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Coolane Sand and Gravel Aquifer Summary of Initial Characterisation

GW3D Project Report TR2023/28
March 2023

Coolane 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



Coolane Sand and Gravel Aquifer Description March 2023

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Hydrometric Area Local Authority		Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
14 – Barrow, Kildare County Council		Rivers: River Greese, Lerr River Streams: Burtown Stream, Coolane Stream, Ballynamony Stream Lakes: None	River Barrow and River Nore SAC	4.97
Topography	This sand and gravel aquifer is located to the west and northwest of Castledermot Town, along the route of the M9 motorway (Figure 1). The aquifer extends in a north-south direction and is approx. 6.5 km long, and approximately 500 m wide. The body comprises areas of undulating glaciofluvial sediments elevations between 69 m and 103 m AOD. There are a number of sand and gravel pits in the aquifer, which have altered the natural, local topography in places. The aquifer rests between bedrock cored ridges which range in elevation from 95 m to 149 m AOD.			
Geology and Aquifers	Aquifer categories	Data were available from 30 borehole records from within the aquifer body. Using these data, along with the groundwater level data collected in the field, it has been inferred that approx. 37% of the area of the delineated aquifer body has a depth of saturated sands and gravels greater than 5 m. 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).		
	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 16 water level data points available from within the sand and gravel aquifer which have allowed for inferences to be made on groundwater levels throughout the body. Particle size distribution graphs were also obtained from geotechnical investigations carried out within the body, and it is noted that the majority of the sediment at depths greater than 3 m below ground level contains less than 8% fines (IGSL, 2007). Within 3 m of the surface, some samples contain greater than 8% fines, suggesting an overlying sediment which is less well sorted; this has also been noted in historical field mapping in the area (Glanville, 1994). Sand and gravel aquifers generally consist of unconsolidated coarse grained material, usually containing less than 8% fines (Ó'Súilleabháin, 2000).		
Overlying Strata	Thickness	Using the data from 16 desk study boreholes, sand and gravel thicknesses are generally 10 m in depth. Proven depth to bedrock varies from 16.5 m below ground level in Ballyvass Townland (GSI, 2023a) to 7.9 m below ground level in Woodlands West Townland (IGSL, 2007).		
	Lithologies	Approximately 11% of the aquifer body is overlain with alluvium, cutover raised peat and lacustrine sediments, with sands and gravels assumed beneath.		
	Thickness	The thickness of the alluvium, cutover raised peat and lacustrine sediments are inferred to be less than 3 m thick.		
	% area aquifer near surface	Approximately 89% of the sand and gravel aquifer is at the surface, with the remainder underneath the alluvial deposits, cutover raised peat and/or lacustrine sediments.		
Recharge	Vulnerability	The groundwater vulnerability of the sand and gravel is 'Extreme' where the water table is inferred to be < 3 m from the surface, this accounts for 20% of the delineated aquifer area. In all other areas where the water table is at a depths > 3 m, the vulnerability is classed as 'High' (80% of the area, Figure 3).		
	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 surrounding Poor Bedrock Aquifer (PI), has also been included.		



