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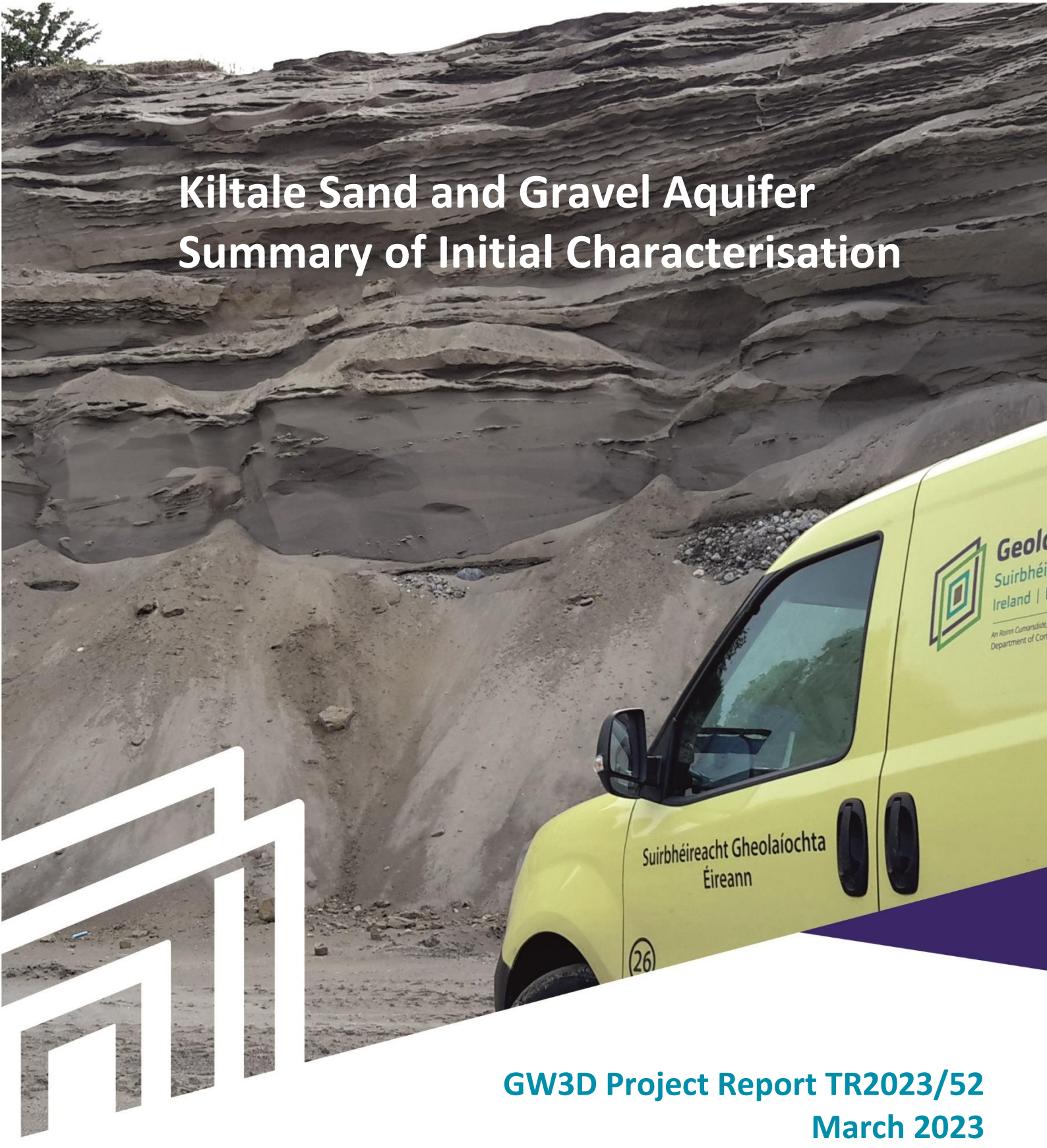

Kiltale Sand and Gravel Aquifer
Summary of Initial Characterisation

GW3D Project Report TR2023/52
March 2023

Geological Survey Ireland is a division of the Department of the Environment, Climate and Communications

Kiltale 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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Kiltale Sand and Gravel Aquifer: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km²)
07 – Boyne Meath County Council	**Rivers:** Boycetown River, Blackcut River, Galtrim River, Ardbrackan River **Streams:** Several unnamed streams **Lakes:** None	None	9.05

