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Geological Survey
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Rathvilly Sand and Gravel Aquifer Summary of Initial Characterisation

GW3D Project Report TR2023/29
March 2023

Rathvilly Sand and Gravel Aquifer Description March 2023

This sand and gravel report forms part of a series representing the output of a body of work undertaken to re-evaluate previously mapped sand and gravel aquifers and to identify new sand and gravel aquifers. This study resulted in the refinement of existing sand and gravel aquifer mapped extents, the modification of some sand and gravel aquifer categories, and the removal of some previously mapped sand and gravel aquifers, as well as identification of new aquifers. In addition to mapping the extent and depths of the sand and gravel aquifers, the investigations consider the hydraulic properties.

The study, undertaken as part of the GW3D project (2015-2019), comprised three parts:

1) Desk study and fieldwork preparation

Sand and gravel bodies above a minimum size criterion were extracted from the GSI Quaternary Sediments 1:50,000 map. Where it was known that the surface expression of the sands and gravels was only a small portion of the subsurface body, such areas were retained. This process left several hundred sand and gravel bodies remaining as a starting point for field work.

2) Fieldwork including mapping and data collection

Field work included a visit to each of the areas which had the potential to be (at least) a Locally Important Sand and Gravel Aquifer owing to its area. In such areas, gravel pits and sand pits were visited and depth and type of sediment recorded, other exposures into the subsurface were visited and logged, wells (whether Public Supply, Group Scheme or private farm or domestic) were dipped and any information on depths recorded, and data was collected where geological and hydrogeological data existed for the area.

3) Data collation, analysis and reporting.

All field data, and information from earlier reports and studies, were compiled and analysed. Where a sand and gravel body had qualifying aquifer properties (either 10 m depth sand and gravel, or 5 m depth saturated sediments), these areas were digitised in a GIS. The aquifer area was then ascertained and drawn up. Such areas formed the basic building blocks for the sand and gravel aquifer map, which included details on the aquifer name, area, aquifer resource value (Rg or Lg), confidence level, county, and any important aspects to note for each body.

The updated mapped sand and gravel aquifers are found on the Geological Survey Ireland site <https://www.gsi.ie/en-ie/data-and-maps/Pages/Groundwater.aspx#Aquifers>

The GW3D Mapping Team involved in the current revision of delineated sand and gravel aquifers were:

Geological Survey Ireland staff:

- Dr. Sophie O'Connor, Groundwater Programme / Land Mapping Unit
- Dr. Sarah Blake, Groundwater Programme

Consultant support:

- Dr. Robbie Meehan, Talamh Ireland
- Coran Kelly, Tobin Consulting Engineers
- Damien Doherty, independent Consultant Geologist/ Tobin Consulting Engineers
- Natalie Duncan, independent Consultant Geologist
- Sara Raymond, independent Consultant Geologist
- James McAteer, Gavin and Doherty Geosolutions



