

*1<sup>st</sup> Draft South Donegal GWB Description – July 2004*

**South Donegal GWB: Summary of Initial Characterisation.**

Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km <sup>2</sup> )
Hydrometric Area 37  Donegal Co. Co.	<b>Rivers:</b> Ballintra, Bridgetown, Cloghanmore, Clogher, Corabber, Crow, Cunlin, Lough Stream, Drumenny, Eany Beg Water, Eany More Water, Eglishe, Eske, Fintragh, Glen (Carrick), Glendarragh, Laghy Stream, Loughadeery, Lowerymore, Oily, Owenteskiny, Owenwee (Carrick), Stragar, Tullinteane. <b>Streams:</b> 1920 unnamed streams <b>Lakes:</b> see list below *	Croaghonagh bog, Lough Eske and Ardanamona Wood, Lough Nillan Bog (Carrickatlieve), Meenaguse/Ardbane Bog, Slieve League, Slieve Tooley/Tormore Island/Loughros Beg Bay, Dunragh Loughs/Pettigo Plateau and River Finn (O’Riain, 2004)	532
<b>Topography</b>	Covering much of south Donegal, this irregularly shaped GWB is bounded to the southwest by the coastline. The northern, eastern and south-eastern boundaries comprises topographic divides (Hydrometric Areas 38, 01 and 36), and the central-southern boundary is marked by more productive aquifers. There are two distinct landscape units: i) lower lying, drumlin (SW-NE trending) dominated terrain to the east, and ii) more mountainous, upland zones in the west, and along the northern and eastern boundaries. Typical inter-drumlin elevations range from 30-90 mAOD, becoming higher further inland. The drumlins are generally an additional 40-60 m higher. Elevations in the west range from <10mAOD at the coast to 600-700 mAOD along the northeast boundary. Surface water flow is both southwards and eastwards, towards the coast.		
<b>Geology and Aquifers</b>	<b>Aquifer type(s)</b>	The majority of the GWB (c.90%) comprises <b>Pl</b> : Poor aquifer which is generally unproductive except for local zones, although just under 10% in the east is categorised as <b>Ll</b> : Locally important aquifer, moderately productive only in local zones. There are also a number of smaller units of <b>Pu</b> : Poor aquifer, generally unproductive.	
	<b>Main aquifer lithologies</b>	Precambrian Quartzites, Gneisses & Schists dominate this GWB (82.97%) with an area of Dinantian Lower Impure Limestones trending N-S in the south (8.14 %), and a smaller area of Granites & Other Igneous Intrusive Rocks along the northeast boundary (4.98%). Other smaller units include Dinantian Age rocks (1.52%), Old Red Sandstones (1.61%) and Precambrian Marbles (0.78%). Refer to Table 1 for details.	
	<b>Key structures.</b>	The rocks in this part of Donegal have been significantly deformed, resulting in a large number of approximately SW-NE faults e.g Slieve League, Ballaghdoe, Barneslough, Barnesmore and Laghy Faults. Dips in the rock succession are variable: ranging from 20-70°, and to the N, NE, E and SE. There are also a number of anticline and syncline folds.	
	<b>Key properties</b>	The 17 available yields for the Precambrian rocks range from 9-218 m <sup>3</sup> /d, with 12 yields <50 m <sup>3</sup> /d. Three specific capacity values are also available: 4.5, 4.8 and 28.4 m <sup>3</sup> /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). Transmissivity values for similar granites in the Leinster region range from 20-30 m <sup>3</sup> /d. A specific dry weather flow of 0.96 l/s/km <sup>2</sup> exists for the Precambrian rocks, indicating these aquifers do not make a particularly large baseflow contribution to streamflow. Storativity is also expected to be low, as would also be expected for the other rock groups.  60% of the 36 groundwater levels are 0-5 m below ground level. The data are inadequate to calculate groundwater gradients however, these are expected to be relatively steep.  <i>(Precambrian Aquifer Chapter; Granites Aquifer Chapter; Donegal GWPS)</i>	
	<b>Thickness</b>	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 m thick, and a zone of isolated poorly connected fissuring typically less than 150 m. Deeper water strikes are recorded between 32-70 m bgl in 7 boreholes. This suggests some deeper flow component, although it is likely to be limited.	
<b>Overlying Strata</b>	<b>Lithologies</b>	The GWB is predominantly covered by peat subsoil (62%) with smaller proportions of till (18% – more prevalent in the lower-lying areas), and mapped rock outcrop (17%).	
	<b>Thickness</b>	Subsoil is absent or thin over much of the GWB, especially on the higher areas. Generally, thicker deposits (>3 m) are evident in the narrow valleys and thicker peat is likely to occur in the western region. In the east, each drumlin represents a thicker till deposit, frequently >10 m thick, with rock near the surface of the inter-drumlin areas.	
	<b>% area aquifer near surface</b>	<i>[Information will be added at a later date]</i>	
	<b>Vulnerability</b>	From the Donegal GWPS, vulnerability ranges from Extreme over the higher areas, to Moderate in the thicker peat and valleys areas, and Low over the thick drumlin deposits.	
<b>Recharge</b>	<b>Main recharge mechanisms</b>	Diffuse recharge occurs via rainfall percolating through the thinner/more permeable subsoil and rock outcrops. Due to the low permeability of the thicker drumlin and peat subsoil deposits and the aquifers themselves, a high proportion of the effective rainfall will discharge to the streams in the GWB. In addition, the steeper mountain and drumlin slopes will promote surface runoff. The high stream density is likely reflect the lower permeability rocks, as well as the subsoil.	
	<b>Est. recharge rates</b>	<i>[Information will be added at a later date]</i>	