Topography	The Kiltale sand and gravel aquifer is situated between Kiltale Village, at it's northeast, and Ginnets Great and Basketstown Townlands, at the southwest. The aquifer contains the glaciofluvial / glaciolacustrine delta feature known as the Galtrim Moraine (Synge, 1950) which runs through the body as a pronounced southwest to northeast ridge, as well as a number of feeder esker systems to the delta, and associated subsidiary delta and/or deglacial fan features. Topographically speaking, the body is generally hummocky, at elevations of between 65 m and 95 m AOD. Away from the sands and gravels, the surrounding landscape is of either bedrock-cored ridges, or drumlins, which occur immediately southwest of the aquifer. The bedrock-cored ridges are at higher elevations of up to 120 m AOD.	
Geology and Aquifers	**Aquifer categories**	There are 21 boreholes or groundwater wells available from within the aquifer with groundwater level information. 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 sand and gravel deposits derived chiefly from limestones (GLs) and tunnel fill esker deposits which are classified as basic in chemical reaction (BasEsk).
	Key structures	The exposures seen during fieldwork showed a high degree of variability in clast size, but in general interbedded sheets of sands and gravels were the dominant structures observed during field work for this project.
	Key properties	The groundwater level data points available from within the sand and gravel aquifer ranged between 0.4 m and 7.0 m below ground level, in Basketstown and Windtown Townlands respectively (GSI, 2023). These data have allowed for inferences to be made on general water levels within the wider body. It is inferred that approx. 47% of the aquifer area has a depth of saturated sand and gravel greater than 5 m (Figure 2). The eskers present are considered to extend to bedrock and act as conduits for groundwater flow. Particle size distribution analyses are present from sediments sampled within the aquifer area, one of these point samples in Boycetown Townland contains less than 5% fines (GSI, 2023). Sand and gravel aquifers generally consist of unconsolidated coarse grained material, usually containing less than 8% fines (Ó'Súilleabháin, 2000).
	Thickness	One borehole log from within the aquifer area, in Basketstown Townland, has depth to bedrock measured at 30 m below ground level (GSI, 2023). In Kiltale Townland, subsoil thickness has been measured at 2.7 m depth below ground level at one point locality. The majority of the aquifer is inferred to have greater than 10 m depth of sands and gravels.
Overlying Strata	**Lithologies**	Approximately 7% of the aquifer is overlain with fen peat, cutover raised peat, lake sediments and/or alluvial deposits, with sand and gravel assumed beneath.
	Thickness	The fen peat, cutover raised peat, lake sediments and/or alluvial deposits are 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 fen peat, cutover raised peat, lake sediments and/or alluvial deposits. A continuous esker sand and gravel ridge cuts through the aquifer, orientated northwest to southeast, bot covering less than 2% of the delineated area of the aquifer.
	Vulnerability	The groundwater vulnerability of the sand and gravel aquifer is 'Extreme' where the water table is inferred to be < 3 m from the surface, approximately 29% of the aquifer area. In all other areas where the water table is at depths > 3 m, the vulnerability is classed as 'High' (71% of the aquifer, Figure 3).

