 17.44 m

$$T = \frac{2.3 \times 0.00015}{4 \times \pi\ (17.44)}$$

$$T = 0.000001574\ m^2/s$$

$$T = 0.135953304\ m^2/d$$

Considering the saturated thickness for the screen section of well MWC was 27.70 m at the time of testing, the Hydraulic Conductivity value of the well arrived at for the pumping period is;

$$K = \frac{T\ (m^2/d)}{\text{Saturated Thickness (m)}}$$

$$= \frac{0.1359}{27.70}$$

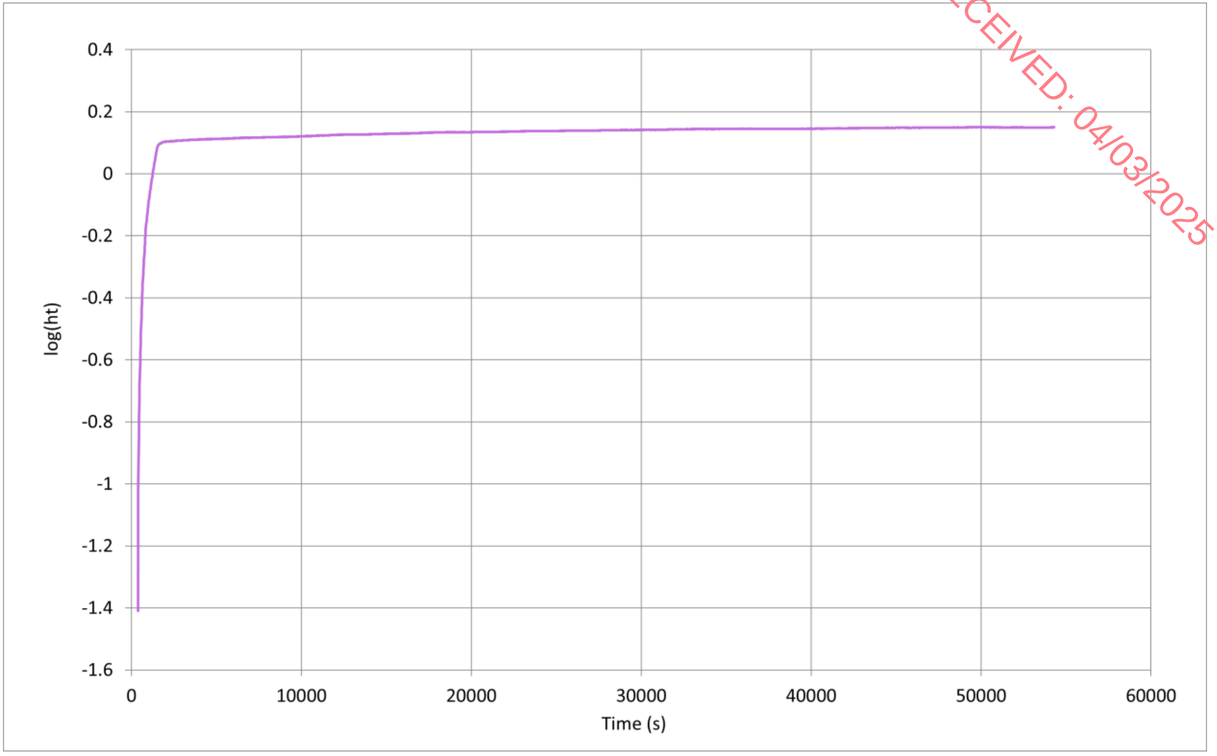
$$K = 0.00491\ m/d$$

$$K = 5.68 \times 10^{-8}\ m/s$$

4.3.2 Recovery Phase

Groundwater level recovery at MWC was monitored at the end of the constant rate test. The response of residual drawdown did not recover to pre-test levels over the 15 hours for which it was monitored. The Bouwer-Rice Method was used to estimate aquifer properties. This procedure involved calculating the difference in water level from the cessation of the pumping phase for a fixed time step (15s). The log of the change in water level (ht) is plotted against time (s) and a tangent is fitted to the curve. Then, using the slope of this tangent along with variables such as well depth, well radius, screen depth and distance from the base of the well to the screened section, a Hydraulic Conductivity value is calculated. The recovery curve is shown in Graph 9.

Graph 9 - MWC small-scale pumping test recovery plotted against time on a log scale



Permeability was calculated by application of the Bouwer Rice method to drawdown levels recorded during the recovery period.

$$K = \left(\frac{(r_{c^2})(\ln(\frac{Re}{rw}))}{2Le}\right)\left(\frac{1}{t}\right)\ln\left(\frac{Y_0}{Y_t}\right)$$

K = 0.000046 m/d

K = 5.28 x 10^{-10} m/s

4.4 SUMMARY

The results from permeability testing at Coshla Quarry are summarised below in Table 3.

