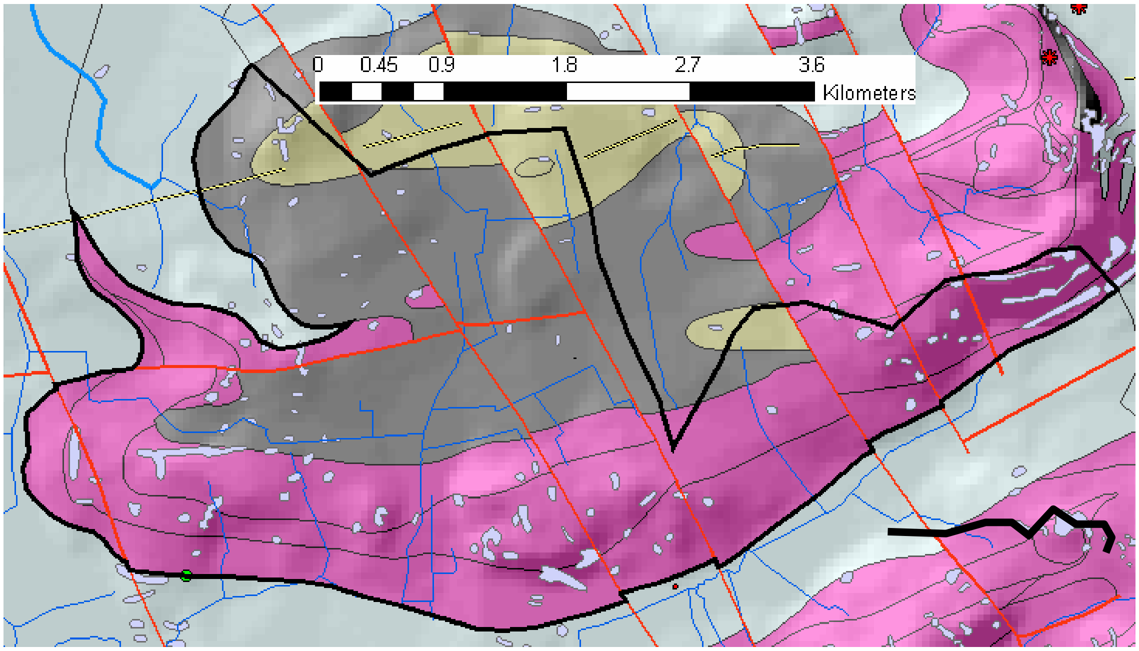
Knockseefin-Longstone West GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystems	Area (km^2)
24 - Maigue catchment Limerick Co. Co.	Tributaries to the Groody and Camoge Rivers.	None.	15.6

Topography		Most of the ground in this GWB is gently hilly, with elevations typically in the range 90-140 mAOD. The GWB is irregular in outline and elongated in a roughly E-W direction. The largest area is in the west, thinning eastwards to a narrow (< 1 km) spur bounded to the north by a ridge that rises up to 231 mAOD. Drainage is poor, particularly in the lower-lying ground in the centre of the west part of the GWB.
Geology and Aquifers	Aquifer category(ies)	The GWB comprises **Ll** : Locally important aquifers which are moderately productive only in local zones.
	Main aquifer lithologies	Basalts and other Volcanic rocks form the majority of the GWB. Namurian Shales and smaller areas of Namurian Sandstones comprise the remainder.