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Hydrometric Area Local Authority		Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
12 – Slaney and Wexford Harbour Carlow County Council Wicklow County Council		Rivers: River Slaney, Streams: Broughillstown Stream, Garretstown Stream, Bough Stream Lakes: None	Slaney River Valley SAC	3.82
Topography	This sand and gravel body is located immediately northwest of Rathvilly, County Carlow, and is situated on a high, elevated, north-south oriented terrace, which flanks the River Slaney (Figure 1). The sand and gravel body is situated at elevations between 96 m and 134 m AOD. The Slaney flows through the southern end of the aquifer, and outcropping bedrock flanks the river on the eastern side of the aquifer area. Bedrock cored ridges are also present on the western side of the body, at higher elevations, up to 146 m AOD.			
Geology and Aquifers	Aquifer categories	There were data available from five desk study borehole records from within the aquifer. The aquifer exceeds the groundwater throughput threshold of 1,000 m ³ /d. Based on its areal extent, inferred thickness, saturated thickness, groundwater throughput and position in the landscape the deposit is classified as Locally Important Sand and Gravel Aquifer (Lg) (DELG/EPA/GSI, 1999; GSI, 2017).		
	Main aquifer lithologies	Hummocky, glaciofluvial sands and gravels derived chiefly from limestones (GLs), with some small areas of alluvium (A), lacustrine clays (L) and cutover peats (Cut).		
	Key structures	In general, exposure is poor within this sand and gravel body, and no significant sand and gravel sedimentary structures were noted during fieldwork.		
	Key properties	There are three water level data points available from within the sand and gravel body which have allowed for inferences to be made on water levels throughout it's area. Using these data, along with other desk study data, it has been inferred that approx. 43% of the aquifer area has a depth of saturated sands and gravels greater than 5 m. Sand and gravel aquifers generally consist of unconsolidated coarse-grained material, usually containing less than 8% fines (Ó'Súilleabháin, 2000).		
	Thickness	Two boreholes have depth to bedrock data from within the sand and gravel body. One of these boreholes has 10 m depth sands and gravels (Figure 2), with 5 m of this depth inferred to be saturated (GSI, 2023b). In general, thicknesses seem to be greater than 10 m throughout the majority of the sand and gravel body, while the eastern fringes are inferred to have less than 10 m depth of sands and gravels.		
Overlying Strata	Lithologies	Approximately 7% of the aquifer is overlain with alluvial deposits, lake sediments and/or cutover raised peat, with sand and gravel assumed beneath.		
	Thickness	The thickness of the alluvium, lake sediments and cutover raised peat is inferred to be less than 3 m thick.		
	% area aquifer near surface	Approximately 93% of the sand and gravel aquifer is at the surface, with the remainder underneath the alluvial deposits, lake sediments and/or cutover raised peat.		
	Vulnerability	The groundwater vulnerability of the sands and gravels is 'Extreme' where the water table is inferred to be < 3 m from the surface, this accounts for 23% of the area of the delineated aquifer body. In all other areas where the water table is at a depth > 3 m, the vulnerability is classed as 'High' (77% of the aquifer area, see Figure 3).		
Recharge	Main recharge mechanisms	Diffuse recharge occurs <i>via</i> rainfall percolating through the unsaturated sands and gravels. Due to the high permeability of sand and gravel, a high proportion of the available recharge will percolate down to the water table. Rejected recharge from the higher, surrounding Locally Important Bedrock Aquifer (LI) has also been included in calculations of throughput.		
	Est. recharge rates	The annual average rainfall for the aquifer is 957 mm (Walsh, 2012), thus providing an estimated diffuse groundwater recharge of 395 mm/yr. The minimum direct groundwater throughput in the aquifer is consequently estimated to be 1,816 m ³ /d, which increases to a potential 2,063 m ³ /d when rejected recharge from the surrounding higher ground is included.		