Table 3 – Summary bedrock permeability data

Well ID	Test Phase	Bedrock K, m/s	Average Bedrock K using Recovery data
MWA	Pumping	2.1×10^{-7}	1.2×10^{-8} m/s
	Recovery	2.7×10^{-8}	
MWB	Pumping	4.5×10^{-8}	
	Recovery	8.8×10^{-9}	
MWC	Pumping	5.7×10^{-8}	
	Recovery	5.3×10^{-10}	

Analysis of the pumping phase data using the Cooper-Jacob approach may not be entirely reliable as all criteria are not satisfied (e.g. achievement of steady-state pumping conditions).

The Bouwer-Rice analysis method is considered to be more appropriate and taking an average of the recovery phase results at each monitoring well yields a Hydraulic Conductivity value of 1.2×10^{-8} m/s.

An analysis of longer term recovery data, for example over a month period, would likely result in even lower bedrock permeability value, more likely towards that obtained at MWC.

Overall, the limestone bedrock is, as described in the BH Logs of 2009, 2019 and 2024, a solid mass of limestone with extremely low permeability ranging from 10^{-8} to 10^{-10} m/s.

4.5 RESULT'S SIGNIFICANCE

In terms of practical water management at quarries bedrock Hydraulic Conductivity values of the order of 10^{-8} to 10^{-10} m/s can essentially be regarded as impermeable and groundwater inflows to the void are likely to be negligible.

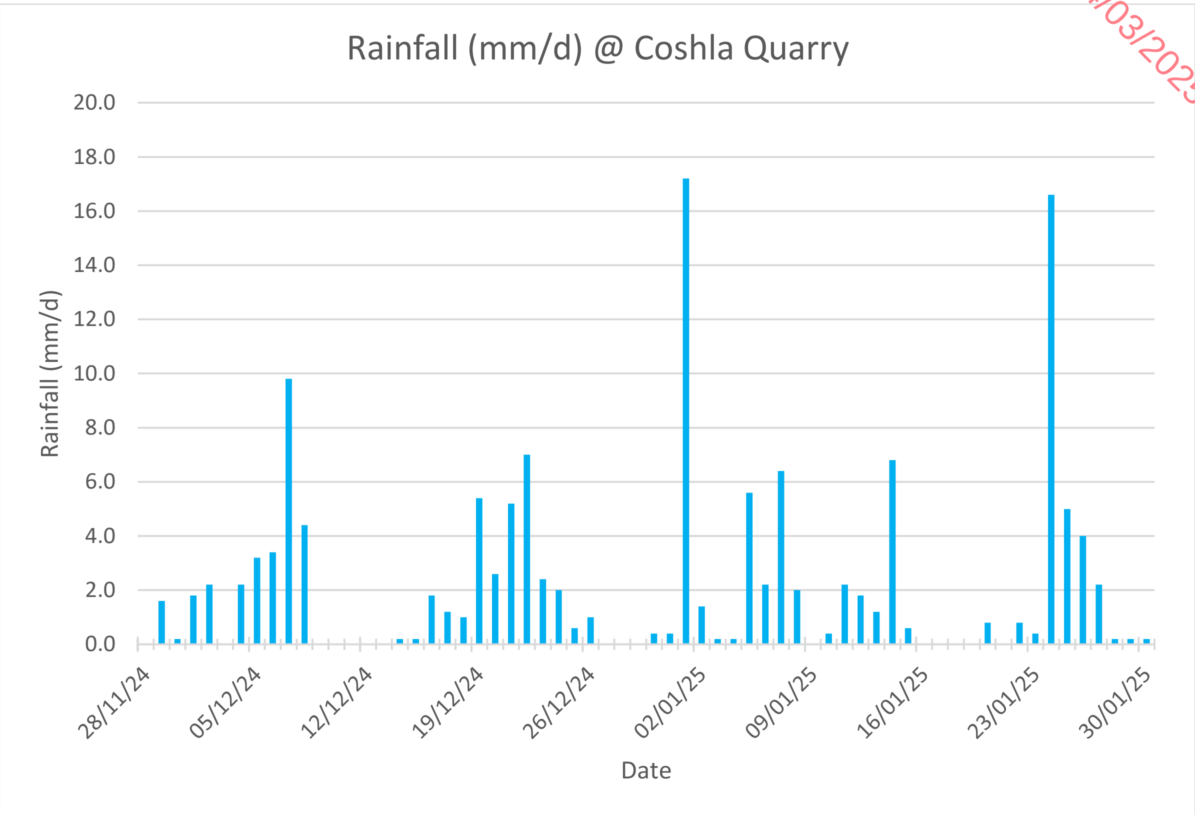
Hydraulic Conductivity values of the order of 10^{-8} to 10^{-10} m/s are the values specified for Clay liners under earth lined slurry tanks, or Integrated Constructed Wetlands designed to accommodate wastewater, because such low values mean that they are essentially impenetrable and safeguard the receiving environment.

The results are evidence that there are no groundwater transmission conduits in the depth range from ground level of 21 to 25m OD at the locations tested on the quarry to the bore depth elevation of -26m OD.

Appendix 8.11 Long Term Monitoring Data

Rain

- A site specific Rain Gauge was installed at the site. The information will be used to relate the metered discharge at the site. Data are presented here.



