

Manor Cunningham GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
Hydrometric Area 39 Donegal Co. Co.	Rivers: Dooballagh Burn, Corravaddy Burn, Swilly, Corkey. Streams: Leslie Hill Stream, 100 unnamed streams Lakes: None	Lough Swilly (O’Riain, 2004)	32
Topography	This NW-SE trending GWB (Figure 1) is bounded by lower productivity aquifers to the northeast and southwest. Lough Swilly forms the northern boundary and the southern boundary comprises a topographic divide (Hydrometric Area 01). The topography grades from low-lying, flat areas along the coast (<10 mAOD) and in the centre of the GWB to more hilly zones along the northeast and southwest boundaries c.170 mAOD. Drumlins occur in the centre of the body. Surface water predominantly flows northwards to discharge into Lough Swilly.		
	Geology and Aquifers	Aquifer categories	The entire GWB comprises LI : Locally important aquifer which is moderately productive only in local zones.
Main aquifer lithologies		This is categorised an independent GWB because it solely comprises Precambrian Marbles. It is noted that a band (13.87%) within the northeast boundary of the GWB is specifically noted as being ‘marble-rich’ (DGmb) whilst the remaining area (86.13%) is described as ‘marble, quartzite, psammite, graphitic’. Refer to Table 1 for details.	
Key structures		As part of an anticline feature, the marbles are dipping to the northeast. The angle of dip is unknown but is possibly around 20-30°. Intersecting the Marbles are 5 SW-NE trending faults.	
Key properties		<p>Yields in this particular area range from 7-1090 m³/d, averaging 308 m³/d for 9 wells. Transmissivity values of 11 and 12 m²/d have been calculated for the Magherabeg/Veagh WSS (2 wells located c.250 m away from each other within the ‘marble-rich’ unit), and specific capacity values are available for 5 wells (0.1, 0.4, 0.8, 31 and 82 m³/d/m). Interestingly, the highest 4 yields and 2 specific capacities are recorded for the wells within the ‘marble-rich’ unit.</p> <p>Although not within the same GWB, these rocks continue to the south (Hydrometric Area 01: Raphoe GWB). Yields in this GWB range from 2-330 m³/d (6 wells), with 2 specific capacity values of 4 and 165 m³/d/m. The same rocks are also found in Culdaff, which supply the Culdaff WSS: yield of 523 m³/d, transmissivity of c.110 m²/d, and specific capacity of 126 m³/d/m.</p> <p>Additionally it is noted that karstification may occur in these rocks e.g. Pollnapaste Cave at the mouth of the Gweebarra River, west Donegal (Parkes <i>et al</i>, 1999). A ‘fractured cavity’ recorded in the Culdaff WSS borehole log may also reflect some degree of dissolution. However, Faulkner (2000) does note that not all marble units appear to be susceptible to karstification.</p> <p>The Donegal data highlight that yields and transmissivities (calculated and implied) are variable and that there are productive zones in these rocks that may have been enhanced by karstification. However, transmissivity values are not generally expected to be high i.e. <20 m²/d, and storativity is also considered to be relatively low.</p> <p>Five groundwater levels are available: 0-5 m below ground level. The data are inadequate to calculate groundwater gradients however, given the relatively low permeability of the rock, these are expected to be relatively steep.</p> <p><i>(Precambrian Aquifer Chapter; Donegal GWPS; Magherabeg/Veagh Source Report; Culdaff Source Report)</i></p>	
Thickness		Most groundwater flux is expected 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 c.10 m thick, and a zone of isolated poorly connected fissuring typically less than 150 m. In this GWB, deeper water strikes are recorded in 3 wells, ranging from c.25-48 m below rock head, which reflect the third component of the groundwater flux.	
Overlying Strata	Lithologies	The GWB is predominantly covered till (77%), with a smaller proportion of alluvium (19%).	
	Thickness	Deep subsoil (>10 m thick) covers the central, low-lying, flat valley area, through the middle of this GWB. This rapidly becomes thinner moving away from the central area, until it is thin (<3 m) or absent along the southwest and northeast boundaries.	
	% area aquifer near surface	<i>[Information will be added at a later date]</i>	
	Vulnerability	From the Donegal GWPS, the zones along the southwest and northeast boundaries are classified as Extremely vulnerability. The thicker subsoil along the central axis of the body results in a Moderate vulnerability categorisation with the intervening area being classed as High.	
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 and the aquifers, a high proportion of the effective rainfall will quickly discharge to the streams in the GWB. Steep drumlin slopes will promote surface runoff. The reasonably high stream density is reflects the high proportion of surface runoff as opposed to recharge.	
	Est. recharge rates	<i>[Information will be added at a later date]</i>	

