Kilcullen GWB: Summary of Initial Characterisation.

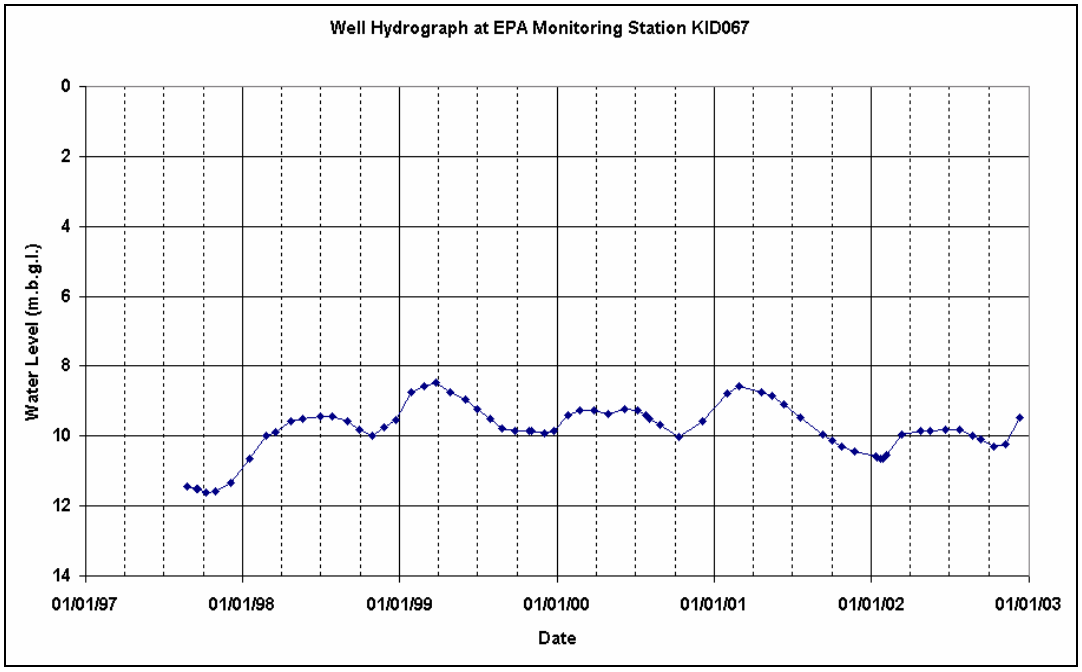
Hydrometric Area Local Authority	Associated surface water bodies	Associated terrestrial ecosystems	Area (km^2)
Wicklow Co. Co. Kildare Co. Co. Dublin Co. Co. Hydrometric Area 09	Rivers: Liffey, Kilcullen Stream, Lemonstown Stream, Douglas, King's, Cock Brook, Ballydonnell Brook, Ballylow Brook, Brittas, Dodder, Camac Lakes: Gilltown, Cleevaun, Three Lakes, Lough Firrib	Ballinagee Wood (1750), Hollywood Glen (2053), Newtown Marshes (1759), Dalkey Coastal Zone and Killiney Hill (1206), Fitzsimons Wood (1753), Glenasmole Valley (**SAC** 1209), Lugmore Glen (1212), Slade of Saggart and Crooksling Glen (211), Kilteel Wood (1394), Liffey Valley Meander Belt (393), Red Bog (**SAC** 397)	642

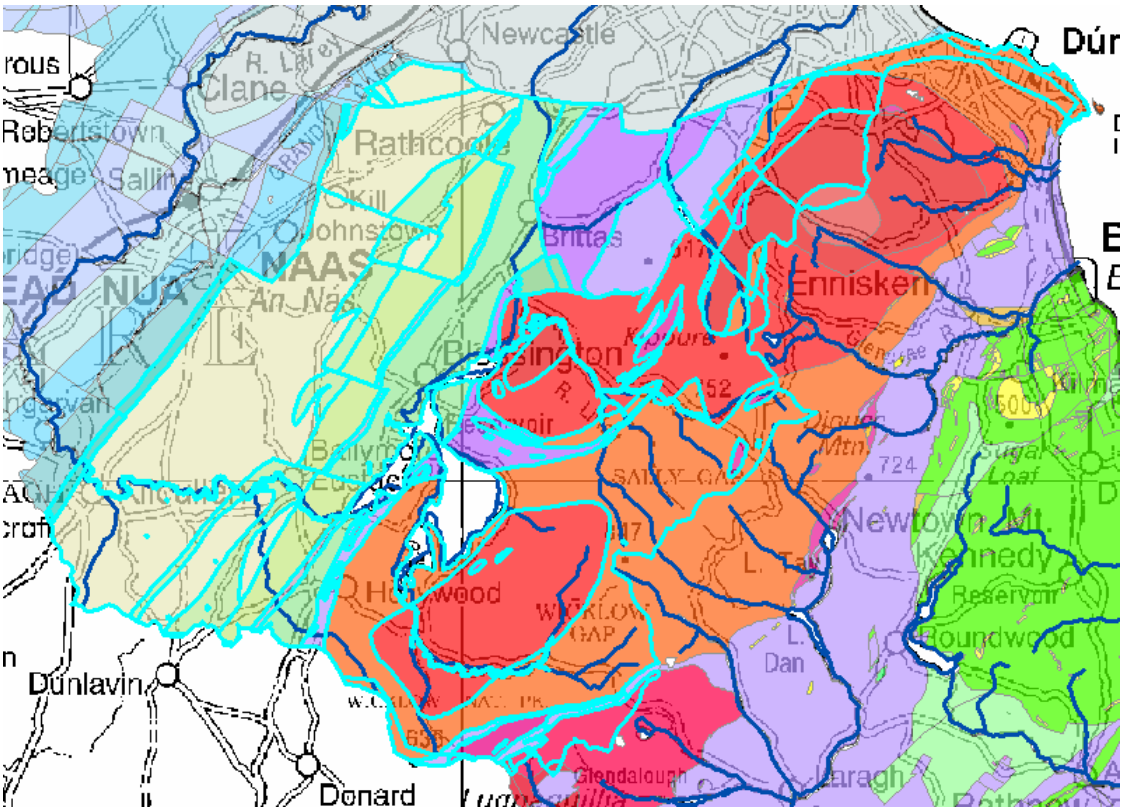
Topography		This large GWB contains areas of Northeast Wicklow, Northwest Kildare and South Dublin. The area has a varied topography with the Wicklow and Dublin mountains defining the topographic boundary to the south and east and the very flat areas of the Kildare lowlands. This variety in topography will have a significant influence on all aspects of the groundwater system.
Geology and Aquifers	Aquifer type(s) Main aquifer lithologies	**Ll:** Locally important aquifer, moderately productive only in local zones **Pl:** Poor aquifer, generally unproductive except for local zones **Pu:** Poor aquifer, generally unproductive The Leinster Granites Ordovician and Silurian metasediments
	Key structures.	The Lower Paleozoic rocks represent a complex geological history and comprise a large range of rock types including greywackes (turbidites), volcaniclastic sediments, lavas, shales, mudstones and cherts. During the Ordovician the Iapetus Ocean began to close and volcanoes formed adjacent to the continental margins, giving