Water Quality

- Table 8.12 (A) = Groundwater Quality & Groundwater Levels
- Table 8.12 (B) = Discharge Quality
- NOTE: All Certificates of Analysis for 2024 are presented with this Appendix. Certificates for 2023 and 2022 are on file at the Site's Office and Hydro-G's office.
- Historic Water Quality Tables are also on file in the EIAR 2020.

Discharge

- Table 8.12 (C) = Discharge Data

Figure 8.11.1 Wells at the Site.

BH1 to BH4 are the Quarterly Monitoring BHs. Results are presented over.

Table 8.12 (A) **Groundwater:** Boreholes Water Quality

Coshla Groundwater Boreholes		21/03/2024	30/05/2024	26/09/2024	07/11/2024
Test	**Units**	**BH1**	**BH1**	**BH1**	**BH1**
Water Level	mTOC	21.70	32.20	29.75	20.57
pH - Field	pH Units	7.53	7.46	7.27	7.22
Conductivity (25°C) - Field	µS/cm	786	708	741	718
Total Suspended Solids	mg/L	13	<10	<10	10
Nitrite (as NO_2)	mg/L	<0.05	0.062	<0.05	<0.05
		21/03/2024	30/05/2024	26/09/2024	07/11/2024
Test	**Units**	**BH2**	**BH2**	**BH2**	**BH2**
Water Level	mTOC	17.56	26.49	27.35	25.64
pH - Field	pH Units	7.57	7.20	7.56	7.47
Conductivity (25°C) - Field	µS/cm	570	569	592	589
Total Suspended Solids	mg/L	<10	<10	<10	<10
Nitrite (as NO_2)	mg/L	<0.05	<0.05	<0.05	<0.05
		21/03/2024	30/05/2024	26/09/2024	07/11/2024
Test	**Units**	**BH3**	**BH3**	**BH3**	**BH3**
Water Level	mTOC	5.36	7.76	11.34	7.99
pH - Field	pH Units	7.38	7.27	7.21	7.11
Conductivity (25°C) - Field	µS/cm	544	643	751	733
Total Suspended Solids	mg/L	<10	<10	10	13
Nitrite (as NO_2)	mg/L	<0.05	<0.05	0.1	<0.05
		21/03/2024	30/05/2024	26/09/2024	07/11/2024
Test	**Units**	**BH4**	**BH4**	**BH4**	**BH4**
Water Level	mTOC	8.88	13.06	14.34	13.07
pH - Field	pH Units	7.34	7.41	7.45	7.61
Conductivity (25°C) - Field	µS/cm	575	589	729	656
Total Suspended Solids	mg/L	<10	<10	<10	<10
Nitrite (as NO_2)	mg/L	<0.05	<0.05	<0.05	<0.05

Table 8.12 (B) **DISCHARGE QUALITY**

ELVs Section 4 licence (W/469/13)		ELVs	21/03/2024	30/05/2024	26/09/2024	07/11/2024	Comment
Suspended Solids	mg/l	35	72	<10	<10	<10	<LOD on all but one occasion
BOD	mg/l	5	0.2	0.1	0.30	0.40	An order of magnitude lower on all ocacasions
COD	mg/l	100	<15	<15	<15	<15	< LOD on all occasions
NO3	mg/l	50	11	11	13	6.3	very low baseline Nitrates
Total Hydrocarbons	mg/l	1	<0.01	<0.01		<0.01	two orders of magnitude <ELV, always <LOD
Temperature	oC	20	9.6	15.8	11.6	12.8	acceptable range
pH	pH	6 to 9	7.76	7.55	7.96	7.85	acceptable range
Petrol Range Organics (>C_6-C_{10})	mg/L		<0.0001	<0.0001		<0.0001	neither diesel nor petrol ever detected.
Diesel Range Organics (>C_{10}-C_{21})	mg/L		<0.0001	<0.0001		<0.0001	

Table 8.12 (C) Discharge Data

	Days	Reading in Cubic Metres	Difference m3	m3 per day for this period
18-Dec-18	0	153		
08-Jan-19	28	5085	4932	235
11-Mar-19	62	15516	10431	168
15-Jan-20	310	59148	43632	141
17-Aug-20	215	74917	15769	73
29-Nov-22	834	133601	58684	70
30-Nov-22	1	133882	281	281
01-Dec-22	1	134168	286	286
09-Dec-22	8	136292	2124	266
12-Dec-22	3	137051	759	253
10-Jun-24	546	176190	39139	72
26-Jun-24	16	177284	1094	68
03-Jul-24	7	177725	441	63
10-Jul-24	7	178069	344	49
17-Jul-24	7	178433	364	52
24-Jul-24	7	178960	527	75
07-Aug-24	14	179984	1024	73
18-Sept-24	42	184864	4880	116
25-Sept-24	7	185240	376	54
02-Oct-24	7	185248	8	1
24-Oct-24	22	186083	835	38
30-Oct-24	6	187575	1492	249
26-Nov-24	27	190838	3263	121
09-Jan-25	44	200814	9976	227

132	Average (m3/d)
286	Maximum (m3/d)
1	MINIMUM (m3/d)

TEST REPORT NO: 282070 .1

Client: Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

BHP Ref. No: 24/03/4800
Quote Ref: QC008778
Order No: N/A
Sales Order: 209604
Date Received: 21/03/2024
Date Sampled: 21/03/2024
Date Completed: 02/04/2024
Sample Type: Bore