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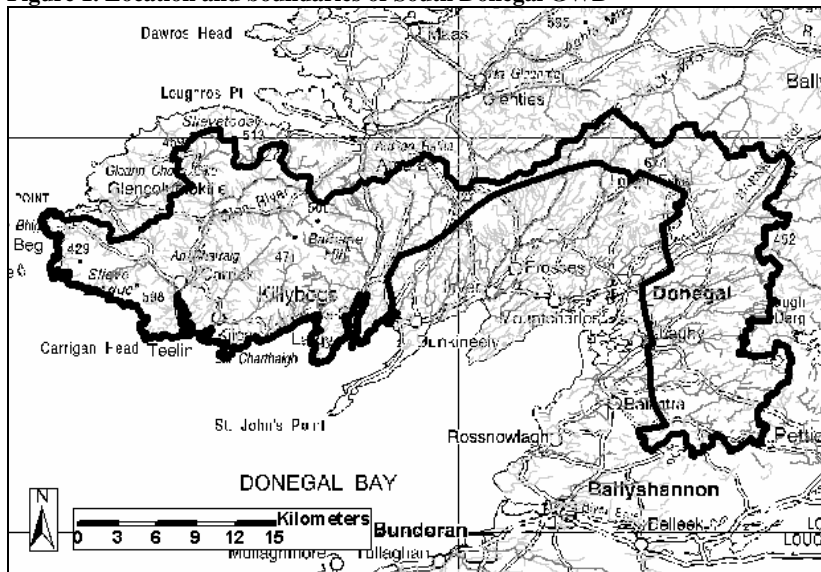
<b>Discharge</b>	<b>Important springs and high yielding wells</b>	<p>Springs: Some low yielding springs used as public supplies e.g. Carrick-Teelin Public Supply (240 m<sup>3</sup>/d). Sources: None identified. Excellent Wells: None identified. Good Wells: Largybrack (218 m<sup>3</sup>/d), Meenaneary (175 m<sup>3</sup>/d), Ballymoon (153 m<sup>3</sup>/d), Kilcar (130 m<sup>3</sup>/d, 110 m<sup>3</sup>/d).</p>
	<b>Main discharge mechanisms</b>	<p>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. Seepages will develop on the coastal cliff faces. Groundwater may also flow into the adjacent, higher permeability GWBs e.g. Inver-Banagherhill (Lm aquifer), and Donegal-Ballintra (Rk<sup>d</sup> aquifer).</p>
	<b>Hydro-chemical Signature</b>	<p>No available data within this particular GWB. <i>National classification:</i> Non-calcareous with bi-modal alkalinity distribution although the higher range is possibly caused by thin marble bands and overlying limestone subsoil. Alkalinity (mg/l as CaCO<sub>3</sub>): 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></p>
<b>Groundwater Flow Paths</b>		<p>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 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 thought to dominant. Groundwater flow directions are expected to follow topography – both southwards and eastwards.</p>
<b>Groundwater &amp; surface water interactions</b>		<p>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.</p>
<b>Conceptual model</b>	<ul style="list-style-type: none"> <li>• Northern, eastern and south-eastern boundaries are topographic divides with the southwest bounded by coastline and the central-south boundary comprising more productive aquifers. The terrain over the western region and along northern and eastern boundaries is characteristically hilly to mountainous cut by deep, narrow valleys. The eastern part of the GWB is dominated by drumlins, which have a general SW-NE orientation.</li> <li>• 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 3 m thick; a zone of interconnected fissuring typically less than 10 m; and a zone of isolated fissuring typically less than 150 m.</li> <li>• Recharge occurs diffusely through the thin/permeable subsoil and rock outcrops, although is limited by any thicker till/peat and the low permeability bedrock itself. Therefore, most of the effective rainfall is not expected to recharge the aquifers.</li> <li>• 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 south and east, as determined by the topography.</li> </ul>	
<b>Attachments</b>		Figure 1. Table 1.
<b>Instrumentation</b>		<p><b>Stream gauges:</b> 37003, 37004, 37005, 37006, 37007, 37011, 37012, 37014, 37020*, 37021, 37070, 37071, 37073. * adjusted dry water flow data available <b>EPA Water Level Monitoring boreholes:</b> None identified. <b>EPA Representative Monitoring points:</b> None identified.</p>
<b>Information Sources</b>		<p>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.</p> <p>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.</p> <p>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.</p>
<b>Disclaimer</b>		Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