rise to a complex suite of volcanic and deep-water sediments. As two continents collided, the accumulated sediments were squeezed up to form a chain of mountains (Caledonian Orogeny). These rocks are thus highly folded and faulted representing polyphase deformation. Large plutons of granite were intruded and the surrounding rocks have been metamorphosed on a regional scale transforming the original shales and sandstones and giving the rocks their pervasive fabric or cleavage, which allows these rocks to be instantly recognisable. The structural geology of the county has caused varying degrees of rock deformation. Bedrock permeability is influenced by this deformation. Rocks deform mainly by folding and faulting; both of which are associated with fracturing and permeability development.
	Key properties	The area is compromised of a number of varied hydrogeological settings. In general there are three main areas of consideration: (a) the Granites which are considered to be a Pl aquifer, (b) the majority of the Ordovician metasediments which are Ll, (c) the other Lower Paleozoic rocks i.e. the Silurian rocks which are classified as Pl and Pu aquifers. There are no data on the aquifer coefficients for the rocks in this area. Pumping tests conducted in Co. Wicklow show that the Ordovician rocks classified as Ll aquifers, have moderately good transmissivities (~$30m^2/d$) in places. The granite and the Silurian rocks are expected to be less permeable except in local zones. In addition to the variety in these rock types there is also the fact that the topography is very varied over the area. With mountainous granite areas in the west and areas of low-lying land towards the coast. The topographic slope will influence the hydraulic gradient in the aquifer, which in turn will determine the velocity and volume of groundwater flow.