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.005T

Testing
Analysing
Consulting

BHP

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 1

Test		Units	Results	Customer Limits	Date Analysed	Method
Water Level		mTOC	21.70	Not Given	21/03/2024	On-Site Meter
pH - Field		pH Units	7.53	Not Given	21/03/2024	BHP AC 067
Conductivity (25°C) - Field		µS/cm	786	50	21/03/2024	BHP AC 067
Total Suspended Solids		mg/L	13	Not Given	26/03/2024	BHP AC 012
Nitrite (as NO_2)	Acc.	mg/L	<0.05	Not Given	21/03/2024	BHP AC 019
B.O.D.	Acc.	mg/L	0.5	0.1	28/03/2024	BHP AC 005

Authorised by: Dervla Purcell, Laboratory Manager
Date Authorised: 02/04/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 282070 .2

Client: Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

Testing
Analysing
Consulting

BHP Ref. No: 24/03/4801
Quote Ref: QC008778
Order No: N/A
Sales Order: 209604
Date Received: 21/03/2024
Date Sampled: 21/03/2024
Date Completed: 02/04/2024
Sample Type: Bore

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 2

Test		Units	Results	Customer Limits	Date Analysed	Method
Water Level		mTOC	17.56	Not Given	21/03/2024	On-Site Meter
pH - Field		pH Units	7.57	Not Given	21/03/2024	BHP AC 067
Conductivity (25°C) - Field		µS/cm	570	50	21/03/2024	BHP AC 067
Total Suspended Solids		mg/L	<10	Not Given	26/03/2024	BHP AC 012
Nitrite (as NO_2)	Acc.	mg/L	<0.05	Not Given	21/03/2024	BHP AC 019
B.O.D.	Acc.	mg/L	0.5	0.1	28/03/2024	BHP AC 005

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 02/04/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 282070 .3

Testing
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BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

Client: Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

BHP Ref. No: 24/03/4802
Quote Ref: QC008778
Order No: N/A
Sales Order: 209604
Date Received: 21/03/2024
Date Sampled: 21/03/2024
Date Completed: 02/04/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 3

Test		Units	Results	Customer Limits	Date Analysed	Method
Water Level		mTOC	5.36	Not Given	21/03/2024	On-Site Meter
pH - Field		pH Units	7.38	Not Given	21/03/2024	BHP AC 067
Conductivity (25°C) - Field		µS/cm	544	50	21/03/2024	BHP AC 067
Total Suspended Solids		mg/L	<10	Not Given	26/03/2024	BHP AC 012
Nitrite (as NO_2)	Acc.	mg/L	<0.05	Not Given	21/03/2024	BHP AC 019
B.O.D.	Acc.	mg/L	0.2	0.1	28/03/2024	BHP AC 005

Authorised by: Dervla Purcell, Laboratory Manager
Date Authorised: 02/04/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

TEST REPORT NO: 282070 .4

Client: Coshla Quarries Ltd
Cashla
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Co. Galway

BHP Ref. No:	24/03/4803
Quote Ref:	QC008778
Order No:	N/A
Sales Order:	209604
Date Received:	21/03/2024
Date Sampled:	21/03/2024
Date Completed:	02/04/2024
Sample Type:	Bore

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Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 4

Test		Units	Results	Customer Limits	Date Analysed	Method
Water Level		mTOC	8.88	Not Given	21/03/2024	On-Site Meter
pH - Field		pH Units	7.34	Not Given	21/03/2024	BHP AC 067
Conductivity (25°C) - Field		µS/cm	575	50	21/03/2024	BHP AC 067
Total Suspended Solids		mg/L	<10	Not Given	26/03/2024	BHP AC 012
Nitrite (as NO_2)	Acc.	mg/L	<0.05	Not Given	21/03/2024	BHP AC 019
B.O.D.	Acc.	mg/L	0.2	0.1	28/03/2024	BHP AC 005

Authorised by: Dervla Purcell
Laboratory Manager
Date Authorised: 02/04/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

TEST REPORT NO: 287024 .1

Client: Coshla Quarries Ltd
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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.005T

BHP Ref. No: 24/05/7286
Quote Ref: QC008778
Order No: N/A
Sales Order: 216050
Date Received: 30/05/2024
Date Sampled: 30/05/2024
Date Completed: 31/05/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 1

Test		Units	Results	Customer Limits	Date Analysed	Method
Water Level		mTOC	32.20	Not Given	30/05/2024	On-Site Meter
pH - Field		pH Units	7.46	Not Given	30/05/2024	BHP AC 067
Conductivity (25°C) - Field		µS/cm	708	Not Given	30/05/2024	BHP AC 067
Total Suspended Solids		mg/L	<10	Not Given	31/05/2024	BHP AC 012
Nitrite (as NO_2)	Acc.	mg/L	0.062	Not Given	30/05/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager **Date Authorised:** 04/06/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 287024 .2