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**\* Lakes:**

Barnes Lough, Birchhill Lough, Black Lough, Breen Lough, Cormullin Lough, Craigroe Lough, Croagh Lough, Croaghanmeal Lough, Croaghonagh Lough, Croleavy Lough, Cullionboy Lough, Cunlin Lough, Dunragh Beg Lough, Dunragh Lough, Dunragh Middle Lough, Durlough, Fannia Lough, Garlagh Lough, Glasskeeragh Lough, Golard Lough, Hugh Boyle's Lough, Illanmore Lough, Lake Alaban, Lake Namanfin,	Lough Acarnan, Lough Achallan, Lough Achully, Lough Aderry, Lough Agh, Lough Aguse More West, Lough Alaban, Lough Alagh, Lough Alowney, Lough Amarla, Lough Amincheen, Lough Anabosin, Lough Anabrack, Lough Anaddy, Lough Anarget, Lough Ancarn, Lough Ankeeran, Lough Anore, Lough Ariddoge, Lough Aroshin, Lough Aruddy, Lough Ascolta, Lough Asgartha, Lough Asmullan,	Lough Atannia, Lough Atlieve, Lough Auva, Lough Awillin, Lough Belshade, Lough Boyle, Lough Brockagh, Lough Cronagorma, Lough Cuill, Lough Cullion, Lough Divna, Lough Doo, Lough Doo Beg, Lough Doo More, Lough Eske, Lough Fad, Lough Farlaggy, Lough Folla, Lough Garlagh More, Lough Geeta, Lough Gillaganliany, Lough Gulladuff, Lough Keerari, Lough Kib,	Lough Lagan, Lough Leabane, Lough Lilly, Lough Mardal, Lough Meenanea, Lough Meenaviller, Lough Naboy, Lough Nabrackbautia, Lough Nabrackboy, Lough Nabrackdeelan, Lough Nabrackmore, Lough Nabradan, Lough Nabreen, Lough Nacollum, Lough Nacroagh, Lough Nacroaghy, Lough Nacrow, Lough Nadarragh, Lough Nadrooa, Lough Nageage, Lough Nagolan, Lough Nagrockgranagh, Lough Nahoory, Lough Nalugraman,	Lough Namaddy, Lough Nambraddan, Lough Namealtoge, Lough Narath, Lough Nashane, Lough Nasheeoge Lough Natragh, Lough Naweeloge, Lough O' Muilligan, Lough Reagh, Lough Robin, Lough Sallagh, Lough Shivnagh, Lough Slug, Lough Tamur, Lough Unna, Lough Unshagh, Lougheraherk, Loughinisland, Meenadreen Lough, Meenaguse Lough, Meenawley Lough, Miley's Lough, Rath Lough, Tamur Lough.
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**Figure 1. Location and boundaries of South Donegal GWB**



