

Ardee GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
Hydrometric Area 06 Meath Co. Co. Louth Co. Co. Monaghan Co. Co. (small area)	Rivers: Garra, Dee, Glyde, Lagan. Lakes: Ballyhoe, Corstown Great, Brackan.	None identified (O’Riain, 2004)	109
Topography	Located around Ardee and Nobber (Figure 1), this approximately triangular-shaped GWB is bounded by less productive rocks to the east and west, karst aquifer to the north and a topographic divide to the southwest (Hydrometric Area 07). Elevations generally increase westwards (inland), ranging from c.40 mAOD in the flatter eastern area, to c.120 mAOD in the west, where drumlins are a topographic feature. Surface water generally flows eastwards, to eventually discharge into Dundalk Bay.		
	Geology and Aquifers	Aquifer categories	The vast majority (c.98%) of the GWB comprises LI : Locally important aquifer which is moderately productive only in local zones, with the remainder categorised as Lm : Locally important aquifer which is moderately productive.
Main aquifer lithologies		The main rock group in this GWB is the Dinantian Upper Impure Limestones (47.39%). The remaining groups flanking these are also of Dinantian age: Lower Impure Limestones (27.46%), early Sandstones, Shales and Limestones (22.79%) and a small area of Sandstones (2.35%). These are detailed in Table 1.	
Key structures		Deformation in this part of the county has resulted in these rocks forming part of a syncline feature, and predominantly dipping by 10-40° to a NW. There are a large number of faults throughout the GWB trending NE-SE over the eastern portion of the body and NW-SE over the western area.	
Key properties		<p>Yields from 12 wells in this GWB range from 12-1636 m³/d, averaging c.350 m³/d. Well yields may be influenced by the high degree of faulting in this body or by their close proximity with the more the productive Carrickmacross GWB (e.g. the highest yielding well). The 8 available specific capacity values range from 1.5-38 m³/d/m with an average of 11 m³/d/m. Generally, these rocks are expected to have relatively low transmissivity (<20 m²/d). However a transmissivity of 30 m²/d was estimated for the Nobber PWS*. This higher values may be influenced by faulted zones, especially in the coarser-grained rocks. The specific dry weather flow value is considered to be relatively low (0.4 l/s/km²), although it is higher than the down-gradient flows across less productive rocks (0.1-0.32 l/s/km²). Such values suggest that this aquifer does not make a significant baseflow contribution to streamflow. Storativity is also expected to be low.</p> <p>Just under half of the 21 available groundwater levels are <6 m below ground level, with the deepest level recorded at c.35 m bgl. The occurrence of deeper flows may be related to the faulting in the GWB. The fluctuation in one available water level record is limited – between 3.2 m and 5.5 m below ground.</p> <p>*The two Nobber PWS boreholes straddle the Carrickmacross/Ardee GWB boundary. However, due to the dip of the rocks, the Carrickmacross GWB borehole actually abstracts water from the underlying Upper Impure Limestones, which are a continuum of the Ardee GWB.</p> <p><i>(Dinantian Aquifer Chapters; Nobber Source Report)</i></p>	
Thickness		Most groundwater flux is likely to be in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3 m thick, a zone of interconnected fissuring 15-20 m thick, and a zone of isolated poorly connected fissuring typically less than 150 m. Water strikes are noted between 19-45 m bgl in 3 borehole although 2 of these may be influenced by their close proximity to the more productive Carrickmacross GWB.	
Overlying Strata	Lithologies	Till covers the majority of this GWB (c.78%), with small proportions of other subsoil types, such as peat (8%), alluvium (7%) and sand/gravel (7%).	
	Thickness	The available outcrop borehole data indicate that the subsoil is generally thicker (>3 m thick) throughout the GWB, with a few sporadic areas of outcrop/thin subsoil (<3 m thick). The thickest subsoil (>10 m) appears to be in the central region of the body.	
	% area aquifer near surface	<i>[Information will be added at a later date]</i>	
	Vulnerability	From the Meath GWPS, the vulnerability is predominantly Moderate around the centre of the GWB and High to the south. Smaller zones of Low vulnerability occur along the western and eastern boundary, where Low permeability material has been mapped. The areas of Extreme vulnerability are limited due to the generally thicker subsoil. This pattern is likely to continue into Louth.	
Recharge	Main recharge mechanisms	Diffuse recharge occurs via rainfall percolating through the subsoil and rock outcrops. Due to the low permeability of some subsoil deposits (e.g. thicker till) and the aquifers, a high proportion of the effective rainfall will quickly discharge to the streams in the GWB. In addition, steeper slopes in the drumlin areas will promote surface runoff. The relatively high stream density is likely to be influenced by both the lower permeability aquifers and subsoil.	