Client: Coshla Quarries Ltd
Cashla
Athenry
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BHP Ref. No:	24/05/7287
Quote Ref:	QC008778
Order No:	N/A
Sales Order:	216050
Date Received:	30/05/2024
Date Sampled:	30/05/2024
Date Completed:	31/05/2024
Sample Type:	Bore

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.005T

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EMail:dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 2

Test		Units	Results	Customer Limits	Date Analysed	Method
Water Level		mTOC	26.49	Not Given	30/05/2024	On-Site Meter
pH - Field		pH Units	7.20	Not Given	30/05/2024	BHP AC 067
Conductivity (25°C) - Field		µS/cm	569	Not Given	30/05/2024	BHP AC 067
Total Suspended Solids		mg/L	<10	Not Given	31/05/2024	BHP AC 012
Nitrite (as NO_2)	Acc.	mg/L	<0.05	Not Given	30/05/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager **Date Authorised:** 04/06/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 287024 .3

Client: Coshla Quarries Ltd
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RECEIVED: 04/03/2025

BHP Ref. No:	24/05/7288
Quote Ref:	QC008778
Order No:	N/A
Sales Order:	216050
Date Received:	30/05/2024
Date Sampled:	30/05/2024
Date Completed:	31/05/2024
Sample Type:	Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 3

Test		Units	Results	Customer Limits	Date Analysed	Method
Water Level		mTOC	7.76	Not Given	30/05/2024	On-Site Meter
pH - Field		pH Units	7.27	Not Given	30/05/2024	BHP AC 067
Conductivity (25°C) - Field		µS/cm	643	Not Given	30/05/2024	BHP AC 067
Total Suspended Solids		mg/L	<10	Not Given	31/05/2024	BHP AC 012
Nitrite (as NO_2)	Acc.	mg/L	<0.05	Not Given	30/05/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager

Date Authorised: 04/06/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

TEST REPORT NO: 287024 .4

Client: Coshla Quarries Ltd
Cashla
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BHP Ref. No: 24/05/7289
Quote Ref: QC008778
Order No: N/A
Sales Order: 216050
Date Received: 30/05/2024
Date Sampled: 30/05/2024
Date Completed: 31/05/2024
Sample Type: Bore

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EMail:dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Bore
Client Ref: Borehole 4

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	13.06	Not Given	30/05/2024	On-Site Meter
pH - Field	pH Units	7.41	Not Given	30/05/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	589	Not Given	30/05/2024	BHP AC 067
Total Suspended Solids	mg/L	<10	Not Given	31/05/2024	BHP AC 012
Nitrite (as NO_2) Acc.	mg/L	<0.05	Not Given	30/05/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager
Date Authorised: 04/06/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 297523 .1

Client: Coshla Quarries Ltd
Cashla
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EMail: dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

BHP Ref. No: 24/09/6866
Quote Ref: QC008778
Order No: N/A
Sales Order: 230093
Date Received: 26/09/2024
Date Sampled: 26/09/2024
Date Completed: 27/09/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 1

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	29.75		26/09/2024	On-Site Meter
pH - Field	pH Units	7.27	Not Given	26/09/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	741	Not Given	26/09/2024	BHP AC 067
Total Suspended Solids	mg/L	<10	Not Given	27/09/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	<0.05	Not Given	26/09/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager
Date Authorised: 01/10/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~: Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 297523 .2

Client: Coshla Quarries Ltd

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EMail: dervlapurcell@bhp.ie

RECEIVED: 04/02/2025

BHP Ref. No: 24/09/6867
Quote Ref: QC008778
Order No: N/A
Sales Order: 230093
Date Received: 26/09/2024
Date Sampled: 26/09/2024
Date Completed: 27/09/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 2

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	27.35		26/09/2024	On-Site Meter
pH - Field	pH Units	7.56	Not Given	26/09/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	592	Not Given	26/09/2024	BHP AC 067
Total Suspended Solids	mg/L	<10	Not Given	27/09/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	<0.05	Not Given	26/09/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager **Date Authorised:** 01/10/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE

TEST REPORT NO: 297523 .3

Client: Coshla Quarries Ltd
Cashla
Athenry
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New Road
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Tel: +353 61 455399
EMail: dervlapurcell@bhp.ie

BHP Ref. No: 24/09/6868
Quote Ref: QC008778
Order No: N/A
Sales Order: 230093
Date Received: 26/09/2024
Date Sampled: 26/09/2024
Date Completed: 27/09/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 3

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	11.34		26/09/2024	On-Site Meter
pH - Field	pH Units	7.21	Not Given	26/09/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	751	Not Given	26/09/2024	BHP AC 067
Total Suspended Solids	mg/L	10	Not Given	27/09/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	0.10	Not Given	26/09/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager   **Date Authorised:** 01/10/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 297523 .4

Client: Coshla Quarries Ltd

Cashla
Athenry
Co. Galway

BHP Ref. No: 24/09/6869
Quote Ref: QC008778
Order No: N/A
Sales Order: 230093
Date Received: 26/09/2024
Date Sampled: 26/09/2024
Date Completed: 27/09/2024
Sample Type: Bore