Coolane Sand and Gravel Aquifer Description March 2023

	Est. recharge rates	The annual average rainfall for the aquifer is 810 mm (Walsh, 2012), thus providing an estimated diffuse groundwater recharge of 265 mm/yr. The minimum direct groundwater throughput in the aquifer is consequently estimated to be 1,351 m ³ /d, which increases to 1,885 m ³ /d when rejected recharge from the surrounding higher ground is considered.
Discharge	Large springs and large known abstractions (m³/d)	There are no known large springs or abstractions from this aquifer body.
	Main discharge mechanisms	Groundwater is expected to discharge into the rivers and 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, Ballyvass and Coolane Townlands.
	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 depend 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. The geomorphology of this sand and gravel aquifer at Coolane and the pattern of streams within it would suggest groundwater flows paths are unlikely to exceed these lengths.
Groundwater & Surface water interactions		Groundwater has been seen to discharge <i>via</i> lowlying springs; therefore connectivity between groundwater and surface water is expected to be high.
Conceptual model	- This hummocky sand and gravel body is present along the route of the M9 motorway and comprises land classified as having undulating glacial sediments topography (GSI, 2023b), at elevations between 69 m and 103 m AOD. - Proven depth to bedrock varies from 7.9 m to 16.5 m below ground level (IGSL, 2007; GSI, 2023a), but generally the sorted glaciofluvial sediments are expected to be at least 10 m thick. - Approximately 37% of the area of delineated aquifer is inferred to have a depth of saturated sands and gravels greater than 5 m, with the remainder of the aquifer inferred to have a saturated thickness less than this. - The majority of the particle size distribution graphs, at depths greater than 3 m below ground level obtained from geotechnical investigations, contains less than 8% fines (IGSL, 2007). - An area of 0.84 km² of rejected recharge from the surrounding Poor Bedrock Aquifer (PI) has been included in potential throughput calculations. - The minimum direct groundwater throughput in the aquifer is estimated to be 1,351 m³/d, which increases to 1,885 m³/d when the rejected recharge from the surrounding higher ground is considered.	
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 RS14B100300 (Burtown Stream) None present

Coolane Sand and Gravel Aquifer Description March 2023

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/ • Glanville, C. (1994). Report on Quaternary mapping across Sheet 26/33 SE, south County Kildare. Unpublished report for Quaternary Section, GSI. • 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, Internal groundwater databases. • GSI (2023b). Geological Survey Ireland, Physiographic Units Webviewer. • IGSL (2007). N9/N10 Kilcullen to Waterford – Phase 3, Ground Investigation Report. • NPWS viewer. http://webgis.npws.ie/npwsvviewer/ • 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 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.

Coolane Sand and Gravel Aquifer

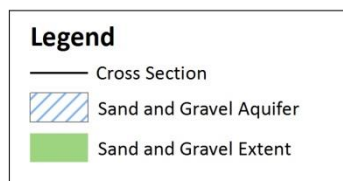
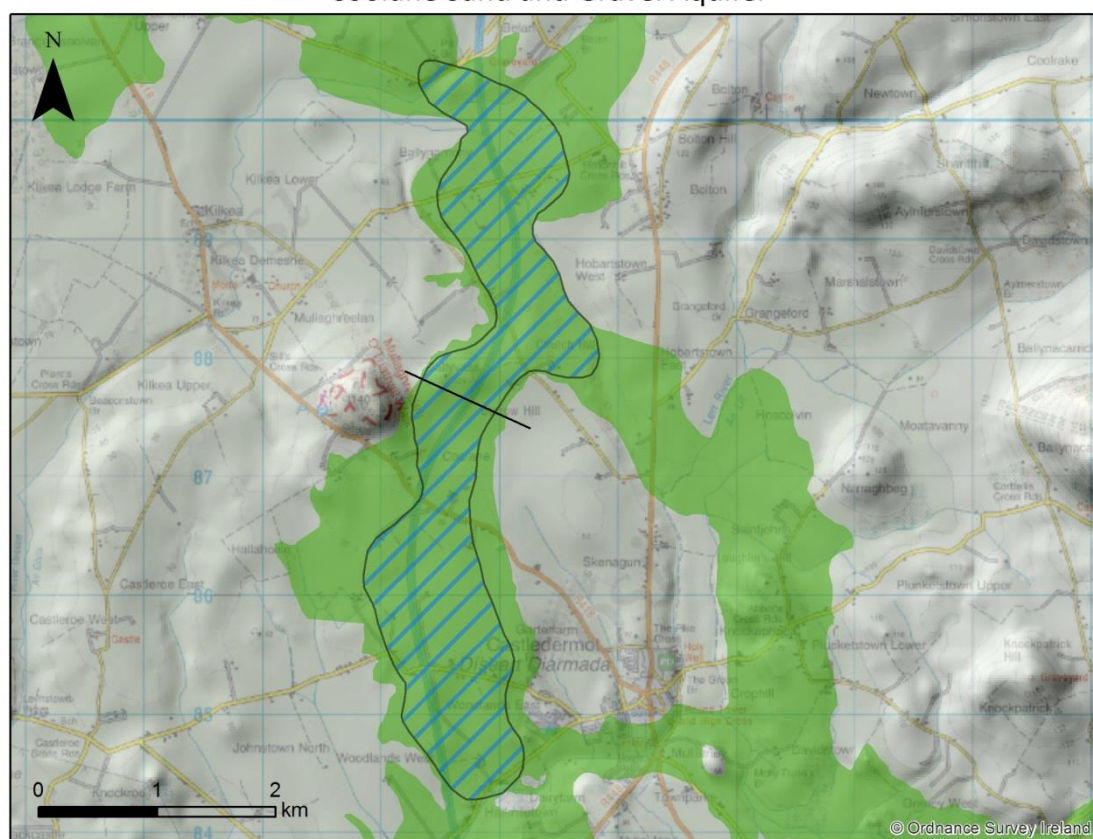