	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. Overall, the Volcanic and Namurian Sandstone/ Shale rocks are in the western and southern part of the core of a large, boat-shaped syncline whose axis is orientated ENE-WSW. Strata are tilted inwards to the centre of the fold core at angles of 15-25°. NNW-SSE trending major faults separated by about 0.5-2.5 km cross-cut the fold. There are also faults parallel to the fold axis that displace the rocks. 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 N-S 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 nearby Knockroe East GWB, transmissivity is about 100 m^2/d. However, there are failed wells known in this rock unit group in this area. Transmissivity in the Namurian rocks is in the range 2–20 m^2/d, with median values biased to the lower end of the range. At Glin WS in the Ballylongford GWB, a pumping test gave transmissivity of 14 m^2/d [7-27 m^2/d], but this may have been affected by faulting. At Glin WS, estimated groundwater gradients are 0.04 - 0.05. Over the GWB, they are likely to be in the range 0.02 – 0.07. Storativities in all rock units are low, of the order of 0.015. *(data sources: Rock Unit Group Aquifer Chapters, Source Reports, see references; estimation from maps)*
	Thickness	The thickness of the Basalts and other Volcanic rocks varies laterally, attaining maximum thicknesses of around 300 m. The Namurian Shales and Sandstones can attain combined thicknesses of many 100's of metres. However, most groundwater flow is likely to take place in the top 15-25 m, in the zone that comprises a weathered layer of a few metres and a connected fractured layer below this. Deeper groundwater flow also occurs along fault zones and large fractures. Deeper water strikes are particularly noted in the layered rocks of the Namurian aquifers in other areas (e.g., west Co. Limerick), and seem to be associated with slightly better yields (moderate to good, rather than poor) and better productivities (III and IV, rather than IV and V).
Overlying Strata	Lithologies	Rock is close to the ground surface over much of the GWB. Where subsoils are thicker than ~1 m, Namurian 'Head' predominates over the GWB. Limestone Till and Volcanic Till are also found, together with small areas of Undifferentiated Alluvium.
	Thickness	Outcrops and thin subsoils occur over much of the GWB. Few data are available to assess the thickness of subsoils away from the outcropping rock areas. Existing data record subsoils of 10 m, 10 m and 19 m thick.
	% area aquifer near surface	*[Information to be added at a later date]*
	Vulnerability	Groundwater vulnerability is Extreme over nearly the entire GWB. There are small Highly vulnerable areas in stream valleys over the Namurian aquifers, and along parts of the margins of the GWB.
Recharge	Main recharge mechanisms	Diffuse recharge will occur over the entire groundwater body via rainfall percolating through the subsoil and directly to the aquifer via outcrop. 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. The drainage density indicates that a significant proportion of effective rainfall does recharge the aquifer. In the lower-lying areas particularly, a high proportion of the recharge will discharge rapidly to surface watercourses via the upper layers of the aquifer.
	Est. recharge rates	*[Information to be added at a later date]*

Discharge	Important springs and high yielding wells (m^3/d)	There are no data available to assess the aquifers within this GWB capacity to support Excellent (> 400 m^3/d) or Good yielding (100 m^3/d < yield < 400 m^3/d) boreholes, or High (>2,160 m^3/d) yielding springs. The EPA monitor two sources within the GWB: Clover Field GWS and Knockancrohy, Old Pallas. There are no abstraction data available for these sources.
	Main discharge mechanisms	The main discharges are to the streams crossing the GWB. Small springs and seeps issue at the stream heads.
	Hydrochemical Signature	There are no data available to assess this GWB. Groundwaters sampled in a GWB comprised of Namurian strata (the Ballylongford GWB) are Moderately Hard (120-270 mg/l $CaCO_3$) and have moderate alkalinities (170-240 mg/l $CaCO_3$). 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. Within the Volcanic rocks, data from the nearby Knockroe East GWB indicate a calcium–bicarbonate signature. There, groundwaters are Moderately Hard (210-250 mg/l as $CaCO_3$) with corresponding alkalinities and neutral pHs. Conductivities are relatively high, normally ranging between 480 and 550 µS/cm. These parameters indicate an influence by carbonate dissolution processes, which is thought to be an influence of either the limestone-dominated subsoil cover or perhaps limestones interbedded with the volcanic rocks at depth. Within this GWB, the $CaCO_3$ availability may be lower, resulting in softer waters. Iron can be a problem in this aquifer 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. Background chloride concentrations 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 and faults. 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 10-20 m, below which is a generally poorly fractured zone. The aquifers are generally unconfined, with the water table following the topography. In lower-lying areas, the water table will be shallow and in hydraulic continuity with the streams. In the Namurian aquifers, groundwater levels are likely to be shallow, even in elevated areas. Deeper water levels (up to 15 m) are observed, however, in elevated areas underlain by volcanic rock aquifers. This indicates that they are more transmissive, at least in some areas, than the Namurian rocks. In areas where Namurian aquifers are extensive, deep inflow levels and groundwater hydrochemistry indicates that some of the aquifer is confined. In all aquifers, unconfined groundwater flow paths are short (30-300 m), with groundwater discharging to the streams. Confined flow paths in the Namurian may be significantly longer, up to 1000 m. Local groundwater flow will be from the higher ground between surface water bodies to the rivers and streams. There is no regional groundwater flow system.