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Discharge	Large springs and large known abstractions (m ³ /d)	There are no known large springs or abstractions from this aquifer body.	
	Main discharge mechanisms	Groundwater is expected to discharge into the streams that flow through the aquifer. Some small, lowlying springs are also seen on the OSI 6 inch raster map (1830s – 1930s) at, for example, Rahill Townland.	
	Hydrochemical Signature	There are no data readily available to assess the hydrochemistry of this aquifer, but the groundwater is likely to have a calcium bicarbonate (CaHCO ₃) signature.	
Groundwater Flow Paths		The length of flow paths depends on the extent of the sand and gravel deposit. In general, locally important sand and gravel aquifers are expected to have relatively short flow paths <i>i.e.</i> up to several hundred metres. Given the geometry and setting of the aquifer body at Rathvilly, this is also expected to be the case here.	
Groundwater & Surface water interactions		Groundwater has been seen to discharge <i>via</i> lowlying springs; therefore connectivity between groundwater and surface water is high in these localities, and is assumed to be so throughout the extent of the aquifer.	
Conceptual model	• The aquifer has a ‘hummocky glaciofluvial sediments’ topography (GSI, 2023a), which forms an elevated terrace at elevations between 96 m and 134 m AOD. • One borehole record indicates 10 m depth of sand and gravel (Figure 2), with 5 m of this depth inferred to be saturated (GSI, 2023b). • Approximately 43% of the aquifer area is inferred to have a depth of saturated sands and gravels greater than 5 m, with the remainder of the delineated aquifer area inferred as less than this. • Approximately 7% of the aquifer is overlain with alluvial deposits, lake sediments and/or cutover raised peat, with sands and gravels assumed beneath. • Diffuse groundwater recharge is estimated to be approx. 395 mm/yr. • Rejected recharge from the surrounding Locally Important Bedrock Aquifer (LI) contributes some groundwater recharge into the sand and gravel aquifer. • The minimum direct groundwater throughput in the aquifer is estimated to be 1,816 m³/d, which increases to a potential 2,063 m³/d when rejected recharge from the surrounding higher ground is included.		
Attachments	Figure 1: Location and extent Figure 2: Cross section Figure 3: Groundwater vulnerability		
Instrumentation	Hydrometric gauges: National Water Monitoring Stations; River: Groundwater:	None present RS12S021010 (Rathvilly - d/s) None present	
Information Sources	• DELG/EPA/GSI (1999). Groundwater Protection Schemes. Department of the Environment and Local Government, Environmental Protection Agency and Geological Survey Ireland. • EPA map viewer. https://gis.epa.ie/EPAMaps/ • GSI (2017). A description of Irish aquifer categories. 3 pp. Available from: https://www.gsi.ie/documents/GSI%20Aquifer%20Category%20Descriptions.pdf • GSI (2023a). Geological Survey Ireland, Spatial Resources Viewer: Quaternary Geomorphology Map. https://www.gsi.ie/en-ie/data-and-maps/Pages • GSI (2023b). Geological Survey Ireland, Internal groundwater databases. • NPWS viewer. http://webgis.npws.ie/npwsviewer/ • Ó’Súilleabháin, C. (2000). Assessing the boundary between high and moderately permeable subsoils. Unpublished MSc., University of Dublin. Department of Civil, Structural and Environmental Engineering, Trinity College Dublin. • Walsh, S. (2012). A Summary of Climate Averages 1981-2010 for Ireland, Climatological Note		



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Information Sources (contd.)	No.14, Met Éireann, Dublin.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations and assumptions based on the information sources described above and established hydrogeological formulae. Figures 1, 2, and 3 are used for illustrative purposes only.



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Rathvilly Sand and Gravel Aquifer

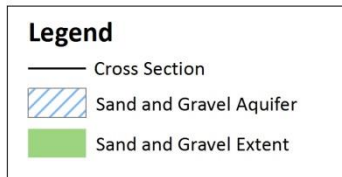
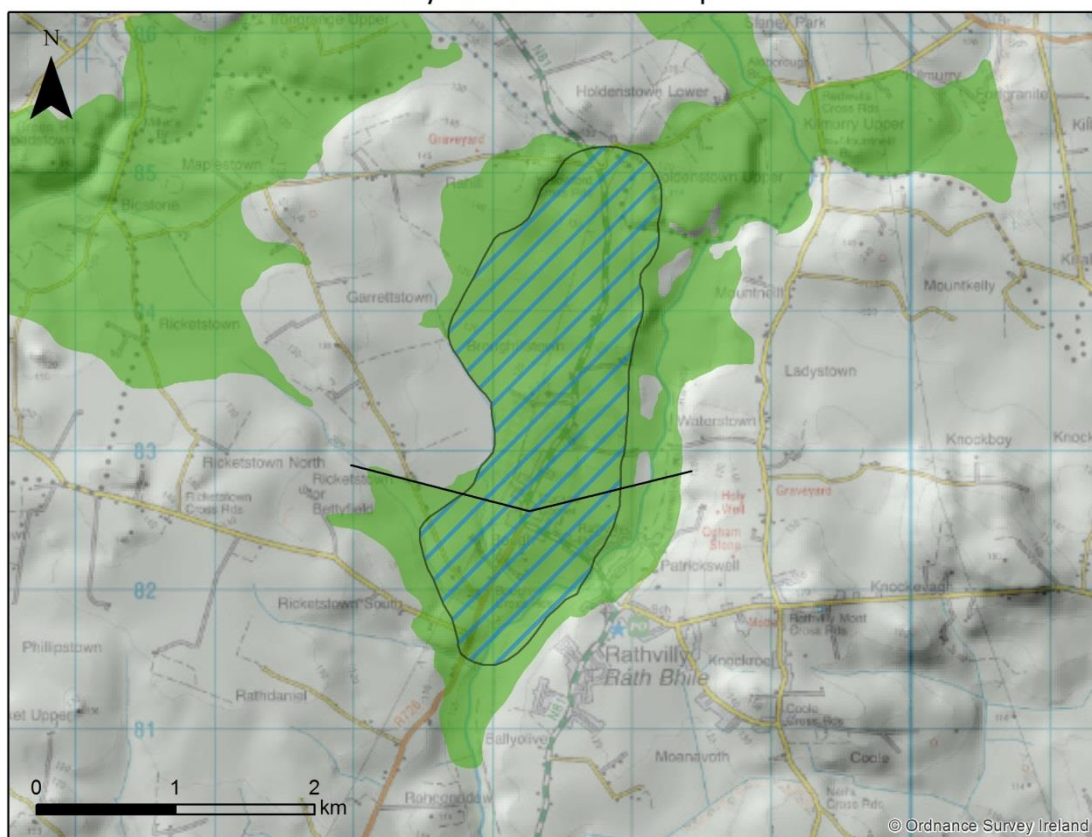