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EMail: dervlapurcell@bhp.ie

RECEIVED: 04/02/2025

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 4

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	14.34		26/09/2024	On-Site Meter
pH - Field	pH Units	7.45	Not Given	26/09/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	729	Not Given	26/09/2024	BHP AC 067
Total Suspended Solids	mg/L	<10	Not Given	27/09/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	<0.05	Not Given	26/09/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager

Date Authorised: 01/10/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE

TEST REPORT NO: 300564 .1

Client: Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

BHP Ref. No:	24/11/1468
Quote Ref:	QC008778
Order No:	Not Required
Sales Order:	234243
Date Received:	07/11/2024
Date Sampled:	07/11/2024
Date Completed:	25/11/2024
Sample Type:	Bore

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Limerick
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EMail: dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 1

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	20.57		07/11/2024	On-Site Meter
pH - Field	pH Units	7.22	Not Given	07/11/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	718	Not Given	07/11/2024	BHP AC 067
Total Suspended Solids	mg/L	10	Not Given	11/11/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	<0.05	Not Given	25/11/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager
Date Authorised: 27/11/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE

TEST REPORT NO: 300564 .2

Client: Coshla Quarries Ltd

Cashla
Athenry
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BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail: dervlapurcell@bhp.ie

BHP Ref. No: 24/11/1469
Quote Ref: QC008778
Order No: Not Required
Sales Order: 234243
Date Received: 07/11/2024
Date Sampled: 07/11/2024
Date Completed: 25/11/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 2

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	25.64		07/11/2024	On-Site Meter
pH - Field	pH Units	7.47	Not Given	07/11/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	589	Not Given	07/11/2024	BHP AC 067
Total Suspended Solids	mg/L	<10	Not Given	11/11/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	<0.05	Not Given	25/11/2024	BHP AC 019

Authorised by: **Dervla Purcell** **Laboratory Manager** **Date Authorised:** 27/11/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE

TEST REPORT NO: 300564 .3

Client: Coshla Quarries Ltd

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New Road
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Tel: +353 61 455399
EMail: dervlapurcell@bhp.ie

RECEIVED: 04/02/2025

BHP Ref. No: 24/11/1470
Quote Ref: QC008778
Order No: Not Required
Sales Order: 234243
Date Received: 07/11/2024
Date Sampled: 07/11/2024
Date Completed: 25/11/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 3

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	7.99		07/11/2024	On-Site Meter
pH - Field	pH Units	7.11	Not Given	07/11/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	733	Not Given	07/11/2024	BHP AC 067
Total Suspended Solids	mg/L	13	Not Given	11/11/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	<0.05	Not Given	25/11/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager **Date Authorised:** 27/11/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE

TEST REPORT NO: 300564 .4

Client: Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

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Tel: +353 61 455399
EMail: dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

BHP Ref. No: 24/11/1471
Quote Ref: QC008778
Order No: Not Required
Sales Order: 234243
Date Received: 07/11/2024
Date Sampled: 07/11/2024
Date Completed: 25/11/2024
Sample Type: Bore

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly_Bore
Client Ref: Borehole 4

Test	Units	Results	Customer Limits	Date Analysed	Method
Water Level	mTOC	13.07		07/11/2024	On-Site Meter
pH - Field	pH Units	7.61	Not Given	07/11/2024	BHP AC 067
Conductivity (25°C) - Field	µS/cm	656	Not Given	07/11/2024	BHP AC 067
Total Suspended Solids	mg/L	<10	Not Given	11/11/2024	BHP AC 012
Nitrite (as NO_2)	mg/L	<0.05	Not Given	25/11/2024	BHP AC 019

Authorised by: Dervla Purcell, Laboratory Manager — **Date Authorised:** 27/11/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE

TEST REPORT NO: 282070

Client: Coshla Quarries Ltd
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Co. Galway

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RECEIVED: 04/02/2025

BHP Ref. No:	24/03/4798
Quote Ref:	QC008778
Order No:	N/A
Sales Order:	209603
Date Received:	21/03/2024
Date Sampled:	21/03/2024
Date Completed:	02/04/2024
Sample Type:	Surface Water

FTAO: Martin Collins
Site: Coshla
BHP Ref: Bi-annually Surface Water
Client Ref: Quarry Discharge

Test		Units	Results	Customer Limits	Date Analysed	Method
B.O.D.	Acc.	mg/L	0.2	Not Given	28/03/2024	BHP AC 005
C.O.D.	Acc.	mg/L	<15	Not Given	27/03/2024	BHP AC 006
Nitrate (as NO_3)	Acc.	mg/L	11	Not Given	21/03/2024	BHP AC 019
pH - Field		pH Units	7.76	Not Given	21/03/2024	BHP AC 067
Temperature - Field		°C	9.6	Not Given	21/03/2024	BHP AC 067
Total Suspended Solids	Acc.	mg/L	72	Not Given	26/03/2024	BHP AC 012
Total Petroleum Hydrocarbons (>C_6-C_{40})	*	mg/L	<0.01	Not Given	02/04/2024	1670
Petrol Range Organics (>C_6-C_{10})	*	mg/L	<0.0001	Not Given	02/04/2024	1670
Diesel Range Organics (>C_{10}-C_{21})	*	mg/L	<0.0001	Not Given	02/04/2024	1670