Figure 1: Coolane Sand and Gravel Aquifer extent with cross section location.

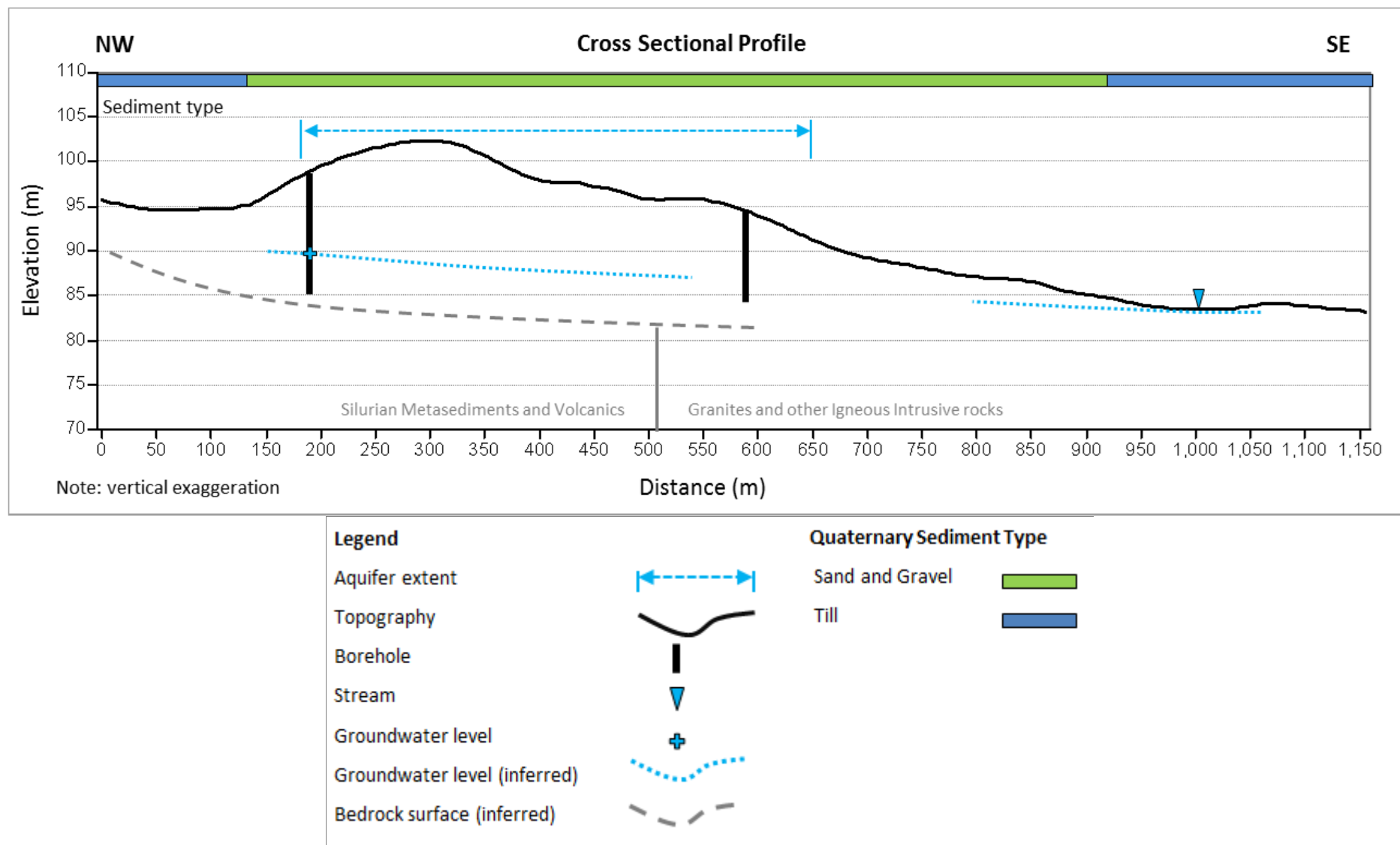


Figure 2: Cross section through the Coolane Sand and Gravel Aquifer body.

Coolane Sand and Gravel Aquifer Description March 2023