Figure 1: Rathvilly Sand and Gravel Aquifer extent with cross section location.

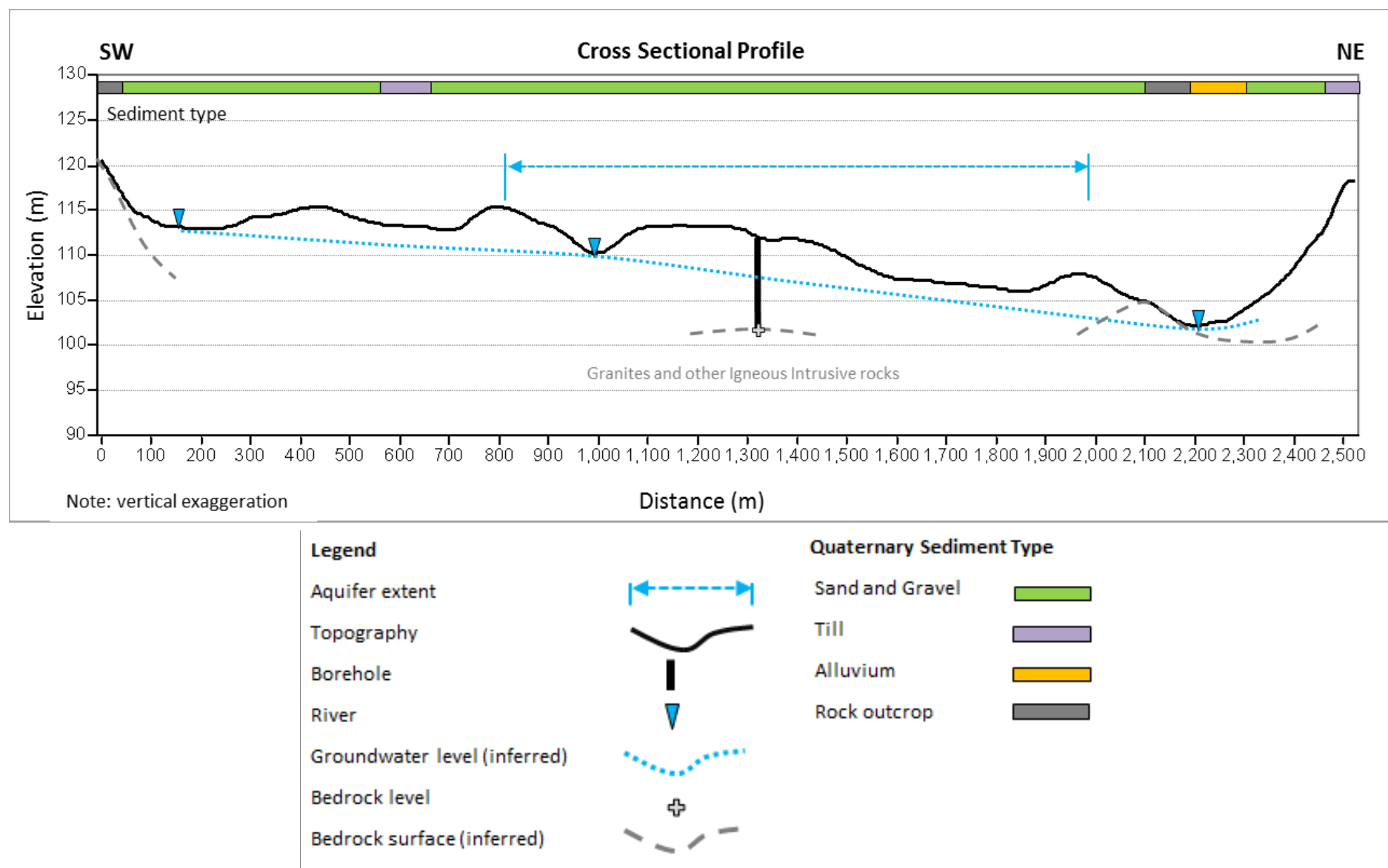


Figure 2: Cross section through the Rathvilly Sand and Gravel Aquifer body.

