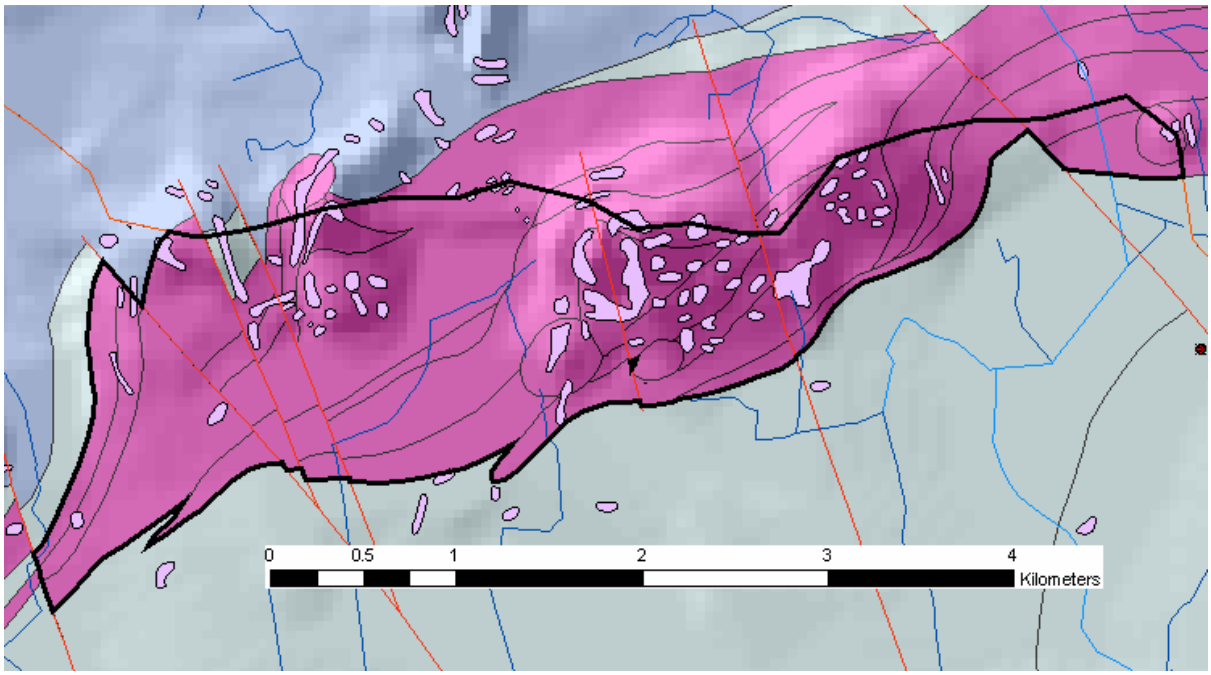
Knockroe NW GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
24 - Maigue Limerick Co. Co.	Rivers: Groody*, tributaries to the Camoge River. ** note that the Groody River crosses the hydrometric boundary into Hydrometric Area 25.*	None groundwater-dependent.	6

Topography	This body is narrow (≤ 1.5 km) and elongated roughly E-W. The terrain is hilly and steep, with ground elevations ranging from 70 mAOD in the west, 70-100 mAOD along the southern boundary, to more than 200 mAOD at Derk Hill on the northern boundary. Generally, elevation increases rapidly from the southern to the northern boundary. There are several hills along the northern boundary of the GWB whose tops are generally above 160 mAOD. Drainage within the GWB is generally good, although ponding can occur in the hills, and there are drainage ditches in lower-lying areas. Drainage is southwards; the Groody River flows northards across only a small part of this GWB.	
Geology and Aquifers	Aquifer categories	The majority of the rocks are currently classified as **Ll:** Locally important aquifers which are moderately productive only in local zones. The small volcanic plugs (Trachytes) are currently classified as **Lm:** Locally important aquifers which are generally moderately productive. In the NW, there are very small areas of **Lm** and **Rk^{d}**: Regionally important karstified aquifer dominated by diffuse flow.