Authorised by: Dervla Purcell
Laboratory Manager

Date Authorised: 03/04/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 287024

Client: Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

BHP Ref. No: 24/05/7282
Quote Ref: QC008778
Order No: N/A
Sales Order: 216049
Date Received: 30/05/2024
Date Sampled: 30/05/2024
Date Completed: 11/06/2024
Sample Type: Surface Water

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

FTAO: Martin Collins
Site: Coshla
BHP Ref: Bi-annually Surface Water
Client Ref: Quarry Discharge

Test		Units	Results	Customer Limits	Date Analysed	Method
B.O.D.	Acc.	mg/L	0.1	Not Given	06/06/2024	BHP AC 005
C.O.D.	Acc.	mg/L	<15	Not Given	05/06/2024	BHP AC 006
Nitrate (as NO_3)	Acc.	mg/L	11	Not Given	30/05/2024	BHP AC 019
pH - Field		pH Units	7.55	Not Given	30/05/2024	BHP AC 067
Temperature - Field		°C	15.8	Not Given	30/05/2024	BHP AC 067
Total Suspended Solids	Acc.	mg/L	<10	Not Given	31/05/2024	BHP AC 012
Total Petroleum Hydrocarbons (>C_6-C_{40})	*	mg/L	<0.01	Not Given	10/06/2024	1670
Petrol Range Organics (>C_6-C_{10})	*	mg/L	<0.0001	Not Given	10/06/2024	1670
Diesel Range Organics (>C_{10}-C_{21})	*	mg/L	<0.0001	Not Given	10/06/2024	1670

Authorised by: Dervla Purcell, Laboratory Manager

Date Authorised: 12/06/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 297523

Client: Coshla Quarries Ltd
Cashla
Athenry
Co. Galway

BHP Ref. No: 24/09/6870
Quote Ref: QC008778
Order No: N/A
Sales Order: 230094
Date Received: 26/09/2024
Date Sampled: 26/09/2024
Date Completed: 07/10/2024
Sample Type: Surface Water

Testing
Analysing
Consulting

BHP

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Thomondgate
Limerick
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EMail:dervlapurcell@bhp.ie

FTAO: Martin Collins
Site: Coshla
BHP Ref: Quarterly Surface Water
Client Ref: Quarry Discharge

Test		Units	Results	Customer Limits	Date Analysed	Method
B.O.D.	Acc.	mg/L	0.30	Not Given	02/10/2024	BHP AC 005
C.O.D.	Acc.	mg/L	<15	Not Given	01/10/2024	BHP AC 006
Nitrate (as NO_3)		mg/L	13	Not Given	26/09/2024	BHP AC 019
pH - Field		pH Units	7.96	Not Given	26/09/2024	BHP AC 067
Temperature - Field		°C	11.6	Not Given	26/09/2024	BHP AC 067
Total Suspended Solids	Acc.	mg/L	<10	Not Given	01/10/2024	BHP AC 012

Authorised by: Dervla Purcell
Dervla Purcell
Laboratory Manager

Date Authorised: 08/10/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
***** Subcontracted to an approved accredited laboratory
****** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised

~ : Sample Condition : ACCEPTABLE

BHP/AC/F115v3

TEST REPORT NO: 300564

Client: Coshla Quarries Ltd

Cashla
Athenry
Co. Galway

Testing
Analysing
Consulting

BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail:dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

BHP Ref. No:	24/11/1473
Quote Ref:	QC008778
Order No:	Not Required
Sales Order:	234245
Date Received:	07/11/2024
Date Sampled:	07/11/2024
Date Completed:	18/11/2024
Sample Type:	Surface Water

FTAO: Martin Collins
Site: Coshla
BHP Ref: Bi-annually Surface Water
Client Ref: Quarry Discharge

Test		Units	Results	Customer Limits	Date Analysed	Method
B.O.D.	Acc.	mg/L	0.40	Not Given	13/11/2024	BHP AC 005
C.O.D.	Acc.	mg/L	<15	Not Given	12/11/2024	BHP AC 006
Nitrate (as NO_3)		mg/L	6.3	Not Given	14/11/2024	BHP AC 019
pH - Field		pH Units	7.85	Not Given	07/11/2024	BHP AC 067
Temperature - Field		°C	12.8	Not Given	07/11/2024	BHP AC 067
Total Suspended Solids	Acc.	mg/L	<10	Not Given	11/11/2024	BHP AC 012
Total Petroleum Hydrocarbons (>C_6-C_{40})	*	mg/L	<0.01	Not Given	15/11/2024	1670
Petrol Range Organics (>C_6-C_{10})	*	mg/L	<0.0001	Not Given	15/11/2024	1670
Diesel Range Organics (>C_{10}-C_{21})	*	mg/L	<0.0001	Not Given	15/11/2024	1670

Authorised by: Dervla Purcell, Laboratory Manager

Date Authorised: 18/11/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)
Acc.: INAB Accredited
ND: None detected in volume analysed
* Subcontracted to an approved accredited laboratory
** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised

