


1st Draft Bandon GWB Description – 1st March 2004

Note: This GWB is overlain by four locally important gravel aquifers as described in the South Cork GWPS

Bandon GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km ²)
20 Cork Co. Co	Rivers: Bandon, Ilen, Garrown, Oulysallis, Dirty, Brewery, Clodagh, Ruagagh, Saivnose, Glanaphuca, Caha, Blackwater, Kealroota, Owenkeagh, Glasheenahielan, Argideen, Brinny, Reanagar, Stick, Bawnaknockane, Rathruane, Durrus, Coomnagoragh, Roaringwater, Leamawaddra, Mullaghnagown, Roury, Cashel, Sall, Ballymahane, Minane, Ballinspittle, Bealnascartane, Burrane, Owennashingaun, kilbrittain, Carhoo, Owenahinchy. Streams: Clonakilty, Tinneel, Leap, Cullenagh lake. Lakes: Castlenalact, Ship, Coolkellure, Cullenagh, Kealanine, Garranes, Deelish, Glanatnaw, Driminidy, Constable, Neaskin, Portalougha, Carrigeenhawks, Dunmanway, Poulnamuck, Nadrippal, Mohona, Ballynacarriga, Curraghalicky, Patrick, Toughmacdermody, Atarriff, Carragh, Corran, Slieveadrohid, Bateman's, Konockeennagearagh, Gorm, Beag, Ballin, Keamore, Shreelane, Aghills, Shepperton, Doo, Naluharacaun, Marsh, Cluhir, Banousal, Abisdealy, Avilliheen, Nacartan, Ballyvally, Adoreen, Adoolig, Cloonties, Avrickeen, Kilkieran, Ballincolla.	Fountainstown Swamp (000371), Bandon Vally (001740), Killaneer House Glen (001062), Minane Bridge Marsh (001966), Bandon Valley (001515), Bandon Valley (001034), Bandon Valley (001035), Courtmacsherry Estuary (001230), Batemans Lough (001037), Garretstown Marsh (001053), Garrylucas Marsh (000087), Cloonties Lough (001044), Myross Wood (001070), Kilkieran Lake and Castlefreke Dunes (001061), Derreennatra Cutaway (002105), Lough Hyne Nature reserve and Environs (000097).	1796
Topography			
Geology and Aquifers	Aquifer categories	LI: Locally important aquifer which is moderately productive only in local zones (76%). PI: Poor aquifer which is generally unproductive except for local zones (24%).	
	Main aquifer lithologies	Mainly Dinantian Mudstones and Sandstones (Cork Group) (56%) and Devonian Old Red Sandstones (44%). There is a small area of Namurian Sandstones (1%) and a tiny occurrence of Igneous Intrusive Rocks (<0.1%).	
	Key structures	The widespread faulting and folding associated with the Variscan Orogeny in the south of Ireland has given rise to zones of enhanced permeability in the mudstones and sandstones. These can occur close to faults and near the axes of folds. Such zones are generally local.	
	Key properties	Permeability generally decreases rapidly with depth in these aquifers. In general, the Devonian ORS and Dinantian Mudstone and Sandstones (Cork Group) aquifer transmissivities will be in the range 2-20 m ² /d. However, 'Excellent' yielding wells (>400 m ³ /d) are known in some of the units – these yields are usually associated with boreholes being situated on fault zones. Summer yields are sometimes unsustainable. At a County Council source at Carrigavulleen/Ballinspittle in this GWB a transmissivity of 2.3 m ² /d was calculated for rocks of the Cork Group, where there was no evidence of a fault zone close to the well. Hydraulic conductivity is not expected to be greater than 0.5 m/d and may be as low as 0.05 m/d. At a second source in the same area at Garretstown/Ballinspittle, transmissivity ranging from 15 to 20 m ² /d was calculated. Transmissivity values from another source at Roberts Cove close to a localised fault zone ranged 10-13 m ² /d. Aquifer storativity will be low in all rock units. Groundwater gradients are likely to be in the range 0.01 to 0.04.	
Thickness	The Dinantian Mudstones and Sandstones (Cork Group) and Devonian Old Red Sandstone units in this GWB form sequences which can be several kilometres thick (Sleeman & Pracht, 1994). Most groundwater flow in this GWB is expected to occur within the top 15 m of the aquifer, in the layer that comprises a weathered zone of a few metres and a connected fractured zone below this.		

