

Swinford GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
34 Mayo and Galway Co. Co.	Rivers: Castlebar, Cloonlee, Clydagh, Glone, Gweestion, Killeen, Little, Lough Talt, Mannin, Manulla, Meander, Pollagh, Moy, Sonnagh, Spaddagh, Strade, Toormore, Trimoge, Bellanamean, Cloonlavis, Eighnagh, Mad, Mullaghanoe, Oughtagh, Owenaher, yellow. Lakes: See table 1.	Killaturly Turlough (000511), Balla Turlough (000463), Mannin and Island Lakes (001910), Slisheen Turlough (001559).	564
Topography	A northern, southern and western arm define the GWB, stretching from Knock to Castlebar to Swinford. The land surface is generally low-lying, with areas of higher relief toward the eastern parts of the GWB. Elevations range from 20 mAOD to 120 mAOD. The southeastern, southern and western boundaries are topographic divides, which include the divide between the Shannon and Western RBD areas. It is bounded along the northern boundary by the Ox Mountains. The northern and eastern boundaries comprise the poorer aquifers of the Foxford and Kilkelly GWB's. The drainage is to the north, flowing across the GWB toward L. Conn. The location and boundaries of the GWB are illustrated in Figure 1.		
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 dominate the GWB. There is a sliver (trending NE-SW) of Granites & other Igneous Intrusive rocks occupying approximately 1km ² in the vicinity of Castlebar. Table 2 presents all the rock units in the GWB.	
	Key structures	As the shape of the GWB suggests, the key structural trend is NE-SW. Major faults such as the Errif Valley fault parallel this overall trend. The bedding strikes NE-SW along the southern and northern arms of the GWB, generally dipping at 2-10° to the southeast. On the western side of the GWB the beds strike almost N-S and dip to the northwest at low angles. Faults in this area trend almost E-W and are cross cut by the major faults. A major open NE-SW trending syncline runs through the northern arm, known as the Castlebar syncline. The Castlebar syncline merges with the Ballymote syncline toward the northeastern end of the GWB.	
	Key properties	Table 3 shows the recorded karst features of which there are 9. This is considered to represent only a fraction of existing features. Yield data are sparse, there are 2 "excellent" (>400 m ³ /d) and 4 "good" (100-400 m ³ /d) wells present. Brady <i>at al</i> (2000) estimated transmissivities are in the range of 10-20 m ² /d southwest of Castlebar. Transmissivities are expected to be variable, ranging from 1 to greater than 2000 m ² /d. The data indicate the variability of the aquifer properties. Storativity is likely to be low - approximately 0.01-0.02. Annual water fluctuations are 2-8 m below ground level in the western part of the GWB as can be seen in Figure 3. There are no data to calculate groundwater velocities, but these are expected to range from 10-100m/hr. Flow directions are likely to be from south to north under hydraulic gradients that are expected to be greater than 0.0005.	
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	Till is the dominant subsoil type, covering approximately 65% of the GWB. Cutover peat covers approximately 20% and sand/gravel bodies approximately 10%. The presence of blanket peat/cutover peat is unexpected over the karstified limestone. It may be due to the presence of low permeability till.	
	Thickness	Along the western side, thickness ranges from 0-8 m (n=14). On the northern limb the data are sparse and thicknesses are generally less than 3 m. There are no data along the southern limb of the GWB.	
	% area aquifer near surface	<i>[Information to be added at a later date]</i>	
	Vulnerability	<i>[Information to be added at a later date]</i>	
Recharge	Main recharge mechanisms	Both point and diffuse recharge occur in this GWB. Diffuse recharge occurs over the GWB via rainfall percolating through permeable subsoil. Despite the presence of peat and till, point recharge to the underlying aquifer occurs by means of swallow holes and collapse features/dolines. Dolines have been recorded even in areas of thick peat deposits (Hickey et al, 2002). Recharge may also occur along 'losing' sections of streams.	
	Est. recharge rates	<i>[Information to be added at a later date]</i>	
Discharge and high yielding wells (m³/d)	Good wells: Windsor – 163 m ³ /d, Castlebar – 109 m ³ /d, Balla – 218 m ³ /d, Ardboley – 109 m ³ /d. Excellent wells: Knockrickard – 545 m ³ /d, Monard – 545 m ³ /d. Springs: No high flows.		