	Main aquifer lithologies	The GWB comprises Basalts and other Volcanic Rocks. There are tiny areas of Dinantian Pure Bedded and Unbedded Limestones in on the NW boundary of the GWB.
	Key structures	The main structures influencing groundwater flow are both primary (formed during deposition) and secondary (created by subsequent deformation). When the lavas solidified, cooling joints formed at right angles to the surface of the flow in some parts of the succession. The rocks are on the northwestern limb of a large boat-shaped syncline whose axis is orientated ENE-WSW. Strata are tilted at 15-25^{o} angles to the south and ESE. NNW-SSE trending major faults cross-cut the fold, particularly in the west of the GWB. Movements during the folding would also have caused some fracturing and jointing of the rocks. Deakin (1995) considers that fracturing and jointing in the area may provide high transmissivity zones in a north-south direction.
	Key properties	Transmissivity in the Volcanic rocks in this area is thought to be variable: in some zones, columnar cooling joints provide a connected pathway for groundwater flow. In other parts, alteration of the rocks during their emplacement in shallow seas, or subsequent weathering during subaerial exposure in a tropical environment have clogged potential flow pathways (both cooling joints and tectonic fractures) with clays. At Herbertstown WS in the Knockroe SW GWB, transmissivity is about 100 m^2/d. However, there are failed wells known in this rock unit group. In the cherty Pure Bedded Limestones, transmissivity is likely to be in the range 10-100 m^2/d, with most values probably in the lower half of the range. The karstified limestones will have higher transmissivities. Although the aquifers are generally moderate transmissivity, the high relief of the ground means that groundwater gradients will be quite high (up to 0.05) in the NW and SE parts, and lower (around 0.01) in the most extensive flatter areas in the middle. *(data sources: Rock Unit Group Aquifer Chapters, Source reports, see references)*
	Thickness	In general, the effective thickness of this aquifer is likely to be ≤ 15-20 m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, more isolated water-bearing joints or faults can be intercepted at greater depths.
Overlying Strata	Lithologies	GSI mapping records Limestone Tills and small areas of Till with Gravel. There are areas of Undifferentiated Alluvium along some of the surface water courses.
	Thickness	There are no data for this GWB. In the north and east, there are plenty of outcrops and subsoil is likely to be very shallow (< 2m). In the south and west parts, although there are some isolated outcrops, subsoils are likely be thicker in this lower-lying area.
	% 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	Diffuse recharge will occur via rainfall percolating through the subsoil or directly into the aquifer where rock is at surface. 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	Springs and large known abstractions (m^3/d)	Ballybricken WS (Boughilbreaga) (44 m^3/d - EPA database). *[More information may be added at a later date]*
	Main discharge mechanisms	The main discharges are to the streams crossing the aquifer, and most likely to small springs. There may be some cross-flow from this GWB to the Herbertstown GWB to the south and to the Fedamore GWB to the west.

	Hydrochemical Signature	There are no data available for this GWB. The limited data available for the very similar Knockroe SW GWB indicate a calcium–bicarbonate signature. Groundwaters are Moderately Hard (210-250 mg/l as $CaCO_3$) with corresponding alkalinities of 145-165 mg/l as $CaCO_3$ and neutral pHs of 7-7.5. Conductivities are relatively high, normally ranging between 480 and 550 μS/cm. These parameters indicate an influence by carbonate dissolution processes. This may be an influence of either the limestone-dominated subsoil cover or perhaps limestones interbedded with the volcanic rocks at depth. Iron may be a problem due to the weathering of the rock forming minerals in the volcanic rocks. Due to the clayey weathering products, suspended solids can be a problem in some wells. Groundwater in the pure limestones will be very hard with high alkalinities and electrical conductivities. Background chloride concentrations in the aquifers will be higher than in the Midlands, due to proximity to the sea.