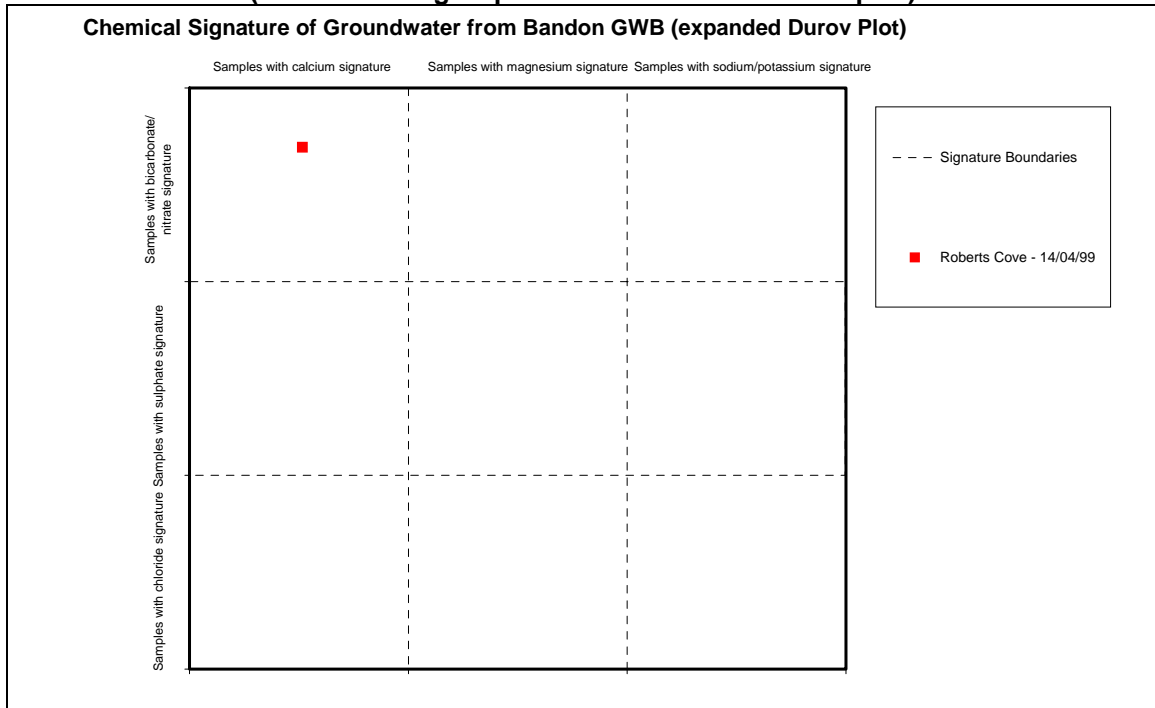
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Overlying Strata	Lithologies	<p>The GWB is generally covered by till derived from sandstone & shale. There are also frequent sand and gravel deposits, several of which are classified as locally important sand and gravel aquifers. Alluvium occurs along the major rivers. Rock outcrop and shallow rock are common, particularly along stream channels. The frequency of rock outcrop increases in the west of the body. The till is generally of ‘moderate’ permeability, although some smaller pockets of ‘low’ permeability till occur. The sand and gravel deposits along the River Bride are of ‘high’ permeability. Subsoil permeability has only been mapped in the South Cork region; no detailed subsoil permeability mapping has been carried out in West Cork or Kerry.</p> <p><i>Subsoil Types identified in Bandon GWB by Teagasc Parent Material Mapping (Draft): Alluvium (A); Blanket Peat (BktPt); Sandstone sands and gravels (Devonian & Carboniferous) (GDSs) & (GDCSs); Made Ground (Made); Rock outcrop and rock close to surface (Rck); Till – Devonian & Carboniferous Sandstone & Shale Till (TDCSSs); Devonian Sandstone Till (TDSs), Namurian Shale & Sandstone Till (TNSSs).</i></p>
	Thickness	Subsoil is generally < 10 m thick within the GWB with large areas of < 3 m subsoil.
	% area aquifer near surface	
	Vulnerability	Based on available data, most of this GWB will be of either Extreme or High Vulnerability. A GWPS has been prepared for the “South Cork” region and a Groundwater Vulnerability Map is available. A GWPS has not yet been prepared for West Cork or Kerry.
Recharge	Main recharge mechanisms	Diffuse recharge will occur via rainfall percolating through the subsoil or areas of outcropping rock. The proportion of the effective rainfall that will recharge the aquifer is determined by the permeability of the soil and subsoil, and by the slope. The generally shallow ‘moderate’ permeability subsoil in this GWB will not restrict percolation of recharge to the aquifer. The overlying gravels will provide permeable pathway for recharge to the underlying bedrock aquifer.
	Est. recharge rates	
Discharge	Large springs and high yielding wells (m³/d)	<p><i>Note: The following data needs to be checked and updated by RBD Project Consultants.</i></p> <p>Data from GSI Well Database: Ballinspittle/Garretstown WSS (111.2 m³/d), Minane Bridge WSS (>100 m³/d), Roberts Cove WSS (131 m³/d).</p>
	Main discharge mechanisms	The main discharges are to the rivers and streams crossing the GWB and to generally small springs and seeps. Groundwater will also discharge at the coast. Localised seepages may develop on the cliff faces. Specific dry weather flow for a number of rivers crossing this GWB range from
	Hydrochemical Signature	This GWB is underlain by non-carbonate rock units, which include Old Red Sandstone rocks, as well as the sandstones and mudstones of the Cork Group. Alkalinity ranges 14-310 mg/l (as CaCO ₃) and hardness ranges 43-224 mg/l (moderately soft to moderately hard). The Old Red Sandstone formations largely contain calcium bicarbonate type water. Conductivities in these units are relatively low ranging 125-600 µS/cm, with an average of 312 µS/cm. Conductivities in the Cork Group rocks are quite similar with an average of 381 µS/cm and a range of 160 -433 µS/cm. In general, high iron (Fe) and manganese (Mn) concentrations can occur in groundwater derived from ORS, due to the dissolution of Fe and Mn from the sandstone/shale where reducing conditions occur. It has been demonstrated that at low pumping rates water does not reside long enough in the well for oxidation to occur, thereby resulting in elevated Fe and Mn in small domestic supplies (Applin <i>et al</i> , 1989). Background chloride concentrations in all aquifers will be higher than in the Midlands, due to the proximity to the sea. Where the influence of sea water incursion is responsible for high chloride levels pumping rates in such areas may need to be kept below a level with could cause sea water to be drawn into the boreholes. The hydrochemical signature of groundwater from a public supply well in the Dinantian Mudstones and Sandstones (Cork Group) in this GWB is demonstrated in an expanded Durov plot in Figure 1 below.
Groundwater Flow Paths		These rocks have no intergranular permeability; groundwater flow occurs in fractures and faults. In the mud-dominant units limited fracturing and in-filling of fractures are to be expected. The permeability of individual fractures and the degree of interconnection will be generally low, with fracturing confined to local zones. Permeability is highest in the upper few metres but generally decreases rapidly with depth. In general, groundwater flow is concentrated in the upper 15 m of the aquifer, although deeper inflows from along fault zones or connected fractures can be encountered. Significant yields can be obtained where boreholes are drilled into known fault zones. In these rocks groundwater flow paths are expected to be relatively short, typically 30-300 m, with groundwater discharging to small springs, or to the streams and rivers that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments. Groundwater is generally unconfined in this groundwater body.