	Thickness	The majority of groundwater flow will occur in the top couple of metres. This flow is mostly in along a weathered zone in a lateral direction towards rivers and springs. In some instances a greater degree of structural deformation may provide a fracture network, which will allow groundwater movement at greater depths. Only flow in isolated fractures is expected below 30 m.
Overlying Strata	Lithologies	There are three dominant subsoil types oin this GWB: (a) large deposits of sand and gravel, the largest (the largest sand and gravel deposit in the country) being the Mid-Kildare Gravel aquifer or "The Curragh". This is located to the southwest of the body overlying much of the lowland Silurian rocks in Kildare. In the more mountainous areas the main subsoil type is granite-derived till with some smaller areas of Peat. Other than these mountainous areas and the gravel deposits, limestone-derived till is most common.
	Thickness	The till thickness, as in all Ireland, varies on a local and regional scale. In general there are thinner deposits in the mountainous areas where there are large areas of outcrop and rock close to surface. Thicker subsoils are found in the low lands where there are generally more than 3m of subsoil, in some instances thickness are over 30m.
	% Area aquifer near surface	There is a high area in the uplands where the rock is close to surface and only small areas of outcrop are seen on the low lands.
	Vulnerability	Vulnerability of the uplands is generally Extreme. In the low lands the vulnerability is more commonly Moderate and Low.

Recharge	Main recharge mechanisms	The dominant recharge process in this area will be diffuse recharge from water percolating through the overlying tills and in to the aquifer. High rates of potential recharge are expected in the hilly areas where there are very thin subsoils and high rainfall. A large portion of this potential recharge will be rejected because the rocks in this area are considered to be poor aquifers and hence do not have a high enough storativity to accept all the water. There for the runoff component to streams will be higher, this must be taken in to account when recharge calculations are being considered. An indication of this process can be seen in the very high drainage density in the area. The drainage density is lower in the Lower Paleozoic rocks (0.542km/km^2) than in the Granites (1.232km/km^2) and a higher proportion of potential recharge will enter the aquifer over this rock type.
	Est. recharge rates	*[Information to be added at a later date]*
Discharge	Springs and large known abstractions	GSI Source Protection Reports – Kilteel EPA Register of Abstractions –Hollywood (264), Ballyknockan (165), Kilbride GWS (140 -Spring), Donard (135 - Gallery), Ashtown GWS/Blessington (110), Brittas (60), Valleymount (40 -Spring), Bullock Park WS (32), Oldcourt GWS (15 - Spring), Red Bog Blessington (8), Wolfstown GWS (4), Hempstown GWS, Kilteel GWS, Ballyfolan GWS (Spring), Baltyboys GWS (Spring), Carrigacurra GWS (Spring), Humphrystown GWS (Spring), Kilbeg No.1 & 2 GWS (Spring), Tinode GWS (Spring), Wicklow Spring Water
	Main discharge mechanisms	Discharge via springs at the break of slopes located at the foot of hills throughout the area. The GWB will also discharge to the overlying streams and rivers as baseflow. The proportion of river flow that is baseflow will vary through out the area. Mountainous rivers have a "flashy" profile and rivers on slopes lower down have a flatter profile. It must be taken in to account that the geomorphology also play a role here in defining the flow characteristics of the rivers. There are a large number of small springs located in the area. These are located at the foot of hill at the break in slope where the water table comes to the surface.
	Hydrochemical Signature	The hydrochemical analyses show that the water is slightly hard, with total hardness values of 100-150 mg l^{-1} (equivalent $CaCO_3$) and electrical conductivity values of 300-500 µS cm^{-1}. The groundwater have very low alkalinity with most recorded values below 50 mg/l and most recorded values of pH are below 7 but do not drop below 6.
Groundwater Flow Paths		The majority of groundwater flow in this aquifer will take place in the upper 3m of the rocks. This will be lateral flow towards discharge point such rivers and streams. Deeper groundwater flow is possible and deep-water strikes are often encountered (between 10 and 40 m.b.g.l.) but they are more isolated features located along open fractures, which allow groundwater flow. Regional groundwater flow paths are not considered to develop, as the rocks do not have sufficient transmissivity to transport water over long distances. Typical groundwater flow paths will be in the order of a couple of hundred metres, with discharge occurring to the closest surface water feature.
