Glencar GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
35 Sligo/ Leitrim Co. Co.	**Rivers**: Owenmore, Shanvaus, Bonet. **Lakes**: Posey, Glenade, Agu, Agow, Nabrack, Aganny.	Glenade Lough (001919), Bonet River (001404), Benbulben, Gleniff and Glenade Complex (000623).	74

Topography	The GWB occupies an area north of Glencar lough, stretching from Benbulben to the main Manorhamilton-Rossinver road. It is mostly an upland area with the exception Glenade valley. Elevations range from 70-643 mAOD (Truskmore). It is bounded to the north by an upland area which includes the catchment divide between the Borders and the Western RBD areas. The Glenade and the Drumcliff GWB's bound the GWB to the northeast and south. The main drainage is to the south and southeast. Figure 1 shows the location and boundaries.	
Geology and Aquifers	**Aquifer categories**	**Rk^c:** Regionally important karstified aquifer dominated by conduit flow. The 'c' signifies conduit flow. **Ll:** Locally important aquifer, moderately productive only in local zones.
	Main aquifer lithologies	Dinantian Pure Bedded Limestones, Dinantian Pure Unbedded Limestones, Dinantian Upper Impure Limestones, Dinantian Shales and Limestones.
	Key structures	The GWB is located between three major fault zones: the Ox Mountains – Pettigoe Fault to the southeast, Rosses Point-Cuilcagh Fault zone to the south, Grange Fault zone to the north and north west. A NW-SE trending fault cuts through the Glenade valley. Apart from the faults the rocks are relatively undeformed and maintain a layer-cake stratigraphy, with the beds gently dipping.
	Key properties	Karstification is widespread throughout as evidenced by the swallow holes, enclosed depressions and caves recorded in the area (Coleman, 1965). They are considered to represent only a fraction of existing features. Transmissivities are expected to be variable, ranging from 1 to greater than 2000 m^2/d. Storativity is likely to be low - approximately 0.01-0.02. Similar groundwater velocities and gradients to those in the Bricklieve area are expected. Tracer tests were carried out in the Bricklieve upland karst area, and groundwater velocities of 25-51 m/hr were recorded (Thorn *et al*, 1990). Groundwater gradients in the Bricklieve upland karst area range from 0.019 to 0.075. General flow directions are likely to be from north to south.
	Thickness	Most groundwater is expected to be in an epikarstic layer a couple of metres thick and in a zone of interconnected solutionally-enlarged fissures and conduits that extends approximately 30 m below this. Deeper inflows can occur in areas associated with faults or dolomitisation.
Overlying Strata	**Lithologies**	The upland areas are extensively covered by blanket peat. The presence of blanket peat is unusual over karstified limestones, however, an explanation is offered by Mac Dermot *et al* (1996), whom indicate that weathering of the Dartry Limestones leaves behind a "cherty residue" which provides a "suitable base for the development of upland bogs".
	Thickness	There are no depth to bedrock data available. Depth to bedrock is expected to increase in the valleys. Rock outcrops occur in the upland areas.
	% area aquifer near surface	*[Information to be added at a later date]*
	Vulnerability	*[Information to be added at a later date]*
Recharge	**Main recharge mechanisms**	Both point and diffuse recharge occur. Diffuse recharge occurs via rainfall percolating through permeable subsoil and rock outcrops. Point recharge to the underlying aquifer occurs by means of swallow holes and caves.
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	**Large springs and high yielding wells (m^3/d)**	None Identified
	Main discharge mechanisms	The main discharges are to springs, streams, rivers and lakes.
	Hydrochemical Signature	There are no data available, however, the groundwater is expected to have a $CaHCO_3$ signature. Alkalinity, electrical conductivity and hardness are expected to be high. Water sampling carried out in the limestones in the vicinity of Carrowmore, Sligo report the following values in six samples (Higgins, 1987). Alkalinity (mg/l as $CaCO_3$): 113-163. Total Hardness (mg/l): 302-430. Conductivity (μS/cm): 580-725.