1st Draft Swinford Description August 2004

	<p>Main discharge mechanisms</p>	<p>The main discharges are to the small springs, streams, rivers and lakes.</p>												
	<p>Hydrochemical Signature</p>	<p>The groundwater has a CaHCO₃ signature as illustrated by an expanded Durov Plot, given in Figure 2. Alkalinity, electrical conductivity and hardness are high. The range and median values are given below for two sources in the GWB.</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">Swinford (n=12)</td> <td style="text-align: center;">Ballyvary (n=14)</td> </tr> <tr> <td>Alkalinity (mg/l CaCO₃)</td> <td style="text-align: center;">130-256,173</td> <td style="text-align: center;">112-376,336</td> </tr> <tr> <td>Hardness (mg/l CaCO₃)</td> <td style="text-align: center;">142-272,204</td> <td style="text-align: center;">122-444,356</td> </tr> <tr> <td>Conductivity (microsiemens/cm)</td> <td style="text-align: center;">311-532,424</td> <td style="text-align: center;">456-768,716</td> </tr> </table> <p>Brady <i>et al</i> (2000) report high alkalinities (465-995 mg/l CaCO₃), hardness (205-380 mg/l CaCO₃) south west of Castlebar at Islandkeady.</p>		Swinford (n=12)	Ballyvary (n=14)	Alkalinity (mg/l CaCO ₃)	130-256,173	112-376,336	Hardness (mg/l CaCO ₃)	142-272,204	122-444,356	Conductivity (microsiemens/cm)	311-532,424	456-768,716
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	<p>Groundwater Flow Paths</p>	<p>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, generally to the north, but the karstified nature of the bedrock means that locally, groundwater flow directions can be highly variable. Groundwater may be confined locally.</p>												
	<p>Groundwater & Surface water interactions</p>	<p>The area is principally drained by several rivers which originate at the southern side of the GWB. Generally, there is a high degree of interconnection between groundwater and surface water in karstified limestone areas. The turloughs represent the close interaction between surface water and groundwater in this GWB. The stream density is relatively high, which is due to the relatively thick, low permeability subsoils. Any contamination of surface water is rapidly transported into the groundwater system, and vice versa.</p>												
<p>Conceptual model</p>		<ul style="list-style-type: none"> • The GWB occupies an area stretching from Knock to Castlebar to Swinford. The land surface is generally low-lying, with areas of higher relief toward the eastern parts of the GWB. Elevations range from 20 mAOD to 120 mAOD. • The southeastern, southern and western boundaries are topographic divides, which include the divide between the Shannon and Western RBD areas. The northern and eastern boundaries comprise the poorer aquifers of the Foxford and Kilkelly GWB's. The drainage is to the north, toward L. Conn. • The aquifer is a Regionally important karstified aquifer (Rk^c). • Several karst features are recorded, and these include turloughs, caves and swallow holes but this is thought to only represent a fraction of the existing karst features. • Transmissivities are expected to variable, ranging from 1 to greater than 2000 m²/d. Storativity is in the range of 1-2%. • Most groundwater flux is likely to be in the upper part of the aquifer. • Till is the dominant subsoil type. The presence of blanket peat/cutover peat is unexpected over the karstified limestone. It may be due to the presence of low permeability till. • The groundwater is unconfined but may become locally confined beneath thick, low permeability subsoil. • Recharge occurs via point and diffuse mechanisms. Despite the presence of peat and till, point recharge to the underlying aquifer occurs by means of swallow holes and enclosed depressions. • The main discharges are to the small springs, streams, rivers and lakes. The stream density is relatively high, probably due to the subsoils overlying the GWB. • The groundwater has a calcium bicarbonate signature. • There is a high degree of interconnection between groundwater and surface water. 												
	<p>Attachments</p>	<p>Table 1, 2 and 3. Figures 1 and 2.</p>												
	<p>Instrumentation</p>	<p>Stream gauges: 34005, 34010, 34011, 34012, 34016, 34018, 34020, 34021, 34022, 34025, 34026, 34026, 34028, 34032, 34033, 34034, 34046, 34047, 34050, 34053, 34058, 34059, 34073, 34101, 34102, 34103. EPA Water Level Monitoring boreholes: (MAY081), (MAY088) EPA Representative Monitoring points: (MAY024), (MAY046), (MAY047), (MAY082), (MAY092).</p>												
	<p>Information Sources</p>	<p>Brady Shipman Martin (2000) <i>Islandeady Quarry Co. Mayo. Environmental Impact Statement</i>. Daly, D. (1982). <i>Barnacurry Group Scheme. An assessment of obtaining a groundwater source</i>. GSI report. File 2.2.16. Mc Connell, B., Mac Dermot, C.V., Long, B. (2002).). <i>A geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 11, South Mayo</i>. Geological Survey of Ireland Map Series Report. Geological Survey of Ireland: The Pure Bedded Limestones Aquifer Chapters. Unpublished.</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.
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Table 1. Lakes in GWB