**Table 1. List of Rock units in South Donegal GWB**

Rock Unit Name	Code	Description	Rock Unit Group	Aquifer Class.	% Area
Termon Formation	TE	Banded semi-pelitic & psammitic schist	Precambrian Quartzites, Gneisses & Schists	PI	30.10%
Slieve League Formation	SL	Flaggy quartzite and dark schist	Precambrian Quartzites, Gneisses & Schists	PI	14.98%
Lough Mourne Formation	LM	Quartz & feldspar pebbles, green matrix	Precambrian Quartzites, Gneisses & Schists	PI	11.29%
Psammitic paragneiss	SWQ	Granoblastic quartzofeldspathic psammite	Precambrian Quartzites, Gneisses & Schists	PI	11.11%
Argillaceous limestones & calc. shales	BSag	Argillaceous limestones & calc. shales	Dinantian Lower Impure Limestones	L1	8.14%
Slieve Tooley Quartzite Formation	ST	Whitish quartzite with pebble beds	Precambrian Quartzites, Gneisses & Schists	PI	5.83%
G2 variety	BaG2	main granite (adamellite)	Granites & other Igneous Intrusive rocks	PI	3.03%
Lough Eske Psammite Formation	LE	Feldspathic psammite; quartzite, marble	Precambrian Quartzites, Gneisses & Schists	PI	2.76%

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Rock Unit Name	Code	Description	Rock Unit Group	Aquifer Class.	% Area
Croaghgarrow Formation	CW	Schist and aluminous schist	Precambrian Quartzites, Gneisses & Schists	Pu	2.02%
G3 varieties of sheet complex	BaG3	Leucogranite and porphyritic aplogranite	Granites & other Igneous Intrusive rocks	Pl	1.62%
Edergole Formation	ED	Conglomerate, sandstone, siltstone	Devonian Old Red Sandstones	Ll	1.61%
Metadolerite	Md	Hornblendic and sometimes schistose	Precambrian Quartzites, Gneisses & Schists	Pl	1.59%
Mullyfa and Deele Formations	MF	Psammite, pebble beds, marble, schist	Precambrian Quartzites, Gneisses & Schists	Pl	0.80%
Gaugin Quartzite Formation	GA	Pale quartzite, pebble beds, rare schist	Precambrian Quartzites, Gneisses & Schists	Pl	0.63%
Malin Schist Formation	MS	quartzofeldspathic & micaceous psammite	Precambrian Quartzites, Gneisses & Schists	Pu	0.59%
Basal sandstones	BSbc	limestones & shales	Dinantian (early) Sandstones, Shales and Limestones	Ll	0.57%
Aghyaran & Killygordon Limestone	DG	Marble, quartzite, psammite; graphitic	Precambrian Marbles	Pl	0.56%
Rinn Point Limestone Formation	RP	Dark fine calcarenite & calcareous shale	Dinantian Upper Impure Limestones	Ll	0.47%
Basal clastics	RPbc	Basal clastics	Dinantian Sandstones	Ll	0.43%
Lower Crana Quartzite Formation	LC	Psammitic schist, some marble beds	Precambrian Quartzites, Gneisses & Schists	Pl	0.43%
Port Askaig Formation	PA	Diamictite, schist & quartzite	Precambrian Quartzites, Gneisses & Schists	Pu	0.40%
Glencolumbkille Pelite Formation	GP	Black graphitic pelitic schist	Precambrian Quartzites, Gneisses & Schists	Pu	0.35%
Appinite suite	Ap	undifferentiated	Granites & other Igneous Intrusive rocks	Pl	0.22%
Glencolumbkille Limestone Formation	GL	Dolomitic marble & semi-pelitic schist	Precambrian Marbles	Pl	0.21%
Microgranite and related rocks	mGr	Porphyritic & non-porphyritic sheets	Granites & other Igneous Intrusive rocks	Pl	0.06%
Muckros Sandstone Formation	MK	Calcareous sandstone & sandy oolite	Dinantian Sandstones	Lm	0.06%
Tectonic schist	ts	Mylonitic	Precambrian Quartzites, Gneisses & Schists	Pl	0.05%
Thorr Granite	Th	Coarse grained monzogranite to tonalite	Granites & other Igneous Intrusive rocks	Pl	0.05%
Quartzite	qz	Quartzite	Precambrian Quartzites, Gneisses & Schists	Pl	0.03%
Appinite suite intrusive breccia	Ab	Wallrock in appinitic matrix	Precambrian Quartzites, Gneisses & Schists	Pl	0.02%
Marble	mb	Marble	Precambrian Marbles	Pl	0.01%