Coolane Sand and Gravel Aquifer Vulnerability

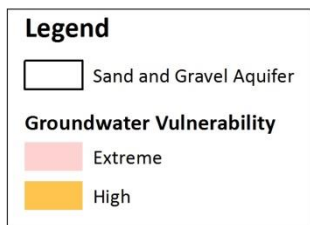
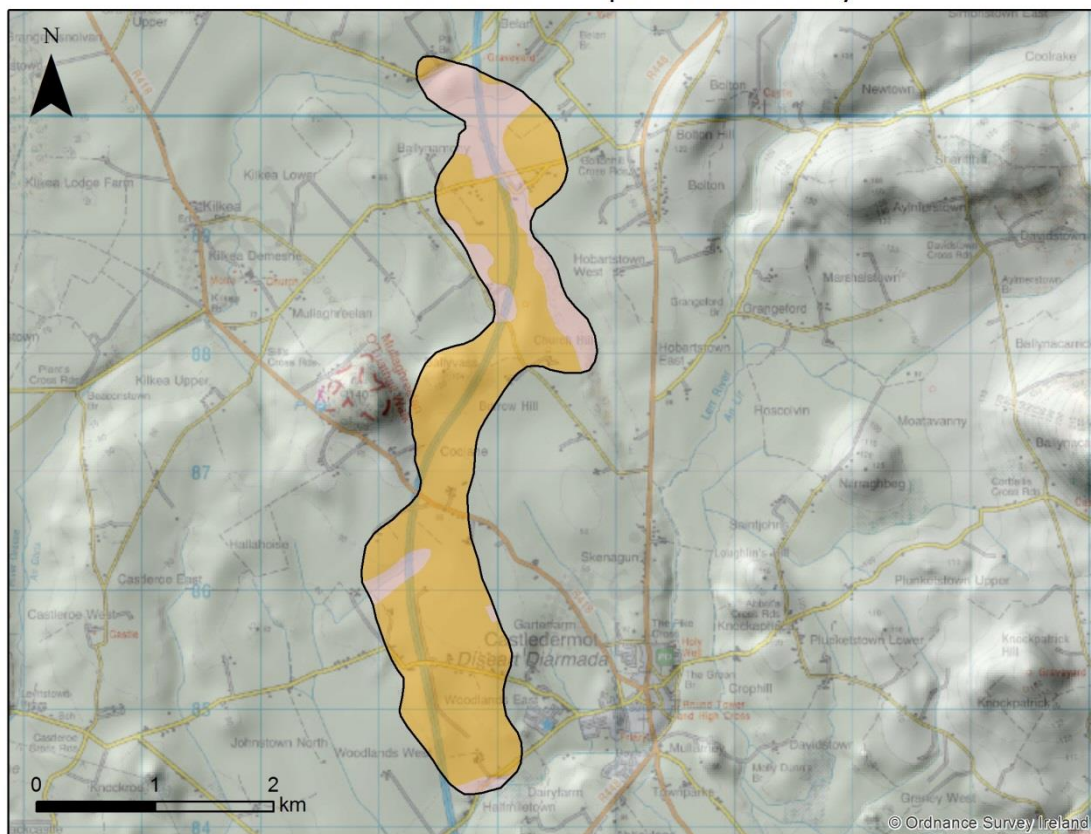


Figure 3: Groundwater vulnerability across the Coolane Sand and Gravel Aquifer.