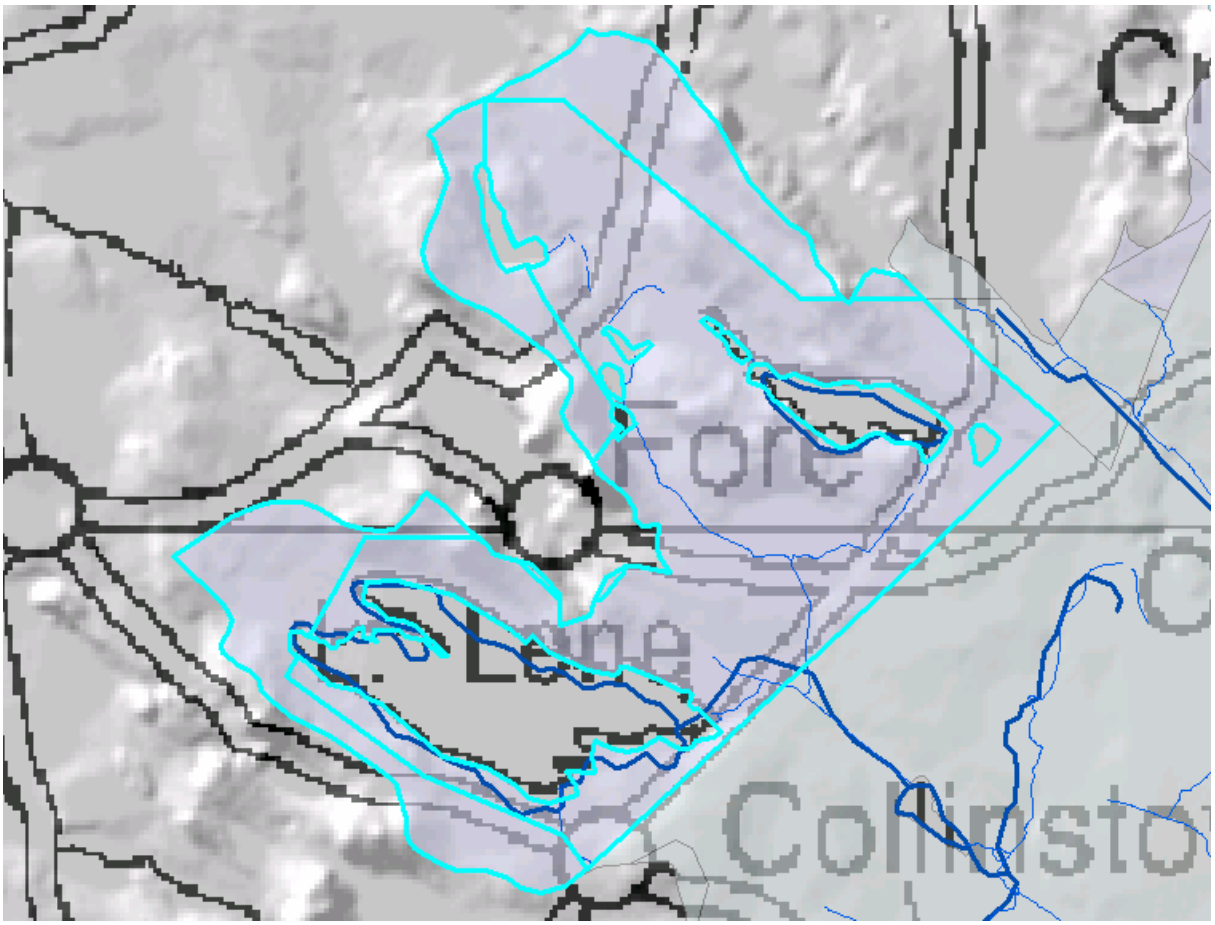
Lough Lene GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority		Associated surface water bodies	Associated terrestrial ecosystems	Area (km^2)
Westmeath Co. Co. Meath Co. Co. Hydrometric Area 07		**Rivers**: Only small streams present. **Loughs**: Lene, Bane, Glass, Ben (North, South & Middle), Carrick, Oldtown, Rushy, White, Bogwood, Doo, Nenagh.	White Lough, Lough Ben & Lough Doo (1810), Lough Nenagh (1814), Lough Lene (SAC - 2121), Lough Bane (2120)	29
Topography		The topography has a very pronounced NW to SE orientation. This is clear from the elongate hills with their long axis in this direction, the highest of which are Ben Knockcurreen (180 m OD) and Ben Fore (216 m OD) The elevations fall away from these hills towards the various lakes which lie at an elevation of roughly 105m OD. The hills have a limestone core with glacial till smeared over them. Glacier movements determined the current elongated shape of the hills, depositing glacial material on the lee side of the hill. This can be seen in the steep side of the hills facing northwest (i.e. towards the direction of glacial advance) and a gentler slope to the southeast. Probably these hills were initially more conical feature as is common in Cone Karst regions (see Ford & Williams 1988).		
Geology and Aquifers	Aquifer type(s) Main aquifer lithologies	The classification of this aquifer is uncertain until more research has been conducted in the area, although at present they are considered to be an **Lm Aquifer:** Locally important aquifer, generally moderately productive. Derravaragh Cherts, considered to be a part of the Dinantian Upper Impure Limestone Group.		
	Key structures.	The faults in this area are orientated from NW to SE.		
	Key properties	No information is available on the hydrogeological properties (transmissivity or storativity) of this aquifer. It is considered that the transmissivity could be high in certain areas where there is a connected fracture network which contains solutionally enlarged conduits. The storativity, as in most karst aquifers, is expected to be low.		
