Tydavnet GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority		Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
Hydrometric Area 03 Monaghan Co. Co.		***Rivers:*** Blackwater, Mountain Water, Scotstown. ***Lakes:*** Shee, Kilmere, Mullaghinaghigo, Mullaghmore, Tully, Duff, Hollywood.	None identified (O'Riain, 2004)	51
Topography	This rectangular, SW-NE aligned, GWB (Figure 1) is bordered by more productive aquifers to the north, south and east and by a topographic divide (R. Blackwater catchment divide) to the west. The general increases slightly from east to west (c.60-110 mAOD), although NE-SW aligned drumlins (c.30 m in height) are a common feature throughout the GWB. Over the majority of the GWB, the surface water flows south to south-eastwards (River Blackwater).			
Geology and Aquifers	**Aquifer categories**	The GWB comprises **LI:** Locally important aquifer, moderately productive only in local zones.		
	Main aquifer lithologies	The majority of the GWB is underlain by Dinantian Shales and Limestones (98.39%), with a small area of Dinantian Sandstones (1.61%). Refer to Table 1 for details.		
	Key structures	The SW-NE aligned rock succession is dipping by c.20° to the northwest.		
	Key properties	Yields for 10 available wells range from 121-1637 m^3/d, averaging 335 m^3/d. However, the two highest ('excellent') yielding wells (1637 and 491 m^3/d) are on the border with the more productive Knockatallon GWB and therefore may not be representative of this GWB. Only one specific value is available, although this is also for one of the 'excellent' yielding wells: 12 m^3/d/m. Despite the 'excellent' wells, generally high yields are possibly achieved along faults and fracture zones and zones of pure limestone (Swartz et al., 2002). Transmissivity values are unavailable but are expected to be <20 m^2/d, and possibly <10 m^2/d in the shale-dominated lithologies. Storativity is also expected to be relatively low. Due to the thick, low permeability subsoil over the northern area, the groundwater in this region may be confined to some extent. The mapped springs in this area are generally clustered around the sporadic outcrop areas, which may indicate that groundwater can only emerge where the subsoil is thin. Of the 40 available groundwater levels, 35 ware <15 m below ground and 23 are <5 m bgl. The data are inadequate to calculate groundwater gradients however, these are expected to be relatively steep, given the generally low permeability of the rock. *Modelling of the Monaghan PWS also indicates that the zone of influence extends beyond the northern boundary of the Monaghan GWB and into the Tydavnet GWB i.e. the catchment area of the pumping boreholes extends into the Tydavnet GWB. It is anticipated that the input from the Tydavent GWB is limited due to difference in aquifer, and the presence of thick, mainly low permeability subsoil over the majority of the Tydavnet GWB.* *(Source Protection Report; Monaghan GWPS*)		
	Thickness	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 10-15 m thick, and a zone of isolated poorly connected fissuring typically less than 150 m. Generally, there is minimal evidence for deeper flow as a large proportion of the available groundwater levels are less than 5 m below ground.		
Overlying Strata	**Lithologies**	The GWB is predominantly covered by till (81%), with small proportions of alluvium (7%) and peat (6%).		
	Thickness	This GWB is mainly covered by thick subsoil (>10 m, frequently deposited as drumlins) that is low permeability in the north and moderate permeability along the southern boundary. Areas of outcrop/shallow rock occur sporadically in the central and southern regions, in some of the inter-drumlin areas.		
	% area aquifer near surface	*[Information will be added at a later date]*		
	Vulnerability	From the Monaghan GWPS, the few areas of Extreme and High Vulnerability are limited to the inter-drumlin areas. The majority of this area is classified as Low vulnerability, due to thick Low permeability subsoil. However, thick Moderately permeable subsoil is present along the southern boundary, resulting in a Moderate vulnerability classification.		
FsRecharge	**Main recharge mechanisms**	Diffuse recharge occurs via rainfall percolating through the thinner/permeable subsoil and rock outcrops, especially in the central and southern portions of the GWB. However, over the remaining GWB, the thick, low permeability subsoil will only allow a fraction of the effective rainfall to filter through and recharge the aquifer. The majority of the rainfall will discharge to the streams in the GWB. In addition, any steeper slopes will promote surface runoff. The moderately high stream density is likely to be influenced by a combination of thick, low permeability subsoil and relatively low permeability rocks.		
	Est. recharge rates	*[Information will be added at a later date]*		

