

1st Draft River Foyle GWB Description – July 2004

River Foyle GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km ²)
Hydrometric Area 01 Donegal Co. Co. NI	Rivers: Carrigans, Deelee, Finn Streams: 124 unnamed streams Lakes: Port Lough	River Finn	134
Topography	This GWB (Figure 1) discharges surface water and groundwater directly to the R. Foyle, which constitutes its eastern boundary, as groundwater is unlikely to flow across this large river. The western boundary is a topographic divide (catchment divide between Lough Swilly and the Foyle), and the body is bounded by a different aquifer type to the south. Elevations range from <10 mAOD in the flat, low-lying valleys to 250 mAOD along the eastern boundary (Holywell Hill; Dooish Mountains). Surface water flows to the east.		
Geology and Aquifers	Aquifer type(s)	PI: Poor aquifer which is generally unproductive except for local zones is the only type of aquifer in this GWB.	
	Main aquifer lithologies	Precambrian Quartzites, Gneisses & Schists is the dominant rock group in the GWB (>99%). Refer to Table 1 for more details.	
	Key structures	As part of a regional-scale syncline fold, these rocks are generally dipping to the northwest by c.50°.	
	Key properties	Well yields (3) range from 9-30 m ³ /d and specific capacity values from 0.2-2.0 m ³ /d/m. Although there are no transmissivity data for the GWB, they are likely to be low, with the possibility of higher values in faulted zones, especially in the coarser-grained rocks (quartzites and gneisses). Specific dry weather flows for this rock group throughout Donegal are low (0.41-1.1 l/s/km ² at 5 stations), indicating that this aquifer does not make a significant baseflow contribution to streamflow. Storativity is also expected to be low. All 6 available groundwater levels are 0-11 m below ground level (4 levels are <3 mbgl). Although the data are inadequate to calculate groundwater gradients, these are expected to be relatively steep. <i>(Precambrian Aquifer Chapter; Donegal GWPS)</i>	
	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 10-15 m thick, and a zone of isolated poorly connected fissuring typically less than 150 m. Three deeper water strikes (33, 43 and 50 mbgl) have been recorded in 2 wells, although yields are low.	
Overlying Strata	Lithologies	Just under 80% of the GWB is covered by till, with a small proportion of alluvium (13%).	
	Thickness	In Donegal (GWPS data), subsoil thickness grades from absent or thin (<3 m) over the higher areas (Holywell Hill; Dooish Mountains) to thick (>10 m) in the valleys. This is also likely to represent the pattern occurring where no data are available (i.e. the small portion of the GWB that is within NI).	
	% area aquifer near surface	<i>[Information will be added at a later date]</i>	
	Vulnerability	From the Donegal GWPS, Extremely vulnerability areas are located on the higher ground, where subsoil is minimal. The remaining GWB range from High to Moderate vulnerability, as the subsoil becomes thicker toward the centre of the valleys.	
Recharge	Main recharge mechanisms	Diffuse recharge occurs via rainfall percolating through the subsoil and rock outcrops. Due to the low permeability of the aquifers, a high proportion of the effective rainfall will discharge to the streams in the GWB and to the River Foyle. Steeper slopes will also promote surface runoff.	
	Est. recharge rates	<i>[Information will be added at a later date]</i>	
Discharge	Large springs and high yielding wells (m³/d)	Sources: None identified. Springs: None identified. Excellent wells: None identified. Good wells: None identified.	
	Main discharge mechanisms	The main groundwater discharges are to the rivers and streams crossing the GWB, as well as directly to the R. Foyle, reflecting short groundwater flow paths. 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: Non-calcareous with bi-modal alkalinity distribution, although the higher range is possibly caused by thin marble bands. Alkalinity (mg/l as CaCO ₃): range of 14-400; mean of 168 (41 'non limestone subsoils' data points) Total Hardness (mg/l): range of 46-412; mean of 200 (39 'non limestone subsoils' data points) Conductivity (µS/cm): range of 160-752; mean of 446 (45 'non limestone subsoils' data points) <i>(Calcareous/Non calcareous classification of bedrock in the Republic of Ireland report)</i>	

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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. Groundwater level data points are mainly <6 m below ground level. Unconfined groundwater flow paths are short (30-300 m), with groundwater generally following the topography and then discharging rapidly to seeps, small springs and streams. Water strikes are only marginally deeper than the estimated interconnected fissure zone and are associated with low yields. Shallow flow is more likely to be dominant. Overall, groundwater flow is eastwards, towards the R. Foyle.
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 western GWB boundary is a topographic divide. The southern boundary represents a change in aquifer type and the eastern boundary is the R. Foyle. The topography comprises large areas of low-lying, flat valleys, with steeper hilly areas in between. • 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 expected to be less than 10-15m; and a zone of isolated fissuring less than 150m. • Recharge occurs diffusely through the subsoils and outcrops, although is limited by the low permeability 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 direction is towards the east.
Attachments	Figure 1. Table 1.
Instrumentation	Stream gauge: 01013, 01047, 01053 EPA Water Level Monitoring boreholes: None EPA Representative Monitoring boreholes: None
Information Sources	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. Long, C.B. & McConnell B.J. (1997) <i>Geology of North Donegal: A geological description to accompany bedrock geology 1:100,000 scale map, Sheet 1 and part of Sheet2, North Donegal</i> . With contributions from P. O'Connor, K. Claringbold, C. Cronin and R. Meehan. Geological Survey of Ireland. 87pp. O' Riain, 2004. <i>Water Dependent Ecosystems and Subtypes (Draft)</i> . 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
Lough Foyle Succession	LFS	Schist and grit with thin marble units	Precambrian Quartzites, Gneisses & Schists	PI	94.53%
Lifford Volcanic Member	DGl _v	Volcaniclastic green beds	Precambrian Quartzites, Gneisses & Schists	PI	3.20%
Metadolerite	Md	Hornblendic and sometimes schistose	Precambrian Quartzites, Gneisses & Schists	PI	1.07%
Claudy Formation	CY	Psammite, pebbly grit, quartzite, marble	Precambrian Quartzites, Gneisses & Schists	PI	0.95%
Culmore Formation	CM	Sandstone with quartz pebbles, mudstone	Dinantian Mixed Sandstones, Shales and Limestones	LI	0.18%
Marble unit	DGmb	Marble-rich unit	Precambrian Marbles	LI	0.07%