Annagh Loughs	Cullentragh Lough	L. Fark	Loughbeg
Ballinvoash Lough	Curnay Lough	Lakeland Lough	Loughbunnaun
Ballyphilip Lough	Curragh Lough	Lough Akeel	Mannin Lake
Black Lough	Curranny Lough	Lough Aveely	Mulroy's Loughs
Cappagh Lough	Curryellaun Lough	Lough Caheer	Needhams Lough
Capparicar Lough	Derreen Lough	Lough Crunnan	Newpark Lough
Cashel Turlough	Derry Lough	Lough Holan	Peenoge Lough
Castlebar Lough	Derrykin Lough	Lough Mallard	Pollboy Lough
Cloonacurry Lough	Derryskall Lough	Lough Nabo	Richards Lough
Cloonagh Lough	Grallaghlea	Lough Nambrackkeagh	Rowans Lough
Cloondeash Lough	Island Lake	Lough Ogirra	Saleen Lough
Cloonturnaun Lough	Islandeady Lough	Loughannamona	Tawny Lough
Cuilmore Lough	Killaturly Lough	Loughanshoneen	Tuckers Lough
Washpool Lough	Windsor Lough		

Table 2. Rock units in GWB

StratCode	UnitName	Description	RockUnit	AquiferCat
AI	Aille Limestone Formation	Dark fine-grained limestone, shale	Dinantian Pure Bedded Limestones	Rkc
AS	Ardnasillagh Formation	Dark cherty limestone, thin shale	Dinantian Pure Bedded Limestones	Rkc
BT	Barney Limestone Formation	Thick-bedded pale lst, minor shale	Dinantian Pure Bedded Limestones	Rkc
OKbh	Burrischoole Member	Cross-bedded peloidal limestone	Dinantian Pure Bedded Limestones	Rkc
CR	Castlebar River Lmstone/ L. Akeel Oolite	Sandy oolite, dark limestone and shale	Dinantian Pure Bedded Limestones	Rkc
NL	Cong Canal Formation	Medium to thick-bedded pure limestone	Dinantian Pure Bedded Limestones	Rkc
CO	Cong Limestone Formation	Thick-bedded pure limestone	Dinantian Pure Bedded Limestones	Rkc
OKcr	Creagh Member	Fine-grained dark limestone & thin shale	Dinantian Pure Bedded Limestones	Rkc
DG	Dargan Limestone	Bioclastic limestone, sandy & oolitic	Dinantian Pure Bedded Limestones	Rkc
D	Dolerite and Gabbro	Dolerite & gabbro, commonly silica poor	Granites & other Igneous Intrusive rocks	Rkc
IL	Illaunagappul Formation	Limestone, thin shale partings	Dinantian Pure Bedded Limestones	Rkc
BTkt	Kinturk Member	Cross-bedded oolite	Dinantian Pure Bedded Limestones	Rkc
OKlc	Lough Carra Member	Thick-bedded pale pure limestone	Dinantian Pure Bedded Limestones	Rkc
OK	Oakport Limestone Formation	Pale grey massive limestone	Dinantian Pure Bedded Limestones	Rkc
VIS	Visean Limestones (undifferentiated)	Undifferentiated limestone	Dinantian Pure Bedded Limestones	Rkc

Figure 1. Location and Boundaries of GWB.