Kiltale Sand and Gravel Aquifer Description March 2023

Recharge	**Main recharge mechanisms**	Diffuse recharge occurs *via* 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. Where fen peat, cutover raised peat, lake deposits and/or alluvium overlie the sands and gravels, the proportion of rainfall that recharges the water table will be significantly less.
	Est. recharge rates	The annual average rainfall for the aquifer is 843 mm (Walsh, 2012), thus providing an estimated diffuse groundwater recharge of 297 mm/yr. The minimum direct groundwater throughput in the aquifer is consequently estimated to be 3,459 m^3/d.
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 seen on OSI 6 inch raster map (1830s – 1930s) in, for example, Foxtown and Galtrim Townlands.
	Hydrochemical Signature	Hydrochemistry data of the sand and gravel aquifer is available for samples taken on a yearly basis through the EPA waste licence No. W0010-02. A raw water sample was taken from Basketstown Landfill Scheme in July 2017, and the key hydrochemical parameters are; the raw water has a calcium bicarbonate ($CaHCO_3$) signature, which is slightly hard; Alkalinity is 225 mg/l $CaCO_3$; Total Hardness is 134 mg/l $CaCO_3$; and Electrical Conductivity @20°C is 348 µS/cm (Fitz Scientific, 2018).
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.e*. up to several hundred metres. Based on the geomorphology of the aquifer, and the patterns of streams, it is considered that flow paths could extend up to 1 km within this body.
Groundwater & Surface water interactions		Groundwater is believed to discharge into the rivers that flow through and originate in the aquifer, therefore connectivity between the groundwater and surface water is expected to be relatively high.
Conceptual model		• The aquifer contains the glaciofluvial / glaciolacustrine delta feature known as the Galtrim Moraine (Synge, 1950). • The body comprises hummocky sands and gravels and associated eskers, at elevations between 65 m and 95 m AOD. • One borehole log from within the aquifer area, in Basketstown Townland, has depth to bedrock measured at 30 m below ground level (GSI, 2023). • Particle size distribution analysis are present from sediment samples taken from within the aquifer, and one of these point samples from Boycetown Townland contains less than 5% fines (GSI, 2023). • Approximately 47% of the aquifer is inferred to have greater than 5 m depth of saturated sands and gravels, with the remainder of the aquifer inferred to have a saturated thickness less than this. • Diffuse groundwater recharge is estimated to be approx. 297 mm/yr. • The minimum groundwater throughput in the aquifer is estimated to be 3,459 m^3/d.
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 RS07B030200 (Bridge North of Martinstown) RS07B030250 (Boycetown – Bridge S of Pike Corner) 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/ • Fitz Scientific (2018). Fitz Scientific Groundwater Analysis at Basketstown Landfill, County Meath. Report for EPA Waste Licence No. W0010-02. • GSI (2017). A description of Irish aquifer categories. 3 pp. Available from: https://www.gsi.ie/documents/GSI%20Aquifer%20Category%20Descriptions.pdf • GSI (2023). 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. • Synge, F.M. (1950). The glacial deposits around Trim, County Meath. Proceedings of the Royal Irish Academy, Vol. 53B, No. 10, pp. 99-110. • 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.