Groundwater & surface water interactions		There will by highly varied groundwater and surface water interaction processes occurring within the large area of this groundwater body. The nature of these interactions will be determined by local factors and it is therefore impossible to generalize over such a large area. Such local influences could include the depths and permeability of subsoil, slope, local permeability of the rock, overlying surface water bodies and human alterations to the environment. Such interactions should be considered on a local scale where the importance of them is most critical e.g. at protected areas.
Conceptual model	This large GWB contains areas of northeast Wicklow, northwest Kildare and south Dublin. The area has a varied topography with the Wicklow and Dublin mountains defining the topographic boundary to the south and east and the very flat areas of the Kildare low lands. The boundary of the GWB is defined to north and west by the geological contact between the Lower Paleozoic rocks and the limestones of the Dublin Basin. The GWB is composed primarily of low permeability rocks, although localized zones of enhanced permeability do occur. Groundwater flow occurs mostly in a shallow upper weathered zone, deeper groundwater flow is possible along fractures, joints and major faults. Recharge occurs diffusely through the subsoils and via outcrops. There are large areas where the rock is close to surface, which would suggest high potential recharge values, but calculations must consider the effect of rejected recharge from the lower permeability rocks. The aquifers within the GWB are generally unconfined, but may become locally confined where the subsoil is thicker and/or lower permeability. Groundwater flow is considered to recharge and discharge on a local scale. Drainage density values suggest shorter flow paths in the granites than on the flatter Lower Paleozoic's. Groundwater discharges to the numerous small streams crossing the aquifer, to springs and seeps	

Attachments	
Instrumentation	Stream gauge: 09007, 09016, 09017, 09020, 09021, 09023, 09026, 09027, 09028, 09029, 09032, 09038, 09039, 09040, 09057, 09058, 09059 Borehole Hydrograph: KID067 EPA Representative Monitoring boreholes: KID048 (Sand and Gravel influence?)
Information Sources	McConnell B, Philcox M, Sleeman A G, Stanley G, Flegg A M, Daly E P &. Warren W P 1994. *A Geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 16, Kildare-Wicklow*. Geological Survey of Ireland, 70 pp. Wright G R & Woods L (2003) *County Wicklow Groundwater Protection Scheme* Report to Wicklow County Council. Geological Survey of Ireland Kelly C & Fitzsimons V (2002) *County Kildare Groundwater Protection Scheme*. Report to Kildare County Council. Geological Survey of Ireland 55pp
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Rock Unit Name	Code	Description
Aghfarrell Formation	AG	Greywacke siltstone, slate, quartzite
Aplite	apl	
Butter Mountain Formation	BZ	Dark slate-schist, quartzite & coticule
Butter Mountain Formation & Mafic volcanics	mvBZ	Dark slate-schist, quartzite & coticule
Carrighill Formation	CZ	Calcareous greywacke siltstone & shale
Dolerite	D	
Dowery Hill Member	AGdh	Andesite breccia & shale
Glen Ding Formation	GD	Chloritic, feldspathic greywacke
Glen of Imail Quartz-diorite	LqGi	Dark, aphyric quartz diorite
Glendalough Adamellite	LqGd	Adamellite with microcline phenocrysts
Percys Table Granodiorite	LqPt	Aphyric granodiorite
Pollaphuca Formation	PO	Coarse greywacke & shale
Quinagh Formation	QU	Lenticular mudstone & coarse siltstone
Slate Quarries Formation	SQ	Slate & greywacke
Tipperkevin Formation	TK	Greywacke & shale
Type 1 granodiorite	Nt1	Fine-grained granodiorite to granite
Type 2e equigranular	Nt2e	Pale grey fine to coarse-grained granite
Type 2p microcline porphyritic	Nt2p	Granite with microcline phenocrysts
Type 3 muscovite porphyritic	Nt3	Granite with muscovite phenocrysts
Type 4 muscovite/microcline porphyritic	Nt4	Muscovite-microcline porphyritic granite




Newcastle
Clane
Rathcoole
Johnstown
MAAS
An Nás
Ennisken
Blessington
Newtown Mt. Kennedy
Roundwood
Dunlavin
Donard
Glendalough
Dan
724