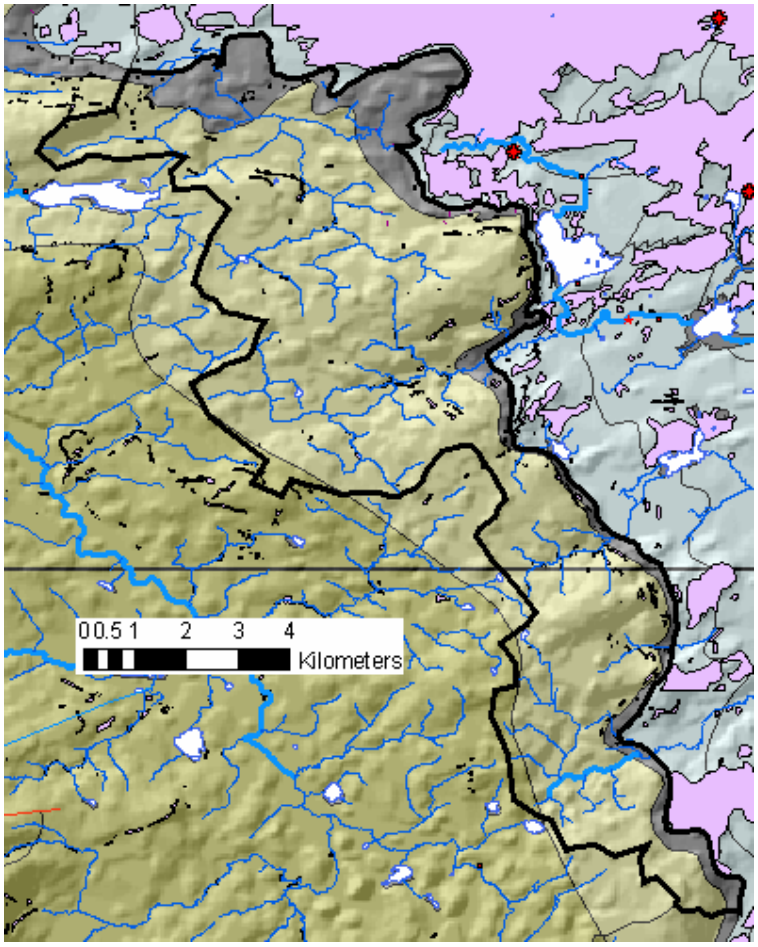
Craggaunboy GWB: Summary of Initial Characterisation.

Note that parts of the eastern GWB boundary may alter. This description is written for the current status.

