Killygordon Marbles GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
Hydrometric Area 01 Donegal Co. Co.	***Rivers:*** Finn ***Streams:*** Cross Roads Stream ***Lakes:*** None identified.	River Finn (O' Riain, 2004)	18

Topography		Predominantly surrounded by lower productivity aquifers, this irregularly shaped GWB is elongated along a N-S axis (Figure 1). Only the southern boundary does not comprise a differing aquifer type, but instead is a topographic divide – part of the Lismullyduff Mountain (c.260 mAOD). The topography slopes down from this boundary towards the River Finn (<20 mAOD), which flows W-E across the central/northern part of the body. The topography rises again on the northern side of the valley. Surface water flow is mainly northwards, towards the R. Finn.
Geology and Aquifers	**Aquifer categories**	This is an independent GWB because it solely comprises **Ll:** Locally important aquifer which is moderately productive only in local zones.
	Main aquifer lithologies	The entire GWB is underlain by Precambrian Marbles. Refer to Table 1 for details.
	Key structures	The deformation in this part of Donegal has resulted in approximately SW-NE orientated faults delineating (northern boundary) and cutting (Laghy Fault) the GWB, and in the rock succession dipping by c.20-40° to the east.
	Key properties	Although there are minimal data in this particular GWB, information for this rock group exists locally and from other parts of County Donegal. Yields in the Raphoe GWB (c.2 km to the north) and the Manor Cunningham GWB (adjoining the Raphoe GWB) range from 2-1090 m^3/d with an average of 202 m^3/d (15 wells). Transmissivity values of 11 and 12 m^2/d have been calculated for the Magherabeg/Veagh WSS (Manor Cunningham GWB), and 7 specific capacity values are available for these 2 GWBs: 0.1, 0.4, 0.8, 4, 31, 82 and 165 $m^3/d/m$. Interestingly, the highest 4 yields and 2 specific capacities in the Manor Cunningham GWB are recorded for the wells within the 'marble-rich' unit. The same rocks are also found in Culdaff, which supply the Culdaff WSS: yield of 523 m^3/d, transmissivity of c.110 m^2/d, and specific capacity of 126 $m^3/d/m$. 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 *et al*, 1999). A 'fractured cavity' recorded in the Culdaff WSS borehole log may also reflect some degree of solution. However, Faulkner (2000) does note that not all marble units appear to be susceptible to karstification. Overall, 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 m^2/d, and storativity is also considered to be relatively low. Only 2 groundwater levels are available for this GWB: 1.5 and 5.6 m below ground level. Groundwater gradients are expected to be relatively steep, given the relatively low permeability of the rock. *(Precambrian Aquifer Chapter; Donegal GWPS; Magherabeg/Veagh Source Report; Culdaff Source Report*)
	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 10-15 m thick, and a zone of isolated poorly connected fissuring typically less than 150 m.
Overlying Strata	**Lithologies**	The GWB is predominantly covered till (83%), with small proportions of peat (8%) and alluvium (5%).
	Thickness	Outcrop and borehole data indicate that the central area of the GWB has thicker subsoil deposits (5-10 m thick), which grade to thin deposits (<3 m) and rock outcrops over the higher areas along the southern and northern boundaries, and to in the west of the GWB.
	% area aquifer near surface	*[Information will be added at a later date]*
	Vulnerability	From the Donegal GWPS, Extremely vulnerable areas are associated with the thinner subsoil deposits in the north, south and west. The remaining central and eastern area are Highly vulnerable, due to the thicker deposits. Small pockets of thicker peat have been categorised as Moderate.
Recharge	**Main recharge mechanisms**	Diffuse recharge occurs via rainfall percolating through the subsoil and rock outcrops. Due to the low permeability of the aquifers and some subsoil deposits, a high proportion of the effective rainfall will quickly discharge to the streams in the GWB. The reasonably high stream density is reflects the high proportion of surface runoff as opposed to recharge.
	Est. recharge rates	*[Information will be added at a later date]*

Discharge	**Large springs and high yielding wells (m^3/d)**	Sources: None identified. Excellent Wells: None identified. Good Wells: None identified. Springs: None identified.
	Main discharge mechanisms	Shallow groundwater is likely to discharge to most streams in the GWB, but the limited bedrock transmissivity means that the baseflow component of the total streamflow will be low. Small springs and seeps are likely to issue at the stream heads and along their course.
	Hydrochemical Signature	No available data within this particular GWB. ***National classification:*** 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) *(Calcareous/Non calcareous classification of bedrock in the Republic of Ireland report)*
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 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. Although there may be deeper water groundwater, shallow flow is expected to be dominant. Groundwater flow directions are expected to follow topography i.e. generally to the north to discharge into R. Finn.
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	• The GWB is bounded by less productive aquifers to the north, east and west. The southern boundary comprises a topographic divide. Elevations range from <20 mAOD along the Finn river valley, to c.260 mAOD along the southern boundary. • 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 less than 10-15 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:** 01045 **EPA Water Level Monitoring boreholes:** None identified. **EPA Representative Monitoring points:** None identified.
Information Sources	Faulkner, T. (2000) *Caves in Metamorphic Limestones of the Irish Dalradian Supergroup*. 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). *County Donegal Groundwater Protection Scheme.* Main Report. Draft Report to Donegal County Council. Geological Survey of Ireland 58pp. Lee M. and Daly D. (2004). *Magherabeg/Veagh Public Water Supply Scheme, Source Protection Zones.* Geological Survey of Ireland Report. Lee M. and Daly D. (2004). *Culdaff Water Supply Scheme, Source Protection Zones.* Geological Survey of Ireland Report. Long, C.B. and McConnell (1999) *Geology of South Donegal: A geological description, to accompany bedrock geology 1:100,000 scale map, Sheet 3, South Donegal*. With contributions by G.I. Alsop, P. O'Connor, K. Carlingford and C. Cronin. Geological Survey of Ireland, 116pp. Parkes, M., Johnston, D., Simms, M.J. and John G. Kelly (1999). *Geological guidance of speleogenesis in marble of the Dalradian Supergroup, County Donegal, Ireland.* Cave and Karst Science Vol. 26. No3. December 1999. Transactions of the British Cave Research Association. O' Riain, 2004. *Water Dependent Ecosystems and Subtypes (Draft)*. Compass Informatics in association with National Parks and Wildlife (DEHLG). WFD support projects.
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.

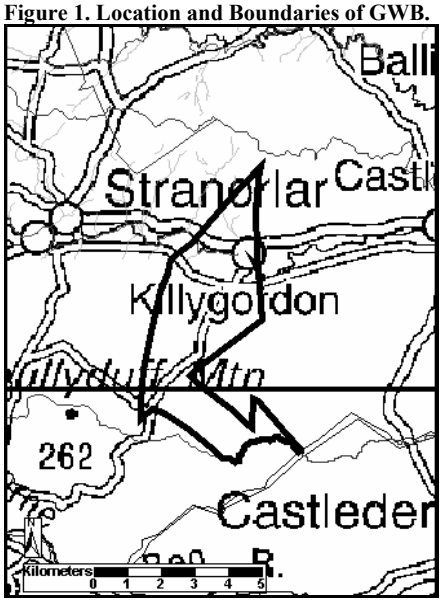

Table 1. List of Rock units in GWB

Rock Unit Name	Code	Description	Rock Unit Group	**Aquifer Class.**	% Area
Aghyaran & Killygordon Limestone Formtns	DG	Marble, quartzite, psammite; graphitic	Precambrian Marbles	Ll	100.00 %