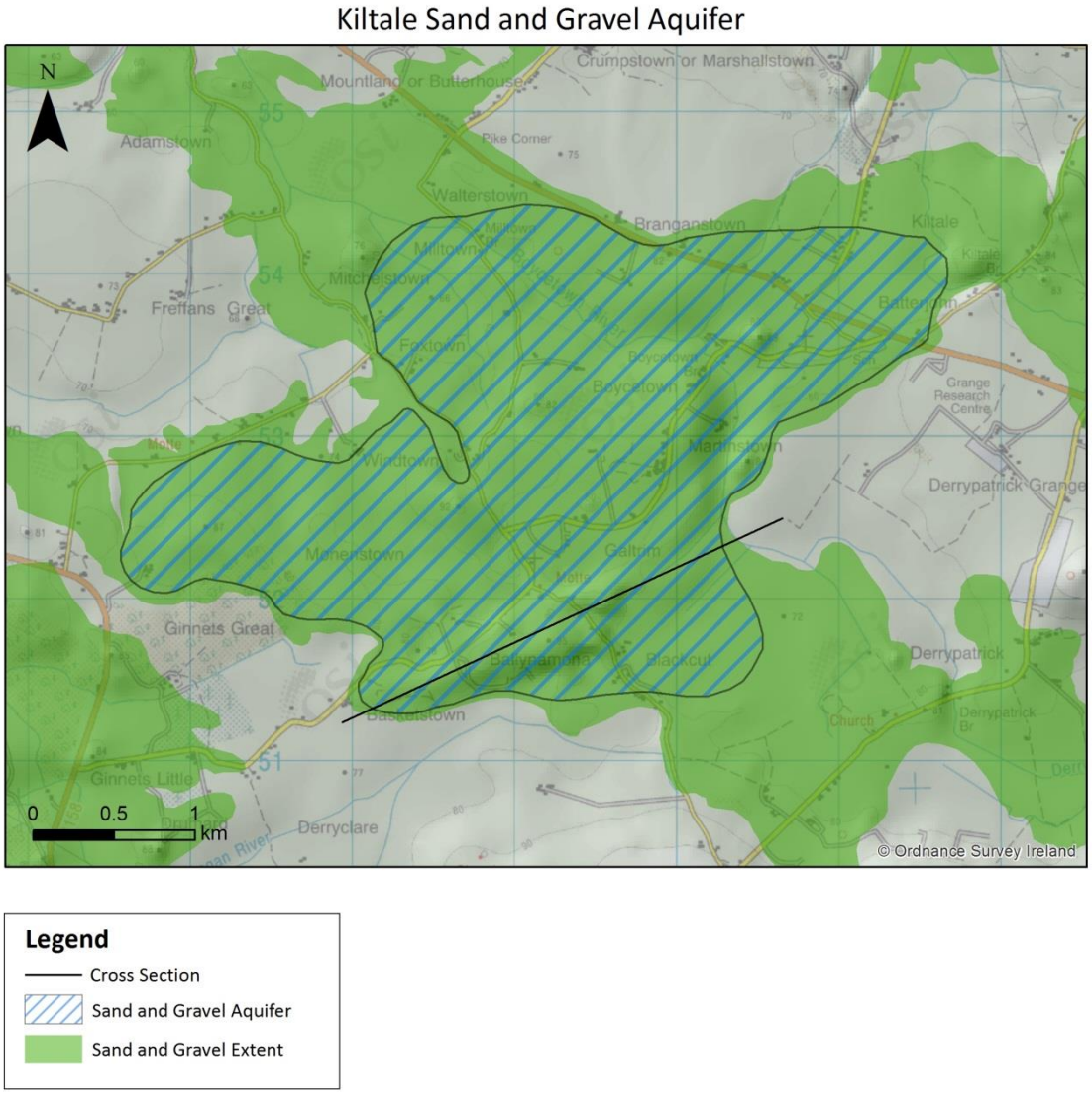

Figure 1: Kiltale Sand and Gravel Aquifer extent with cross section location.

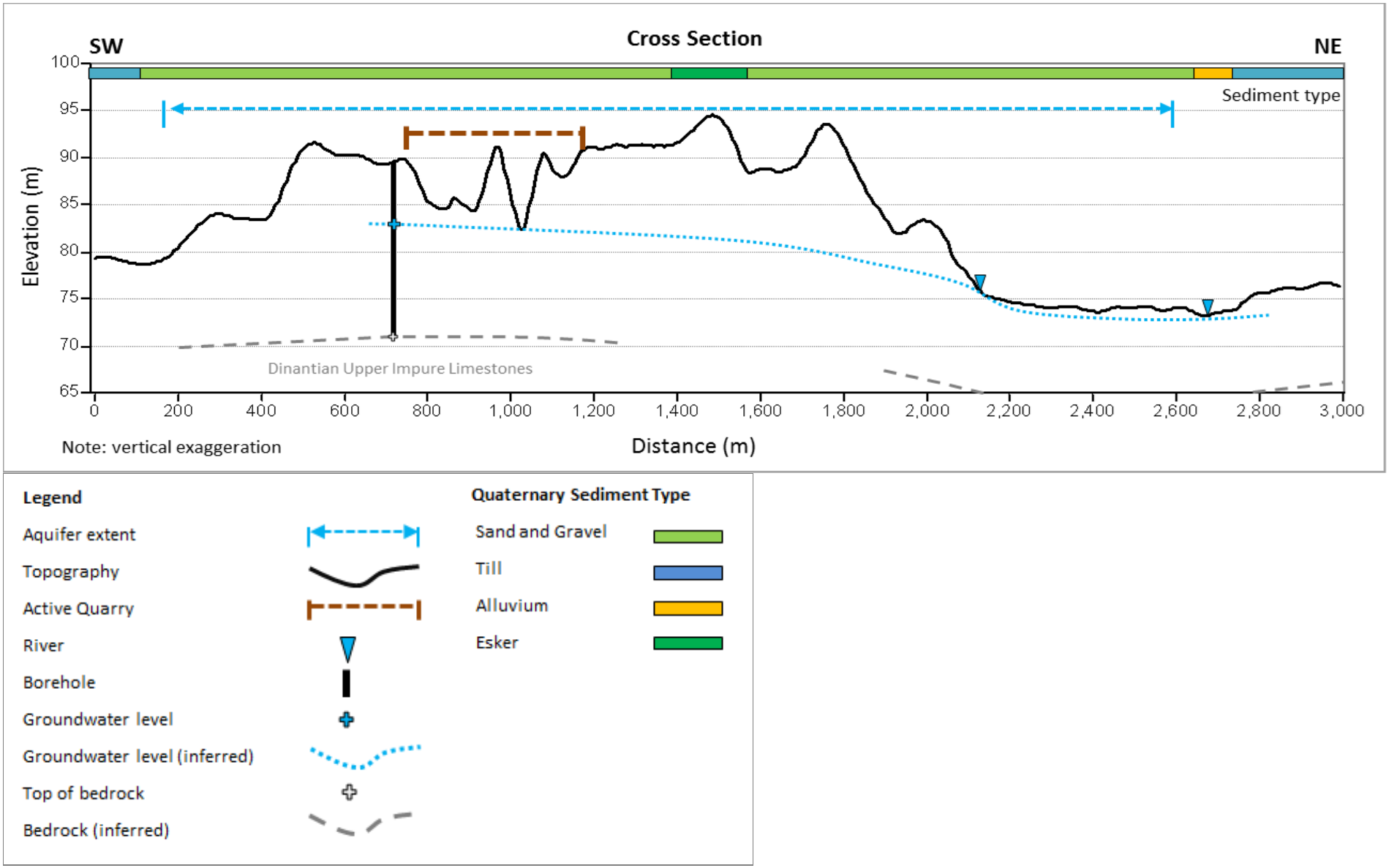

Figure 2: Cross section through the Kiltale Sand and Gravel Aquifer body.