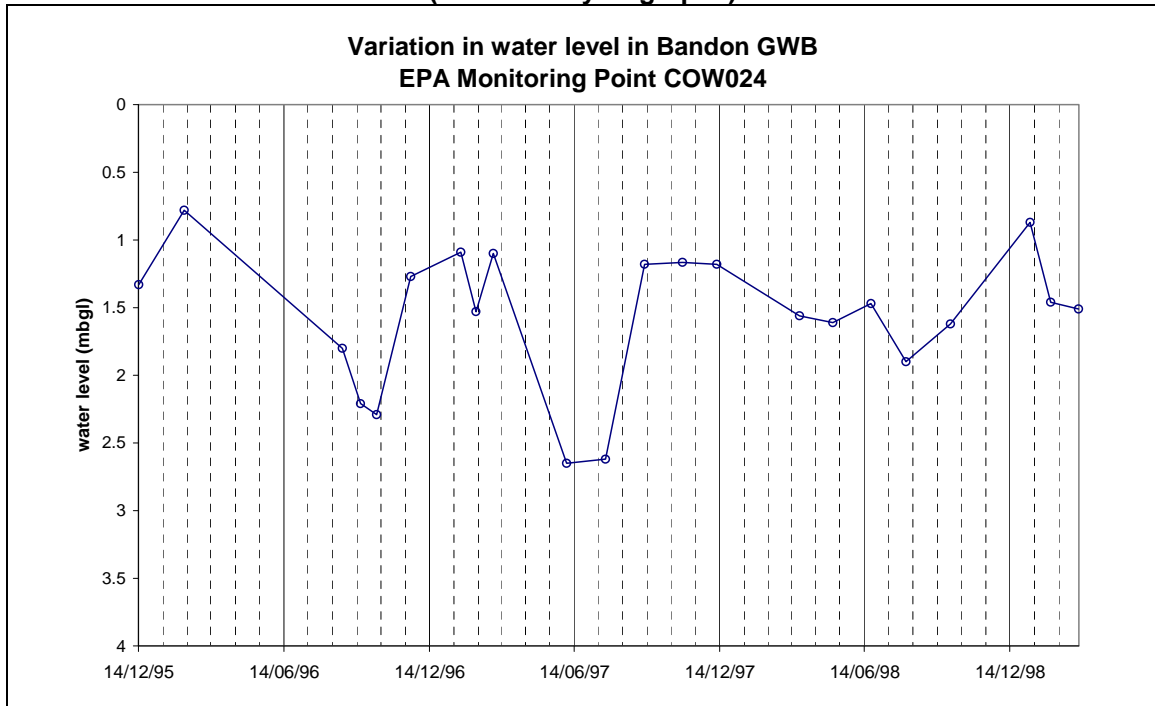
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Groundwater & Surface water interactions	Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low. There are a number of marshes and swamps that are designated as protected areas within this GWB and which may be locally dependant on groundwater.
Conceptual model	<ul style="list-style-type: none"> • The groundwater body is bounded to the south and southeast by the coast, to the north and west by a topographic high and surface water catchment divide which coincides with the groundwater divide. • The topography of this body is • The groundwater body is comprised of rocks with low transmissivity and storativity, although localised zones of enhanced permeability occur along fault zones. • Flow occurs along fractures, joints and major faults. Flows in the aquifer are generally concentrated in a thin zone at the top of the rock, although deeper groundwater flows along faults and major fractures. • Diffuse recharge occurs across the GWB through the subsoils and rock outcrops. • The water table can vary between a few metres up to more than 10 m below ground surface, depending upon topography. Groundwater is generally unconfined. Flow path lengths are generally short, ranging from 30-300 m. Local groundwater flow directions are controlled by local topography. • Groundwater discharges to the numerous streams and rivers crossing the aquifer and to small springs and seeps.
Attachments	Figure 1 Hydrochemical Signature, Figure 2 Groundwater Hydrograph
Instrumentation	<p>Stream gauges: 20001*, 20002*, 20003, 20004, 20005*, 20006*, 20007, 20008, 20009*, 20010, 20011, 20012, 20013, 20014, 20015, 20016, 20017.</p> <p>* Adjusted Dry Weather Flow data available.</p> <p>EPA Representative Monitoring points: None</p> <p>EPA Water Level Monitoring boreholes: Lisvard Co-op (COW 24)</p>
Information Sources	<p>Kelly D, Wright G (2002) <i>Ballinspittle/Garrettstown Water Supply Scheme- Groundwater Source Protection Zones</i>. Geological Survey of Ireland, 28pp.</p> <p>Kelly D, Wright G (2002) <i>Minane Bridge Water Supply Scheme-Groundwater Source Protection Zones</i>. Geological Survey of Ireland, 12pp.</p> <p>Kelly D, Wright G (2002) <i>Robert's Cove Water Supply Scheme-Groundwater Source Protection Zones</i>. Geological Survey of Ireland, 17pp.</p> <p>Kelly D, Leader U, Wright G (2002) <i>South Cork Groundwater Protection Scheme</i>. Report to Cork County Council (South). Geological Survey of Ireland.</p> <p>Sleeman AG, Pracht M (1994) <i>Geology of South Cork. A geological description of South Cork to accompany the Bedrock Geology 1:100,000 Map Series, Sheet 25</i>, Geological Survey of Ireland, 59pp</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