Hydrometric Area Local Authority		Associated surface water features	Associated terrestrial ecosystems	Area (km^2)
27 - Fergus Catchment Clare Co. Co.		Rivers: Shallee, Clooneen, Cragaunboy, Druminshin. Streams: Kilmore North. Loughs: Poulnacloneen, Ballynacarhagh, Fergus, Nagowan, Eenagh.	None defined.	69
Topography	The GWB is elongated NNW-SSE and is situated in the west of the Fergus River catchment, to the west of the limestone lowlands. Ground elevation ranges from about 30 mAOD to over 180 mAOD. The lowest ground is found adjacent to the limestone lowlands of the Ennis GWB. The highest elevations occur down the centre of the GWB, at Carrownagarra (189 mAOD), Slievenacarrowduff (151 mAOD) and Gortacurka (190 mAOD). Between the river valleys of water draining eastwards onto the limestones, ground elevations rise steeply where underlain by the Namurian rocks of this GWB. The western boundary of the GWB, a surface water catchment, is generally about 100-140 mAOD in elevation. Surface drainage is generally from west to east. There is a topographic 'grain' in the NW-SE direction, which influences the drainage pattern; the 'grain' is controlled by the folding of the rocks.			
Geology and Aquifers	Aquifer category(ies)	The vast majority of the GWB comprises **Ll** : Locally important aquifers which are moderately productive only in local zones. Along the east and north of the GWB, a strip of Namurian Shales (Clare Shales) is classified as a **Pu:** Poor aquifer which is generally unproductive.		
	Main aquifer lithologies	The GWB is dominated by rock units from the Namurian Sandstones group. Areas of Undifferentiated Namurian rocks are found along parts of the west of the GWB. Narrow areas of Namurian Shales occur along the northern and eastern margins of the GWB.		
	Key structures	The rocks are folded into relatively small folds with wavelengths of about 3 km. The intensity of folding dies out northwards. The fold axes trend WSW-ENE; strata dip at right angles to the fold axes at angles from 10-50^o. Faults are not mapped but probably exist, and are probably parallel to the fold axes. Fractures and jointing may be more open on the fold axes.		
	Key properties	Transmissivities in the Undifferentiated Namurian rocks and the Namurian Sandstones are generally in the range 2–20 m^2/d, although higher values may be achieved in faulted zones. South of the Shannon Estuary at Glin WS, a pumping test gave a transmissivity of 14 m^2/d [estimate range 7-27 m^2/d]. The Namurian Shales will have very low transmissivities. Aquifer storativities for all rock unit groups will be low. At Glin WS, estimated groundwater gradients are 0.04 - 0.05. Over the GWB, they are likely to be in the range 0.02 – 0.05. *(data sources: Rock Unit Group Aquifer Chapters, Clare GWPS and Source Reports, see references)*		
	Thickness	In general, the effective thickness of the upper part of the aquifer is likely to be about 10-15 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep water strikes (30-100+ m) are noted in this aquifer, and are associated with better yields and productivities; wells are often overflowing. Permeable zones are met at deeper levels than in other rocks. In a 3 km deep exploration borehole drilled by Ambassador Oil near Doonbeg (in the nearby Kilrush GWB), water was struck at 107 m and then intermittently until a depth of 610 m.		
Overlying Strata	Lithologies	*[Information to be added at a later date]*		
	Thickness	Subsoil thickness data for this GWB are sparse. Available data indicate that thicknesses range from 1 m to 13 m. Outcrop is mainly confined to along the courses of the upland streams, where the rivers have incised into the rock, and to the highest areas within the GWB.		
	% area aquifer near surface	*[Information to be added at a later date]*		
	Vulnerability	Vulnerability ranges from Low to Extreme. The vulnerability rating decreases from east to west, in the palaeo-direction of the ice flows. Vulnerability is Low in the lower ground and river valleys, excepting those areas along the river where there has been incision and bedrock exposed.		
Recharge	Main recharge mechanisms	Diffuse recharge will occur via rainfall percolating through the subsoil. The proportion of the effective rainfall that recharges the aquifer is largely determined by the thickness and permeability of the soil and subsoil, and by the slope. Due to the generally low permeability of the aquifers within this GWB, a high proportion of the recharge will then discharge rapidly to surface watercourses via the upper layers of the aquifer, effectively reducing further the available groundwater resource in the aquifer.		
	Est. recharge rates	*[Information to be added at a later date]*		