	Thickness	The thickness of the aquifer is uncertain. In karstic aquifers is it possible to have groundwater flow in conduits to depths of 100m below ground. More commonly, most groundwater flow will take place in the upper 30m of the rock where fractures are more likely to be both open and connected, but deeper water strikes in cavities are possible.		
Overlying Strata	Lithologies	Predominantly limestone-derived till, with some gravel deposits in places and some chert-derived till also present. The Ballany Gravel GWB overlies this area to the north. This deposit contains clean, coarse esker & fan gravels.		
	Thickness	Subsoil thickness considered to be very variable. Thin subsoils and outcrop can be expected on the top and slopes of the hills and thicker deposits in the valleys and surrounding the lakes. There is borehole evidence of 40m of sand/gravel deposits at Martinstown. These boreholes are located on the foot of the slopes of one of the hills to the east of Lough Bane.		
	% area aquifer near surface	Moderate ~ 20%		
	Vulnerability	Vulnerability is generally High with areas of Extreme where subsoil thins on the hilly slopes.		
Recharge	Main recharge mechanisms	Water enters this aquifer by point and diffuse recharge. In karstic limestone it is possible for large amounts of water to enter the aquifer by point recharge where dissolution of the limestone has opened up fractures in the rock. Rainwater can enter the aquifer directly at enclosed depressions or at swallow holes. Two such swallow holes are recorded in this GWB: on the eastern edge of Lough Lene, near Cummerstown, and also on the Western side of Lough Bane, near Carrick. Diffuse recharge is more widespread but subsoils overlying the aquifer will restrict the percolation of water into the bedrock. Therefore the highest amounts of diffuse recharge will occur at and around rock outcrop and where subsoils are thinnest and most permeable. In this instance the gravel deposits are considered to be most permeable.		
	Est. recharge rates	*[Information will be added at a later date]*		
Discharge	Springs and large known abstractions	Ballinlough (Spring – Abstraction is $2500m^3/d$).		
	Main discharge mechanisms	This aquifer will discharge to the surface water features overlying the GWB. There may also be discharge as springs along the geological boundary with the less permeable limestones to the southeast. Evidence indicates discharge from this aquifer across the RBD boundary towards springs located near the village of Fore in the Shannon RBD. Tracer tests have shown an underground connection between the two localities, which is not yet fully understood.		
	Hydrochemical Signature	There are no hydrochemical data available for this GWB. Analogy with other limestones would suggest calcium-bicarbonate signature hard waters with high electrical conductivity values.		

Groundwater Flow Paths	Groundwater flow in this aquifer should be in the direction of falling topographic gradient, which overall is to the southeast. A contradiction to this, as stated previously, suggests groundwater flow through karst conduits into the Shannon RBD. It is not uncommon for Karstic systems to have completely different groundwater flow direction at different water level elevations. As water level rises and falls, different conduits become active or inactive. The direction/dip of such conduits will determine the direction of flow of the groundwater, which may be in complete contradiction to the topographic slope. It is also possible that the noted chert layer could restrict flow and the development of enlarged conduits in certain directions at different levels. The nature of groundwater flow will depend on the degree of karstification of the limestone. Where the aquifer is heavily karstified groundwater flow will be concentrated along a few enlarged conduits. Elsewhere groundwater flow will be though a series of connected fractures and there will be higher flows in the shallower portions of the rock.
Groundwater & surface water interactions	Groundwater and surface water are closely linked in this GWB. The presence of swallow-holes and springs show areas where there is a direct link between the surface water and groundwater. Also many of the lakes in this area are fed by groundwater and are often termed "spring lakes". These lakes have high calcium content as is expected from water that has traveled through limestones. There are important protected ecological areas e.g. fens and wet woodlands, surrounding the lakes, which are considered to be dependent on groundwater.
Conceptual model	This GWB is located in the area near Fore Co. Westmeath. The boundaries of the body are defined to the southeast by the geological contact between the Derravaragh Cherts and the impure limestones of the Lucan Formation (Calp). Elsewhere the GWB boundary is defined by the topographic boundary between the Eastern and Shannon RBDs. This boundary may be called into question due to evidence that groundwater is discharging from this GWB to the springs at Fore, in Shannon RBD. The area contains a number of elongate hills, oriented in a NW-SE direction, which have a limestone core with glacial till smeared over it. The GWB is composed of karstified limestone, which may be highly permeable in some areas. Most groundwater flow will occur along fractures and joints in the upper 30m of the rock. The topographic slope in the area will determine groundwater flow directions in the shallower areas of the rock. The flow in deeper karst conduits pays less attention to topography and can flow against topographic gradients (i.e. uphill – one of the "Seven Wonders of Fore") but will always flow in the direction of reducing hydraulic gradient. Recharge occurs diffusely through the thin subsoils and outcrops on the hill and also directly into the rock at swallow holes. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability. Discharge from the GWB will be to the overlying rivers, springs and in some cases to the lakes.
Attachments	
Instrumentation	Stream gauge: 07072, 07075, 07074 Borehole Hydrograph: None EPA Representative Monitoring boreholes: None
Information Sources	McConnell B, Philcox M & Geraghty M, 2001. *Geology of Meath: A geological description to accompany the bedrock geology 1:100,000 scale map series, Sheet 13, Meath*. Geological Survey of Ireland. 77 p. Woods L, Meehan R & Wright G R, 1998. *County Meath Groundwater Protection Scheme*. Final report to Meath County Council. Geological Survey of Ireland. 54 p.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Formation Name	**Code**	**Description**	**Rock Unit Group**	**Aquifer Classification**
Derravaragh Cherts	DV	Cherty limestone, minor shale	Dinantian Upper Impure Limestones	Lm?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Fore
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