Discharge	**Large springs and high yielding wells (m^3/d)**	Sources: None identified. Springs: None identified. Excellent wells: Clontycasta (491 m^3/d), Aghnameena (1637 m^3/d). *Both wells are on the boundary with the more productive Knocktallon GWB*. Good wells: Tullylone (121 m^3/d), Drumshanny (121 m^3/d), Sheetrim (129 m^3/d), Drumgahan (129 m^3/d), Doogary (146 m^3/d), Mullaghmore North (146 m^3/d), Killylough (216 m^3/d), Killgavna (216 m^3/d).
	Main discharge mechanisms	Shallow groundwater is likely to discharge to most streams in the GWB. Small springs and seeps are likely to issue at the stream heads and along their course. The mapped springs (small) are generally located around areas of shallower subsoil. Groundwater may also flow into the adjacent, higher permeability GWBs e.g. Monaghan Town GWB (Rf), which is located along the south-eastern (down-gradient) boundary.
	Hydrochemical Signature	***National classification:*** Dinantian rocks (excluding Sandstones) Calcareous. Generally Ca- HCO_3 signature. Due to possible dissolution of evaporite minerals in the Monaghan-Cavan-Leitrim area, Na/K/Mg-HCO_3 and Ca-SO_4 signatures may also occur. Alkalinity (mg/l as $CaCO_3$): range of 10-990; mean of 283 (2454 data points) Total Hardness (mg/l): range of 10-1940; mean of 339 (2146 data points) Conductivity (μS/cm): range of 76-2999; mean of 691 (2663 data points) ***National classification:*** Dinantian Sandstones Calcareous. Generally Ca-HCO_3 signature. Alkalinity (mg/l as $CaCO_3$): range of 5-524; mean of 153 (65 'non limestone subsoils' data points) Total Hardness (mg/l): range of 5-502; mean of 162 (67 'non limestone subsoils' data points) Conductivity (μS/cm): range of 39-1184; mean of 408 (69 'non limestone subsoils' data points) *(Calcareous/Non calcareous classification of bedrock in the Republic of Ireland report)*
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. The majority (88%) of available groundwater levels are 0-15 m below ground level, with over half < 5 m bgl. Unconfined flow paths are likely to be short (30-300 m), with groundwater discharging rapidly to nearby streams and small springs. Any confined flow paths are likely to be considerably longer. Groundwater flow directions are expected to follow topography i.e. south-eastwards. *Dinantian Aquifer Chapters (Pure, Impure and Mixed Limestones/Sandstones); Monaghan GWPS*
Groundwater & Surface water interactions		The thick subsoil, especially in the northern region, acts as a confining layer and therefore limits the interaction between surface and groundwater. Where the groundwater is unconfined (thinner/more permeable subsoil in some central and southern regions), the 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	• The GWB is bounded by more productive aquifers to the north, south and east and by a topographic divide to the west. General elevations increase north-westwards, from 60-110 mAOD. NE-SW aligned drumlins (additional 30 m in height) are located throughout the GWB. • The GWB is composed primarily of low transmissivity rocks with a relatively low expected storativity. 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 c.10-15 m; and a zone of isolated fissuring typically less than 150 m. • Groundwater flow in the central and southern portions of the GWB is expected to be unconfined whereas the northern aquifer may be confined by an overlying, thick, low permeability subsoil. • Recharge occurs diffusely through the thinner subsoil and rock outcrops, although is limited by the relatively low permeability of the aquifer itself. The thick, low permeability subsoil in the north with further reduce the recharge. Therefore, most of the effective rainfall is not expected to recharge the aquifer. • Unconfined 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. Flow paths in the confined aquifer may be considerably longer with limited interaction with the surface water. • The main discharges are to the streams, rivers, lakes and springs within the GWB. Overall, the flow direction is likely to be south to southeast, as determined by the topography. • Modelling suggests that part of the Monaghan Source Protection Area falls within the southern portion of the GWB.

Attachments	Figure 1. Table 1.
Instrumentation	**Stream gauges:** None identified. **EPA Water Level Monitoring boreholes:** None identified. **EPA Representative Monitoring points:** None identified.
Information Sources	Geraghty, M., Farrelly, I., Claringbold, K., Jordan, C., Meehan, R., and Hudson, M., 1997. *Geology of Monaghan-Carlingford. A geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 8/9, Monaghan-Carlingford*. Geraghty, M. (ed.). Geological Survey of Ireland. 60 p. O' Riain, G. 2004. *Water Dependent Ecosystems and Subtypes (Draft)*. Compass Informatics in association with National Parks and Wildlife (DEHLG). WFD support projects. Swartz, M and Daly, D. (2002) *County Monaghan Groundwater Protection Scheme Report*. Main Report. Final Report to Monaghan County Council. Geological Survey of Ireland. Swartz, M. (2001) *Monaghan Public Water Supply – Groundwater Source Protection Zones*. Final Report to Monaghan County Council. Geological Survey of Ireland.
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.

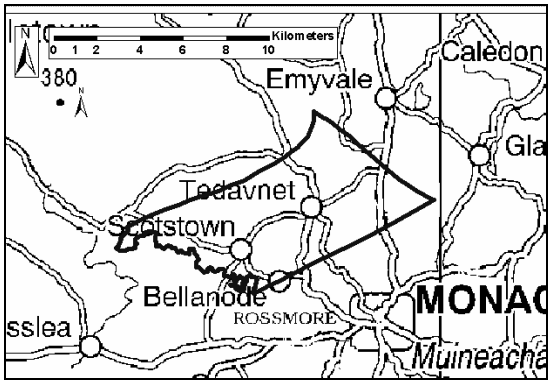

Table 1. List of Rock units in GWB

Rock Unit Name	Code	Description	Rock Unit Group	Aquifer Class.	% Area
Benbulben Shale Formation	BB	Calcareous shale with minor calcarenite	Dinantian Shales and Limestones	Ll	67.39%
Bundoran Shale Formation	BN	Dark shale, minor fine-grained limestone	Dinantian Shales and Limestones	Ll	31.00%
Mullaghmore Sandstone Formation	MU	Sandstone, siltstone & shale	Dinantian Sandstones	Ll	1.61%

Figure 2: Groundwater hydrographs (EPA Groundwater Level Monitoring)