Groundwater & Surface water interactions		Due to the shallow groundwater flow over much of the GWB, the groundwater and surface waters are closely linked. The streams originating within and crossing the GWB are gaining. Low summer baseflow (< 0.5 $l/s/km^2$) is expected.
Conceptual model		• The GWB is irregular in outline. It is bounded on its southern and western boundaries by the contact with the Pure Bedded Limestones of the Herbertstown GWB. The northern, NE and eastern boundaries are coincident with surface water catchments that are implied groundwater highs. The terrain over most of the GWB is gently hilly. In the east, the ground rises higher along a ridge that defines part of the NE boundary. • The groundwater body is composed primarily of low transmissivity rocks, although localised zones of enhanced permeability do occur along faults. The Volcanic rocks are more permeable in places than the Namurian aquifers. Groundwater flows along fractures, joints and major faults. Aquifer storativities are low. • Recharge occurs diffusely through the subsoils and via outcrops. A high proportion of the recharge will discharge rapidly to surface watercourses via the upper layers of the aquifer. • The aquifers within this GWB are both unconfined and confined. Most flow in the volcanic and sedimentary rock aquifers will be unconfined and occur near the surface in a narrow zone comprising a weathered zone of a few metres and a connected fractured zone below this. The water table is from 0-15 m below ground level and follows topography. Groundwater levels tend to be closer to the surface in the Namurian strata than in some areas of the volcanic rocks. Deeper inflow levels will occur where fractures/ faults or jointed zones are intercepted. • Within the Namurian rock aquifer, deep inflows and hydrochemistry data 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 path lengths may be longer, up to 1000 m. North-south fracturing and faulting may cause transmissivity anisotropy. • Groundwater discharges to the streams crossing the aquifer, and to springs and seeps. Deeper flowing groundwater may discharge up the N-S fault zones. Unconfined flow directions are controlled by local topography. • Due to the shallow groundwater flow in this aquifer the groundwater and surface waters are closely linked. This interaction is rapid and seasonal; due to low storage and the local nature of the flow paths, summer baseflows to the rivers are low.
Attachments		None.
Instrumentation		None.

Information Sources	Deakin, J., Daly, D. and Coxon, C. (1998) *County Limerick Groundwater Protection Scheme.* Geological Survey of Ireland Report to Limerick Co. Co., 72 pp. Deakin, J. (1995) *Herbertstown Public Supply, Groundwater Source Protection Zones*. Geological Survey of Ireland Report to Limerick Co. Co., 6 pp. Hudson, M. (1995) *Glin WS: Groundwater Source Protection Zones.* Geological Survey of Ireland Report to Limerick Co. Co., 8 pp. Aquifer Chapter: Basalts and other Volcanic rocks; Namurian Sandstone; Namurian 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
Knockseefin Volcanic Formation (KV)	Ankaramitic lavas, tuffs & intrusions	Basalts & other Volcanic rocks
Knockseefin Lava Flow Member (KVf)	Ankaramitic lava flows (alkali basalt)	Basalts & other Volcanic rocks
Knockseefin Vitric Tuff Member (KVv)	Ankaramitic vitric tuffs (alkali basalt)	Basalts & other Volcanic rocks
Longstone Shale Member (LOsh)	Olive, flaggy mudstone & shale	Namurian Shales
Longstone Flagstone Member (LOfg)	Parallel laminated fine sandstone	Namurian Sandstones
Caherconreafy Member (LOcc)	Coarse, massive, concretionary sandstone	Namurian Sandstones