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Discharge	Large springs and high yielding wells (m³/d)	Sources: Magherabeg/Veagh WSS (450 m ³ /d and 382 m ³ /d). Excellent Wells: Magherabeg/Veagh (above); Tullybogly (1090 m ³ /d). Good Wells: Raymogh (327 m ³ /d, 333 m ³ /d); Doorabble (150 m ³ /d), Galdonagh Glebe (382 m ³ /d). Springs: None identified.
	Main discharge mechanisms	The main groundwater discharges are to the rivers and streams crossing the GWB, reflecting short groundwater flow paths. Small springs and seeps are likely to issue at the stream heads and along their course.
	Hydrochemical Signature	<i>National classification:</i> Precambrian Marbles Calcareous. Generally CaHCO ₃ signature. Alkalinity (mg/l as CaCO ₃): range of 112-428; mean of 274 (22 data points) Total Hardness (mg/l): range of 180-436; mean of 311 (22 data points) Conductivity (µS/cm): range of 414-814; mean of 667 (22 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, which may have some degree of karstification. Available groundwater levels are mainly 0-5 m below ground level. Unconfined 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 suggest a component of deep groundwater flow, however shallow groundwater flow is dominant. Groundwater flow directions are expected to follow topography i.e. generally to the north to discharge into Lough Swilly.
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"> • The southwest and northeast GWB boundaries comprise less productive aquifers. The body is bounded to the south by a topographic divide and to the north by coastline. Elevations range from sea level to 170 mAOD and drumlins are found in the central area. • The GWB is composed primarily of low transmissivity rocks, although there are more productive zones. 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 3 m thick; a zone of interconnected fissuring c.10 m; and a zone of isolated fissuring typically less than 150 m. • Recharge occurs diffusely through the subsoil and rock outcrops, although is limited by any thicker low permeability subsoil and bedrock. Therefore, most of the effective rainfall is not expected to recharge the aquifer. • 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 directions are expected to be to the north, as determined by the topography. 	
Attachments		Figure 1. Table 1.
Instrumentation		Stream gauges: 39014, 39017. EPA Water Level Monitoring boreholes: None identified. EPA Representative Monitoring points: DON43
Information Sources		Faulkner, T. (2000) <i>Caves in Metamorphic Limestones of the Irish Dalradian Supergroup</i> . Limestone Research Group, Department of Geographical Sciences, University of Huddersfield, Queensgate, Huddersfield, HD1 3DH, UK. From Irish Speleology 17, 2000, pp43-49. Lee M. and Fitzsimons V. (2004). <i>County Donegal Groundwater Protection Scheme</i> . Main Report. Draft Report to Donegal County Council. Geological Survey of Ireland 58pp. Lee M. and Daly D. (2004). <i>Magherabeg/Veagh Public Water Supply Scheme, Source Protection Zones</i> . Geological Survey of Ireland Report. Lee M. and Daly D. (2004). <i>Culdaff Water Supply Scheme, Source Protection Zones</i> . Geological Survey of Ireland Report. Long, C.B. and McConnell (1999) <i>Geology of South Donegal: A geological description, to accompany bedrock geology 1:100,000 scale map, Sheet 3, South Donegal</i> . With contributions by G.I. Alsop, P. O'Connor, K. Carlingford and C. Cronin. Geological Survey of Ireland, 116pp. O' Riain, G. 2004. <i>Water Dependent Ecosystems and Subtypes (Draft)</i> . Compass Informatics in association with National Parks and Wildlife (DEHLG). WFD support projects. Parkes, M., Johnston, D., Simms, M.J. and John G. Kelly (1999). <i>Geological guidance of speleogenesis in marble of the Dalradian Supergroup, County Donegal, Ireland</i> . Cave and Karst Science Vol. 26. No3. December 1999. Transactions of the British Cave Research Association.
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.

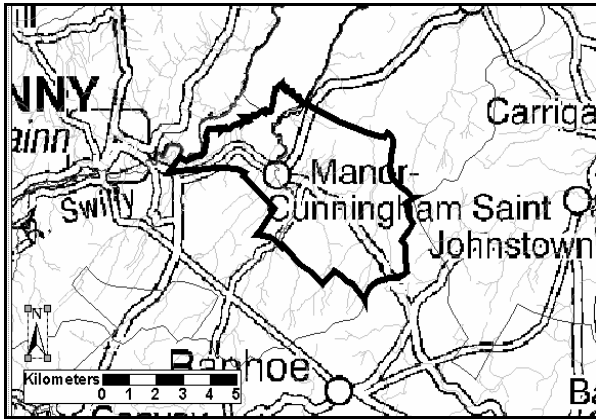


Table 1. List of Rock units in GWB

Rock Unit Name	Code	Description	Rock Unit Group	Aquifer Class.	% Area
Aghyaran & Killygordon Limestone Formtns	DG	Marble, quartzite, psammite; graphitic	Precambrian Marbles	L1	86.13%
Marble unit	DGmb	Marble-rich unit	Precambrian Marbles	L1	13.87%