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	Est. recharge rates	<i>[Information will be added at a later date]</i>
Discharge	Large springs and high yielding wells (m³/d)	Sources: Nobber PWS (175 m ³ /d; 245 m ³ /d) Springs: None identified Excellent Wells: Ardee (1091 m ³ /d); Rolagh (1636 m ³ /d) Good Wells: Ardee (131 m ³ /d); Balrath (218 m ³ /d); College (268 m ³ /d); Julainstown (330 m ³ /d)
	Main discharge mechanisms	The main groundwater discharges are to the rivers and streams crossing the GWB, which reflect short groundwater flow paths. Small springs and seeps are likely to issue at the stream heads and along their course. A proportion of groundwater may also discharge to more productive, adjacent GWBs (e.g. Carrickmacross).
	Hydrochemical Signature	National classification: Dinantian Rocks (excluding Sandstones) Calcareous. Generally Ca- HCO ₃ signature. Alkalinity (mg/l as CaCO ₃): range of 10-990; mean of 283 (2454 data points) Total Hardness (mg/l): range of 10-1940; mean of 339 (2146 data points) Conductivity (µS/cm): range of 76-2999; mean of 691 (2663 data points) <i>(Calcareous/Non calcareous classification of bedrock in the Republic of Ireland report)</i>
	Groundwater Flow Paths	In the absence of inter-granular permeability, groundwater flow is expected to be concentrated in upper fractured and weathered zones and in the vicinity of fault zones. Available groundwater levels are mainly less than 15-20 m below ground level (c.50% <6 mbgl). Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to nearby streams and small springs. Water strikes deeper than the estimated interconnected fissure zone are limited suggesting that relatively shallow groundwater flow is dominant. Groundwater flow directions are expected to follow topography – overall in a easterly direction.
	Groundwater & Surface water interactions	Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is relatively low.

Conceptual model	<ul style="list-style-type: none"> Western, northern and eastern boundaries are differing aquifer types. The southwest boundary is marked by a topographic divide (Hydrometric Area 07). Drumlins occur in the central and western area although the topography flattens out the east. Surface water flows eastwards to eventually discharge into Dundalk Bay. The GWB is composed primarily of low transmissivity rocks. Most of the groundwater flux is likely to be in the uppermost part of the aquifer comprising: a broken and weathered zone typically less than 3m thick; a zone of interconnected fissuring typically less than 20 m; and a possible zone of isolated fissuring typically less than 150m. Recharge occurs diffusely through the subsoil and rock outcrops, although can be limited by thicker peat or till, and the low permeability bedrock. Therefore, most of the effective rainfall is not expected to recharge the aquifers. Flow paths are likely to be short (30-300 m) with groundwater discharging rapidly to the streams crossing the aquifer, and to small springs and seeps. Overall, the flow direction is expected to be to the east, as determined by the topography. A proportion of the Nobber PWS source protection area occurs in this GWB. 	
	Attachments	Figure 1. Figure 2. Table 1.
	Instrumentation	Stream gauges: 06025*, 06043, 06073 . * Adjusted dry water flow data available. EPA Water Level Monitoring boreholes: MEA148, MEA149 (possible not representative of rocks within this GWB) EPA Representative Monitoring points: LOU27, LOU57, MEA20, MEA148
	Information Sources	Geraghty, M., Farrelly, I., Claringbold, K., Jordan, C., Meehan, R., and Hudson, M., 1997. <i>Geology of Monaghan-Carlingford. A geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 8/9, Monaghan-Carlingford.</i> Geraghty, M. (ed.). Geological Survey of Ireland. 60 p. McConnell, B., Philcox, M. and Geraghty, M., 2001. <i>Geology of Meath: A geological description to accompany the bedrock geology 1:100,000 scale map series, Sheet 13, Meath.</i> With contributions from J. Morris, W. Cox, G. Wright, and R. Meehan. Geological Survey of Ireland. 77 p. O' Riain, 2004. <i>Water Dependent Ecosystems and Subtypes (Draft).</i> Compass Informatics in association with National Parks and Wildlife (DEHLG). WFD support projects. Woods, L., Meehan, R. and Wright, G. R., 1998. <i>County Meath Groundwater Protection Scheme.</i> Main report. Final report to Meath County Council. Geological Survey of Ireland. 54 p. Woods, L. (1998). <i>Nobber Water Supply; Groundwater Source Protection Zones.</i> Source Report. Final report to Meath County Council. Geological Survey of Ireland. Revised by Wright G.R. (2004).
	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. Location and Boundaries of GWB.

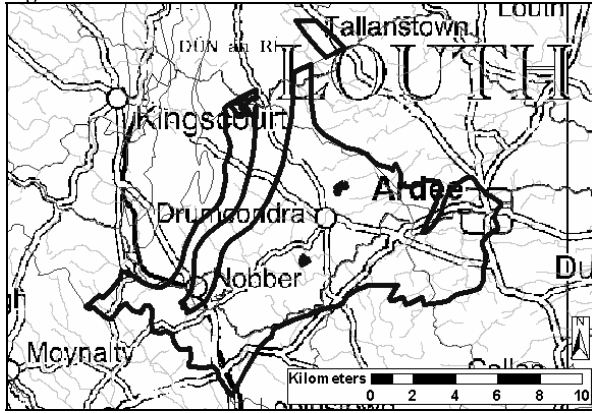


Table 1. List of Rock units in Ardee GWB

Rock Unit Name	Code	Description	Rock Unit Group	Aquifer Class.	% Area
Fingal Group (undiff.)	FNG	Dark limestone, shale and micrite	Dinantian Upper Impure Limestones	L1	47.39%
Cruicetown Group (undiff.)	CRT	Argillaceous bioclastic limestone	Dinantian Lower Impure Limestones	L1	27.46%
Navan Group (undiff.)	NAV	Limestone, mudstone and sandstone	Dinantian (early) Sandstones, Shales and Limestones	L1	22.79%
Sandstone	sd	Rockfield Sdst. Mbr in undif. Navan Gp	Dinantian Sandstones	Lm	2.35%

Figure 2: Groundwater hydrographs (EPA Groundwater Level Monitoring)