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Rathvilly Sand and Gravel Aquifer Vulnerability

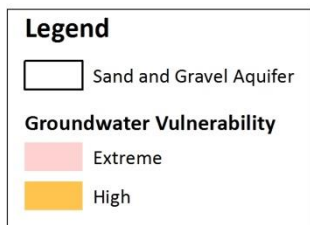
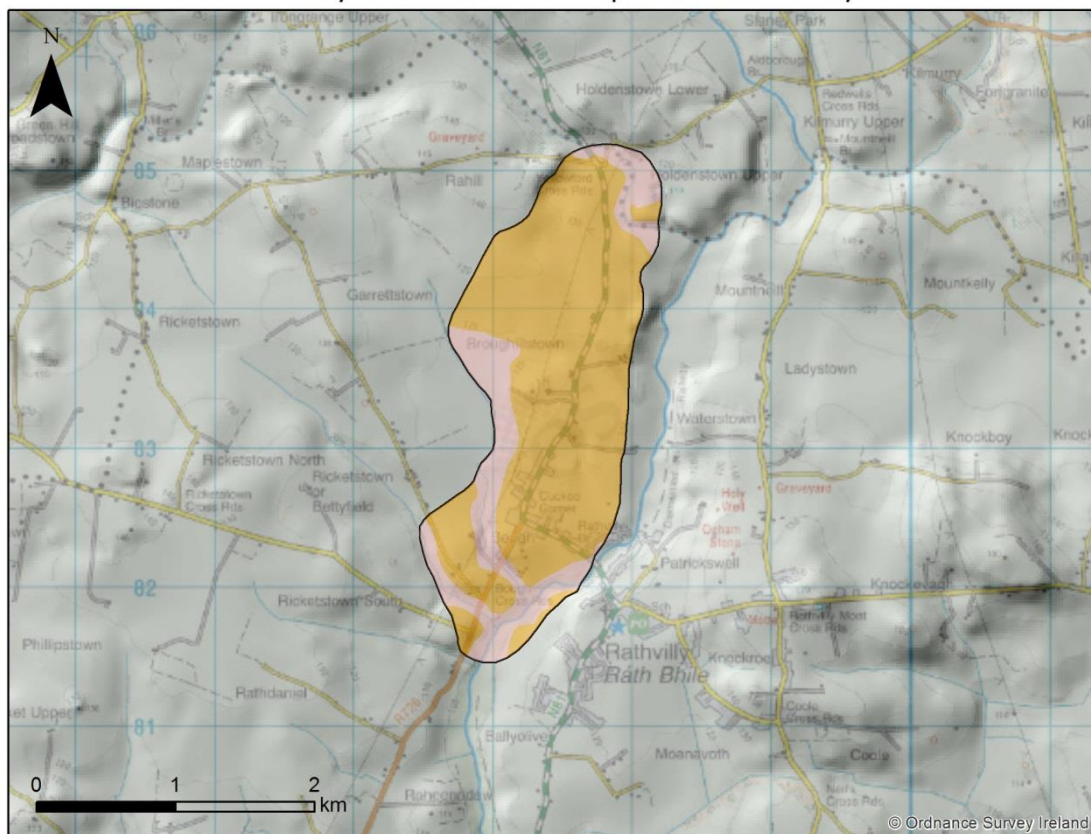


Figure 3: Groundwater vulnerability across the Rathvilly Sand and Gravel Aquifer.