Groundwater Flow Paths	These rocks are generally devoid of intergranular permeability. Groundwater flows through fissures, faults, joints and bedding planes. In pure bedded limestones these openings are enlarged by karstification which significantly enhances the permeability of the rock. Karstification can be accentuated along structural features such as fold axes and faults. Groundwater flow through karst areas is extremely complex and difficult to predict. As flow pathways are often determined by discrete conduits, actual flow directions will not necessarily be perpendicular to the assumed water table contours. Groundwater can flow across surface water catchment divides and beneath surface water channels. Flow velocities can be rapid and variable, both spatially and temporally. Rapid groundwater flow velocities indicate that a large proportion of groundwater flow takes place in enlarged conduit systems. Flow path lengths can be up to a several kilometres in length. Overall groundwater flow will be towards the rivers and lakes, but the karstified nature of the bedrock means that locally, groundwater flow directions can be highly variable.
Groundwater & Surface water interactions	Generally, there is a high degree of interconnection between groundwater and surface water in karstified limestone areas. The karst features represent the close interaction between surface water and groundwater. The stream density is relatively high, which is due to the relatively low permeability subsoils. Any contamination of surface water is rapidly transported into the groundwater system, and vice versa.
Conceptual model	• The GWB occupies an area north of Glencar lough, stretching from Benbulben to the main Manorhamilton-Rossinver road. It is mostly an upland area with the exception Glenade valley. Elevations range from 70-643 mAOD (Truskmore). • It is bounded to the north by an upland area which includes the catchment divide between the Borders and the Western RBD areas. The Glenade and the Drumcliff GWB's bound the GWB to the northeast and south. The main drainage is to the south and southeast. • The aquifer is a Regionally important karstified aquifer (**Rk^{c}**). • Several karst features are recorded, and these include caves and swallow holes but are thought to only represent a fraction of the existing karst features. • Transmissivities are expected to be variable, ranging from 1 to greater than 2000 m^2/d. Storativity is expected to be in the range of 1-2%. • Most groundwater flux is likely to be in the upper part of the aquifer. • Blanket peat is the dominant subsoil type. • Recharge occurs via point and diffuse mechanisms. Point recharge to the underlying aquifer occurs by means of swallow holes. • The main discharges are to springs, streams, rivers and lakes. • The groundwater is expected to have a calcium bicarbonate signature. • There is a high degree of interconnection between groundwater and surface water.
Attachments	Table 1 and Figure 2.
Instrumentation	**Stream gauges:** 35077 **EPA Water Level Monitoring boreholes:** None **EPA Representative Monitoring points:** None
Information Sources	MacDermot, C.V. Long C.B. and Harney S.J (1996) *Geology of Sligo-Leitrim: A geological description of Sligo, Leitrim and adjoining parts of Cavan, Fermanagh, Mayo and Roscommon, to accompany bedrock geology 1:100,000 scale map, Sheet 7, Sligo - Leitrim*. With contributions from K. Carlingbold, G. Stanley, D. Daly and R. Meehan. Geological Survey of Ireland, 100pp.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae.

Table 1 List of Rock Groups In GWB

StratCode	UnitName	Description	RockUnit	Aquifer Class
BS	Ballyshannon Limestone Formation	Pale grey calcarenite limestone	Dinantian Pure Bedded Limestones	Rkc
BB	Benbulben Shale Formation	Calcareous shale with minor calcarenite	Dinantian Shales and Limestones	Ll
DA	Dartry Limestone Formation	Dark fine-grained cherty limestone	Dinantian Pure Bedded Limestones	Rkc
mkDA	Dartry Limestone Formation& Mudbank limestone	Dark fine-grained cherty limestone	Dinantian Pure Unbedded Limestones	Rkc
GD	Glenade Sandstone Formation	Pale orthoquartzitic sandstone	Dinantian Sandstones	Lm
GC	Glencar Limestone Formation	Dark fine limestone & calcareous shale	Dinantian Upper Impure Limestones	Ll
ME	Meenymore Formation	Shale, laminated carbonate, evaporite	Dinantian Mixed Sandstones, Shales and Limestones	Ll

Figure 1 Location and boundaries of GWB.