## Carrowmore East GWB: Summary of Initial Characterisation.

| Hydrometric Area<br>Local Authority | Associated surface water features | Associated terrestrial ecosystem(s) | Area ($km^2$) |
|---|---|---|---|
| 35<br>Sligo/Leitrim Co. Co.'s. | **Rivers**: Bonet, Garavoge, Diffreen<br>**Lakes**:, Gill, Anelteen, Doon, Colgagh, Black, Keelogyboy, Stramore | Cummeen Strand / Drumcliff Bay (000627), Colgagh Lough (001658), Lough Gill (001976). | 58 |

| | | |
|---|---|---|
| **Topography** | | The GWB occupies an area around L. Gill. The land surface is characterised by an upland area to the east which slopes toward L. Gill and the coast. Elevations range from 10-435 mAOD. The GWB is bounded to the south and east by the Dromahair GWB and L. Gill. The northern and western boundaries are topographic highs which act as surface water catchment divides. Figure 1 illustrates the location and boundaries. |
| **Geology and Aquifers** | **Aquifer categories** | **Rk$^c$:** Regionally important karstified aquifer dominated by conduit flow. The 'c' signifies conduit flow. |
| | **Main aquifer lithologies** | Dinantian Pure Bedded Limestones |
| | **Key structures** | The GWB is located to the north of the Ox Mountain Inlier. A major NE-SW trending fault (Ox Mountains-Pettigoe Fault) bounds the southern side of the GWB. A syncline runs through the GWB with the rocks on both limbs dipping approximately 5$^o$. A steep normal fault trending almost E-W belonging to the Cuilcagh-Manorhamilton-Rosses point fault zone cuts into the GWB just north of the Sligo-Manohamilton road. |
| | **Key properties** | Karstification is widespread throughout, and recorded features include swallow holes, caves and springs. Caves are particularly prevalent north of L. Gill. Yield data are sparse, there is 1 "good" (100-400 $m^3$/d) well present. Drilling carried out in the early 1970's by the GSI to locate high yielding wells was unsuccessful (Daly, 1975). Transmissivities are expected to variable, ranging from 1 to greater than 2000 $m^2$/d. Storativity is likely to be low - approximately 0.01-0.02. A tracer test was carried out in the neighbouring Carrowmore West GWB (Higgins, 1987). No groundwater velocities are reported but are expected to be in the order of 20-50 m/hr. General flow directions are likely to be to the west and north west under hydraulic gradients that are expected to be greater than 0.0005 on the low lying areas and greater than 0.005 on the upland areas. |
| | **Thickness** | Most groundwater flow is likely 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** | Data are available for the western 2/3 of the GWB. Till is the dominant subsoil type. |
| | **Thickness** | Data are sparse, with thickness between 0-10 m. Rock outcrops are distributed on 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. There are no surface outlets from the smaller lakes within the GWB, and it is assumed that there is recharge to the underlying aquifer. |
| | **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** | The groundwater is likely to have $CaHCO_3$ signature. Data from the adjoining Carrowmore West GWB is given below for six samples.<br>Alkalinity (mg/l as $CaCO_3$): 113-163.<br>Total Hardness (mg/l): 302-430.<br>Conductivity ($\mu$S/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 as evidenced by a tracer test carried out in the Carrowmore area by Higgins (1987). 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. Overall groundwater flow will be towards L. Gill, 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. Any contamination of surface water is rapidly transported into the groundwater system, and vice versa. |
| **Conceptual model** | • The GWB occupies an area around L. Gill. The land surface is characterised by an upland area to the east which slopes toward L. Gill and the coast. Elevations range from 10-435 mAOD.<br>• The GWB is bounded to the south and east by the Dromahair GWB and L. Gill. The northern and western boundaries are topographic highs which act as surface water catchment divides.<br>• The aquifer is a Regionally important karstified aquifer (**Rk**$^{c}$).<br>• Several karst features are recorded, most notably caves.<br>• Transmissivities are expected to be variable, ranging from 1 to greater than 2000 $m^2$/d. Storativity is likely to be in the range of 1-2%.<br>• Most groundwater flux is likely to be in the upper part of the aquifer.<br>• Till is the dominant subsoil type.<br>• Recharge occurs via point and diffuse mechanisms. Point recharge to the underlying aquifer occurs by means of swallow holes.<br>• The main discharges are to springs, streams, rivers and lakes.<br>• The groundwater has a calcium bicarbonate signature.<br>• There is a high degree of interconnection between groundwater and surface water. |
| **Attachments** | Table 1 and Figure 1. |
| **Instrumentation** | **Stream gauge:** None<br>**EPA Water Level Monitoring boreholes:** None<br>**EPA Representative Monitoring points:** None |
| **Information Sources** | Daly, E. (1975) *Report on the groundwater potential of the area around Sligo town*. Geological Survey of Ireland.<br>Higgins, T. (1987) *An Assessment of the Impact of Human activity on groundwater quality in th eCarrowmore area of County Sligo*. BSc thesis. Sligo Regional Technical College.<br>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.<br>Thorn, R., Drew, D. and Coxon, C. (1990). *The Hydrology and Caves of the Geevagh and Bricklieve Karsts, Co. Sligo. Irish Geography* 23(2) (1990) 120-135. Geographical Society of Ireland, Dublin.<br>Thorn, R. (1987). The Geevagh Karst. *Irish Speleology*. Journal of the Speleological Union of Ireland. Vol. 4 No. 1 1987.<br>Thorn, R., Doyle, M., Henry, H. (1986). *The Groundwater Resources of South County Sligo – A Preliminary Appraisal*. Sligo Regional Techincal College. Report Number 86/1. ISBN 0 948870 01 X. |
| **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 units in GWB**

| | | | |
|---|---|---|---|
| Abbeytown Limestone (BSab) | Crinoidal Calcarenite | Dinantian Pure Bedded Limestones | Rkc |
| Ballyshannon Limestone Formation (BS) | Pale grey calcarenite limestone | Dinantian Pure Bedded Limestones | Rkc |
| Dartry Limestone Formation (DA) | Dark fine-grained cherty limestone | Dinantian Pure Bedded Limestone | Rkc |

**Figure 1 Location and boundaries of GWB.**