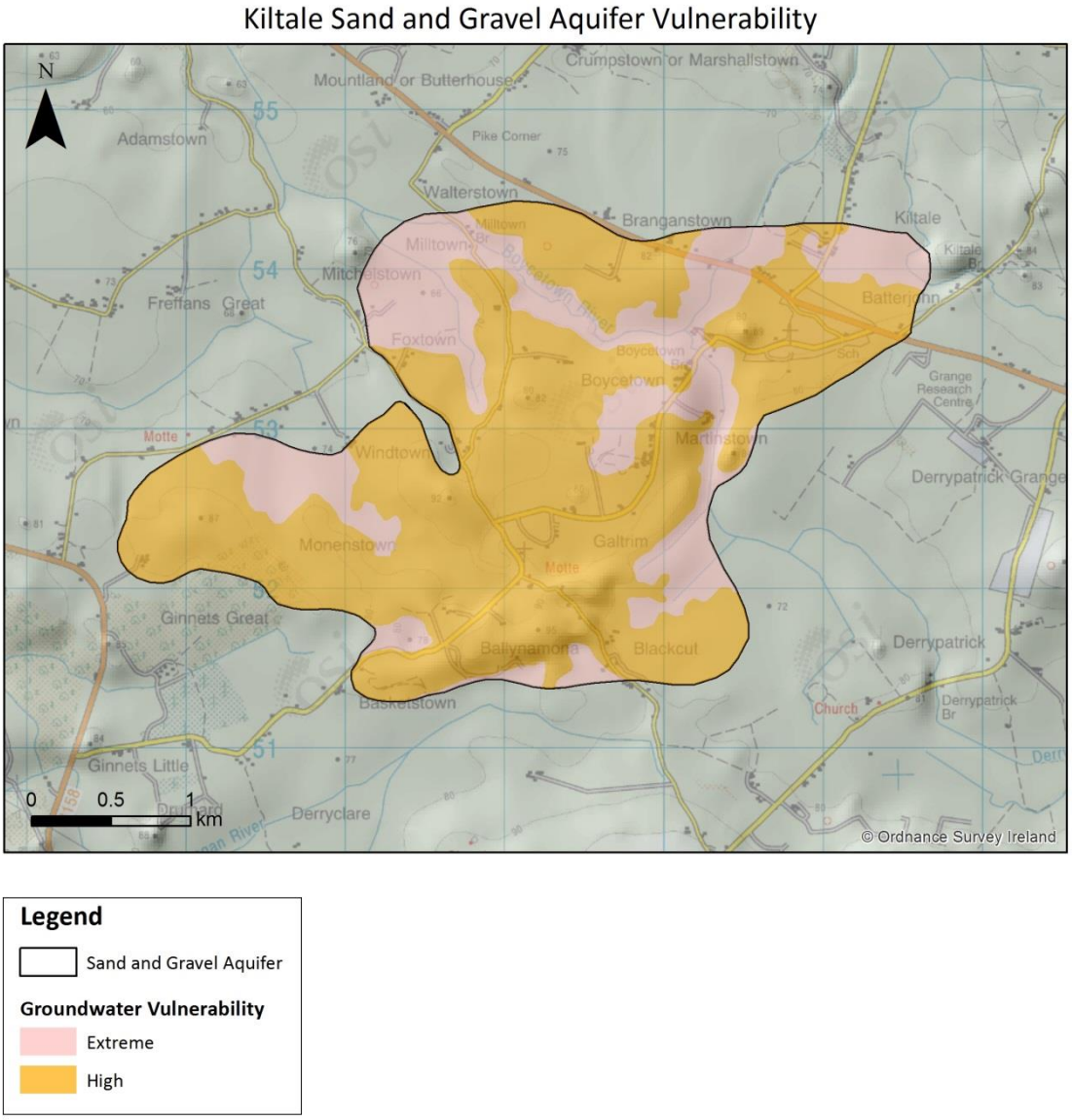

Figure 3: Groundwater vulnerability across the Kiltale Sand and Gravel Aquifer.