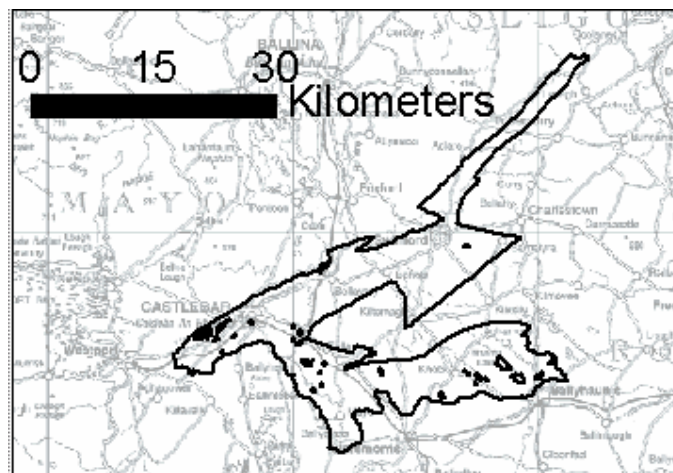


Table 3 Recorded Karst features in GWB

FNUM	FTYPE
1127NEK002	Cave
1431SwK001	Cave
1119NEK063	Enclosed Depression
1127NEK001	Enclosed Depression
1127NwK002	Swallow Hole
1427NwK001	Swallow Hole
1127NEK003	Turlough
1127NwK001	Turlough
1127SwK004	Turlough

Figure 2.

Chemical Signature of Relatively Untcontaminated Waters (expanded Durov Plot)

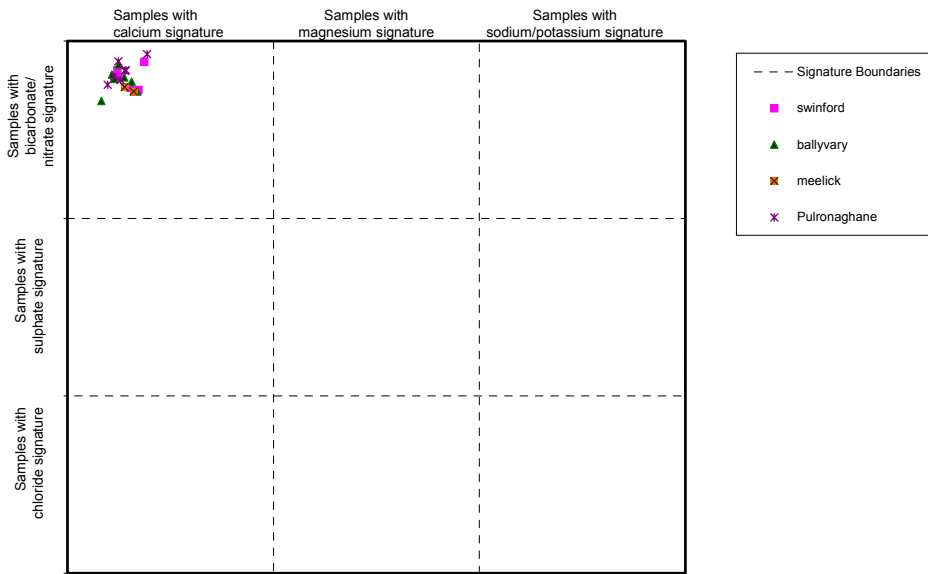


Figure 3.

Variation in water level in Swinford GWB
MAY 081 Mayo Abbey