~ : Sample Condition : ACCEPTABLE

M.T.S. Limited
19 Kernanstown Industrial Estate, Carlow.
Tel: 059 9130044 / 9137134
Email:info@mtsltd.ie Web:www.mtsltd.ie

Materials Testing Services

RECEIVED: 04/03/2025

REPORT FOR SUBCONTRACTED TEST

***Customer Name**	Coshla Quarries	***Scheme / Site**	Quality Control
***F.A.O.**	Martin Collins		
	Athenry	**Material**	Water
	Galway		
	H65 EE33	**Specification**	Not Stated

Sample No.	A28434/1	***Date Sampled**	16/01/2024
***Customer Ref**	Water for Concrete	**Date Received**	16/01/2024
***Location**	Plant		
***Supplier**	Coshla Quarry	**Condition of sample as received:**	Satisfactory

Test: Analysis of water for making concrete

Specification: EN 1008

Result: See attached report

Remarks: Sampled By MTS No — Sampling certificate supplied No
Mass of Bulk sample 10kg
Sampling details where supplied are available on request
* Information supplied by customer
This test was subcontracted to an accredited laboratory – Copy of result enclosed

Authorized By : Noreen Murray
Technical Officer

Issue Date04/03/2024

TEST REPORT NO: 277815

Client: Materials Testing Services Ltd MTS
19 Kernanstown Industrial Estate
Carlow
Co. Carlow

Testing
Analysing
Consulting
BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail: dervlapurcell@bhp.ie

RECEIVED: 04/02/2025

BHP Ref. No: 24/01/3080
Quote Ref: QC006262
Order No: 1842-17012024
Sales Order: 204091
Date Received: 19/01/2024
Date Sampled: 16/01/2024
Date Completed: 31/01/2024
Sample Type: Process Water

FTAO: Elsa Fitzpatrick
Site: Quality Control
BHP Ref: On Demand_Process Water
Client Ref: A28434

Test	Units	Results	IS EN 1008: 2002 Limits	Date Analysed	Method
Colour	-	Pass	Pale Yellow or Paler	26/01/2024	IS EN 1008:2002
Odour	-	Pass	No Odour	26/01/2024	IS EN 1008:2002
Detergents	-	Pass	No foaminng(2mins)	26/01/2024	IS EN 1008:2002
Oils & Grease	-	Pass	Not Visible	26/01/2024	IS EN 1008:2002
Setteable Solids	mL/80 mL	Pass	4	26/01/2024	IS EN 1008:2002
Sugars	mg/L	Pass	100	26/01/2024	IS EN 1008:2002
Humic Matter	-	Pass	Yellow Brown or Paler	26/01/2024	IS EN 1008:2002
Phosphate (as P_2O_5)	mg/L	<0.15	100	18/01/2024	BHP AC 019
Acids (pH)	-	6.99	>4-Not Given	19/01/2024	IS EN 1008:2002
Alkali (as sodium oxide)	%	0.0016	0.15	24/01/2024	IS EN 1008:2002
Lead (Total as Pb)	mg/L	<0.025	100	24/01/2024	BHP AC 129
Zinc (Total as Zn)	mg/L	<0.025	100	24/01/2024	BHP AC 129
Potassium (Total as K)	mg/L	<5	-	24/01/2024	BHP AC 129
Sodium (Total as Na)	mg/L	12	-	24/01/2024	BHP AC 129
Nitrate (as NO_3)	mg/L	27	500	18/01/2024	BHP AC 019

Authorised by: Dervla Purcell, **Laboratory Manager** — **Date Authorised:** 01/02/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

- **Acc.:** INAB Accredited
- **ND:** None detected in volume analysed
- ***** Subcontracted to an approved accredited laboratory
- ****** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
- **~:** Sample Condition : ACCEPTABLE

TEST REPORT NO: 277815

Client: Materials Testing Services Ltd MTS
19 Kernanstown Industrial Estate
Carlow
Co. Carlow

Testing
Analysing
Consulting
BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
EMail: dervlapurcell@bhp.ie

RECEIVED: 04/03/2025

BHP Ref. No: 24/01/3080
Quote Ref: QC006262
Order No: 1842-17012024
Sales Order: 204091
Date Received: 19/01/2024
Date Sampled: 16/01/2024
Date Completed: 31/01/2024
Sample Type: Process Water

FTAO: Elsa Fitzpatrick
Site: Quality Control
BHP Ref: On Demand_Process Water
Client Ref: A28434

Test	Units	Results	IS EN 1008: 2002 Limits	Date Analysed	Method
Sulphate (as SO_4^{2-})	mg/L	22	2000	31/01/2024	BHP AC 095
Chloride (as Cl^-)	mg/L	24	500	25/01/2024	BHP AC 095

Authorised by:	Dervla Purcell Laboratory Manager	**Date Authorised:**	01/02/2024

Additional Information:(Opinions, where stated, are not covered by accreditation)

Acc.:	INAB Accredited
ND:	None detected in volume analysed
*	Subcontracted to an approved accredited laboratory
**	This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
~:	Sample Condition : ACCEPTABLE