Groundwater Flow Paths		These rocks are devoid of intergranular permeability; groundwater flow occurs in fractures, joints and faults. Where clayey weathering products or alteration minerals occur, this can block the flow conduits, unless they have been flushed from the system by high groundwater gradients in the hilly terrain. In the zones where the fractures and joints are not clogged with clays, transmissivities can be relatively high. Groundwater is unconfined; the water table is 1–8 m below ground level, and follows the topography. In general, flows in the aquifer are likely to be concentrated in a thin zone at the top of the rock; the weathered zone may be up to 3 m thick, with a connected fractured zone a further 15-20 m, below which is a generally poorly fractured zone. However, there may be deeper inflows associated with zones of primary columnar jointing or tectonic fracturing and faulting. There may be limestones interbedded between the individual lava flows contributing to the flowing intervals. Groundwater flow paths are relatively short (30-300 m), especially in the hilliest areas, with groundwater discharging locally to the streams and small springs. The general groundwater flow direction is southwards down-slope and westwards. In the very east of the GWB, groundwater discharges to the Groody River.
Groundwater & Surface water interactions		The streams crossing the aquifer will be gaining. There are no data to assess the amount of baseflow contributed by the aquifer to the rivers. Groundwater discharges to the streams, to the Groody River, and to small springs.
Conceptual model		• The groundwater body is elongated E-W. It is bounded to south by the contact with the pure limestones of the Herbertstown GWB, to the west by the contact with the Fedamore GWB. The northern and eastern boundaries coincide with surface water divides. As the catchments are currently drawn, the Groody River crosses the boundary into Hydrometric Area 25. • The GWB comprises low-moderate transmissivity rocks. Localised zones of enhanced permeability occur in the Volcanics due to columnar jointing and tectonic fracturing. However, these zones may be clogged by weathering products, reducing permeability. The Dinantian bedded limestones have low-moderate transmissivity. The pure unbedded limestones are diffusely karstified. Aquifer storativities are low. • Recharge occurs diffusely through the subsoils, particularly in the north and east, where subsoils are thin or absent. Potential recharge may be rejected where the water table is high. • The aquifers are generally unconfined. The water table is from 1-8 m below ground level and follows topography. Groundwater flows along fractures, joints and major faults. Most groundwater flow occurs near the surface in a narrow zone comprising a weathered zone of a few metres and a connected fractured zone below this. Deeper inflow levels will occur where isolated fractures/faults or jointed zones are intercepted. North-south fracturing and faulting may cause anisotropy. Flow path lengths are relatively short, and in general are 30-300 m. • The rock units of this GWB may act as a confining layer to the karstified limestones of the underlying Fedamore GWB. • Groundwater discharges to the streams crossing the aquifer and to small springs. Unconfined flow directions are controlled by local topography. Overall, flow directions are southwards and westwards, except in the very east of the GWB, where groundwater discharges to the Groody River; along part of the southern boundary there may be some cross-flow from this GWB to the Herbertstown GWB, and west to the Fedamore GWB.
Attachments		None.
Instrumentation		None.
Information Sources		Deakin, J. (1995) *Herbertstown Public Supply, Groundwater Source Protection Zones*. Geological Survey of Ireland Report to Limerick Co. Co., 6 pp. Deakin, J., Daly, D. and Coxon, C. (1998) *County Limerick Groundwater Protection Scheme*. Geological Survey of Ireland Report to Limerick Co. Co., 72 pp. Aquifer chapters: Basalts and other Volcanic rocks; Dinantian Pure Bedded Limestones; Dinantian Pure Unbedded Limestones.
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
Knockroe Basalt Lava Flow Member (KRb)	Basaltic lava flows	Basalts & other Volcanic rocks
Knockroe Lithic Tuff Member (KRl)	Lithic tuff & agglomerate	Basalts & other Volcanic rocks
Knockroe Trachyte Lava Flow Member (KRt)	Trachytic lava flows	Basalts & other Volcanic rocks
Knockroe Vitric-Lithic Tuff Member (KRv)	Vitric-lithic tuff & agglomerate	Basalts & other Volcanic rocks
Trachyte (T)		Basalts & other Volcanic rocks
Trachyte Breccias (Tb)		Basalts & other Volcanic rocks
Lough Gur Formation (LR)	Pale cherty crinoidal limestone	Dinantian Pure Bedded Limestones
Waulsortian Limestones (WA)	Pale massive lime-mudstone	Dinantian Pure Unbedded Limestones