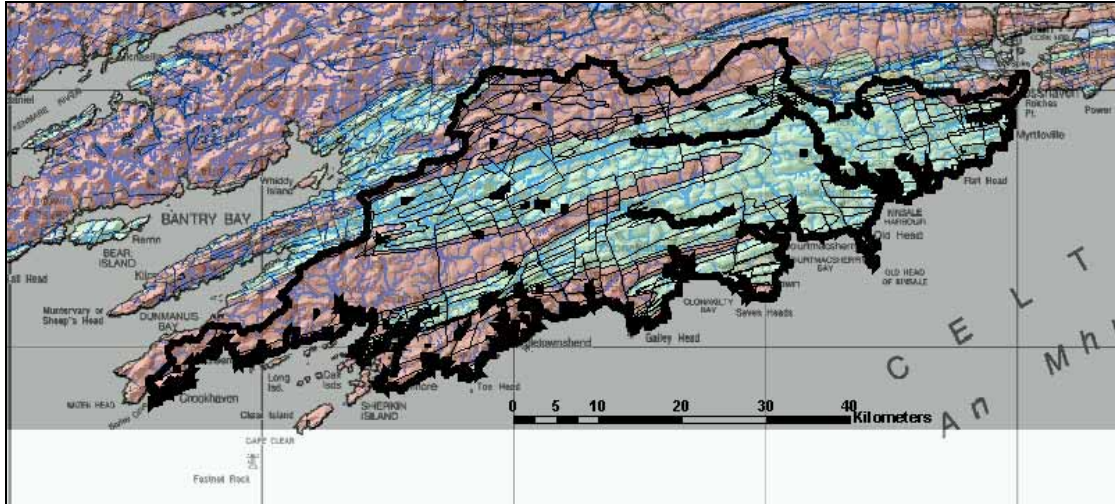
**Figure 1: Hydrochemical signature
(GSI Monitoring as part of Source Protection Report)**