Discharge	Important springs and high yielding wells (m^3/d)	None known. *[More information may be added at a later date]*
	Main discharge mechanisms	The main discharges are to the streams crossing and incising into the sandstone and shale rock units. Small springs and seeps are likely to issue at the stream heads and along their course. Minerals in the shales give rise to acidic surface runoff which has a high eroding capacity by the time it reaches the adjacent, lower-lying limestones of the Ennis GWB. The boundary between the two rock types is typified by an extensive series of swallow holes and collapses where surface waters can get direct rapid access to the limestone groundwater system.
	Hydrochemical Signature	No data are currently available for this GWB. Groundwaters in the Ballylongford GWB (on the south side of the Shannon Estuary) are moderately hard (120-270 mg/l $CaCO_3$) and have moderate alkalinities (170-240 mg/l as $CaCO_3$). Measured electrical conductivity ranges from ~440-560 µS/cm. Spring waters (Tarbert WS) have a calcium bicarbonate signature. Groundwater sampled from a borehole (Glin WS) has a signature varying from Ca-HCO_3 to Na/K-HCO_3 and alkalinities greater than total hardness. This is typical of confined waters where ion exchange has occurred. Reducing conditions may also occur. Both iron and manganese can exceed allowable concentrations, these components coming from the shales. Phosphates occur naturally in the Clare Shales and can wash out into the local water courses, resulting in elevated, but naturally-occurring concentrations. Background chloride concentrations will be higher than in the Midlands, due to proximity to the sea.
Groundwater Flow Paths		The Namurian rocks are devoid of intergranular permeability; groundwater flow occurs in fractures, joints and faults. Zones of high permeability can be encountered near fault zones and in areas of intensive fracturing. Generally, groundwater levels are 0-15 m below ground level (mode ~6 mbgl), and follow the topography. Deeper water levels, of more than 60 mbgl are observed in other GWBs, however, which indicate that there may be zones that are hydraulically isolated from the rest of the aquifer. Unconfined groundwater flow paths are short (30-300 m), with groundwater discharging to seeps, small springs and streams. Groundwater also discharges to the Fergus Estuary and Inner Shannon. Local groundwater flows are determined by the local topography. There is no regional flow system in these unconfined aquifers. Artesian conditions and deep inflow levels indicate that the deeper part of the Namurian Sandstone/ Undifferentiated rock aquifer is confined by shales in the succession. Groundwater travel times in this zone are relatively slow and flow path lengths may be considerably longer than in the unconfined zone. Surface waters flowing off Namurian bedrock onto the lower-lying limestones of the Ennis GWB will sink partially or completely into the karst network in the limestones.
Groundwater & Surface water interactions		Due to the shallow groundwater flow in this aquifer the groundwater and surface waters are closely linked. The aquifer discharges readily to the overlying (gaining) streams. Specific dry weather flows in the Abbeyfeale GWB on the south of the Shannon are low (0.1 to 0.5 $l/s/km^2$ at 5 stations), indicating that the Namurian aquifers have low storage. Small springs and seeps contribute to river flows. The chemistry of the groundwater in this GWB influences the surface water, which in turn influences both the surface and groundwaters in the lowland karst Ennis GWB. The Namurian Shales of this GWB are thought to be the source of iron in groundwaters in the adjacent limestone GWB.
Conceptual model		• The groundwater body is bounded to the east by the contact with the karstic limestones of the Ennis GWB. The northern boundary is formed by the contact with the karstic limestones of the Burren GWB. The western and northern boundaries are surface water catchment divides, which are implied groundwater highs within the unconfined part of the aquifer. The GWB is elongated NW-SE. The terrain is hilly. • The groundwater body is composed primarily of low permeability siliceous rocks, although localized zones of enhanced permeability do occur along faults and in coarser layers. Groundwater flows along fractures, joints and major faults. • Recharge occurs diffusely through the subsoils and via outcrops. The amount of recharge is determined by the slope, subsoil permeability, and by the ability of the aquifer to accept potential recharge. • The aquifers within this GWB are both unconfined and confined. Most flow in this aquifer will occur near the surface; the effective thickness of the unconfined part of aquifer is likely to be about 10-15 m, comprising a weathered zone of a few metres and a connected fractured zone below this. The water table is typically from 0-6 m below ground level and follows topography. Deep inflow levels and artesian wells indicate confined conditions in higher permeability strata from which better yields can be obtained. Unconfined flow path lengths are relatively short, and in general are between 30 and 300 m. Confined flow paths may be significantly longer. • Groundwater discharges to the numerous small streams crossing the aquifer, and to the springs and seeps. Local unconfined flow directions are oblique to the surface water channels. There is no regional unconfined groundwater flow. Overall, surface drainage is to the east. • Surface waters flowing off the Namurian bedrock onto lower-lying limestones of the Ennis GWB will sink partially or completely into the karst network in the limestones. The boundary between the two rock types is typified by swallow holes or collapses. • Part of this GWB is within the Ennis UDC (Pouladower) WS Source Protection Area, since surface water flowing off this GWB will enter the groundwater system in the karst aquifer that is in the Zone of Contribution to Pouladower Spring. • Phosphates occur naturally in the Clare Shales and can wash out into the local water courses, resulting in elevated, but naturally-occurring concentrations. Phosphate-rich waters have the potential to travel rapidly large distances in the karst system of the adjacent GWB, emerging at surface water features. Iron from the Namurian rocks also influences the hydrochemistry of adjacent limestone aquifers.
Attachments		None.
Instrumentation		None known.

Information Sources	Deakin, J. and Daly, D. (2000) *County Clare Groundwater Protection Scheme*. Geological Survey of Ireland Report to Clare Co. Co., 67 pp. Hudson, M. (1995) *Glin WS: Groundwater Source Protection Zones*. Geological Survey of Ireland Report to Limerick Co. Co., 8 pp. Aquifer chapters: Namurian Undifferentiated, Sandstone and Shale.
Disclaimer	Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae



Rock units in GWB

Rock unit name and code	Description	Rock unit group
Central Clare Group (CCG)	Sandstone, siltstone & mudstone	Namurian Undifferentiated
Gull Island Formation (GI)	Grey siltstone and mudstone	Namurian Sandstones
Clare Shale Formation (CS)	Mudstone, cherty at base	Namurian Shales