**Figure 2: Groundwater hydrographs
(EPA Well Hydrographs)**



Bandon GWB (For reference only)



List of Rock units in Bandon GWB

Rock unit name and code	Description	Rock unit group	Aquifer Classification
White Strand Formation (WS)	Sandstone and interbedded pyritic mudstone	Namurian Sandstones	L1
Lispatrick Formation (LP)	Pyritic cherty mudstone with dolomite	Dinantian Mudstones and Sandstones	L1
Courtmacsherry Formation (CY)	Calcareous mudstone with limestone	Dinantian Mudstones and Sandstones	L1
Ardaturrish Member	Black mudstone & silt-lensed mudstone	Dinantian Mudstones and Sandstones (Cork Group)	L1
Kinsale Formation (KN)	Grey mudstone with subordinate sandstone	Dinantian Mudstones and Sandstones	L1
Pigs Cove Member (KNpc)	Sand-lensed mudstone	Dinantian Mudstones and Sandstones	L1
Narrow Cove Member (KNnc)	Flaser-bedded sandstone and mudstone	Dinantian Mudstones and Sandstones	L1
Cuskinny Member (Kncu)	Flaser-bedded sandstone and mudstone	Dinantian Mudstones and Sandstones	L1
Old Head Sandstone Formation (OH)	Flaser bedded sandstone and minor mudstone	Dinantian Mudstones and Sandstones	L1
Gyleen Formation (GY)	Sandstone with mudstone and siltstone	Devonian Old Red Sandstones	L1
Ballyknock Member (Gybn)	Green sandstone, siltstone and mudstone.	Devonian Old Red Sandstones	L1
Ballytrasna Formation (BS)	Purple mudstone with some sandstone	Devonian Old Red Sandstones	L1
Toe Head Formation (TH)	Cross-bedded sandstone and minor mudstone	Devonian Old Red Sandstones	
Castlehaven Formation (CE)	Purple mudstone and siltstone	Devonian Old Red Sandstones	P1
Sherkin Formation (SK)	Sandstone & subsidiary mudstone	Devonian Old Red Sandstones	L1
Gun Point Formation (GP)	Green-grey sandstone and purple siltstone	Devonian Old Red Sandstones	L1
Caha Mountain Formation (CH)	Purple and green sandstone and siltstone	Devonian Old Red Sandstones	P1
Gortanimill Formation (GM)	Sandstone and siltstone	Devonian Old Red Sandstones	L1
Dolerite and Gabbro		Granites & other Igneous Intrusive Rocks	P1