Kenmare GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
21 Kerry Co. Co.	**Rivers:** Owbeg, Roughty, Cleady, Finnihy, Slaheny, Reen.	Roughty River Estuary (002092)	13.7

Topography	This GWB occupies the floor of an ENE-WSW trending valley which meets the coast at Kenmare River (Bay). The valley is bounded to the north and south by parallel ridges that are part of the Beara Sneem GWB. The sea forms the southwestern boundary of the body. Ground elevations range 10–60 m OD, but most of the body is < 40 m OD. The highest ground is along the northern boundary of the GWB. The valley floor slopes gently to the south towards the Roughty River, which flows along the southern boundary of the GWB.	
Geology and Aquifers	**Aquifer categories**	**Rkd*:** Regionally important karstified aquifer dominated by diffuse flow (7.6 km^2) **Ll:** Locally important aquifer which is moderately productive only in local zones (4.9 km^2) **Note: This area of the GWB is small (7.6 km^2), and while likely to be karstified and dominated by diffuse flow, is not sufficiently large to be a regionally important aquifer. A new category for small isolated areas with the same rock type and characteristics as regionally important aquifers is pending. Until such time as this new category is available these areas are represented by Rkd*.*
	Main aquifer lithologies	Dinantian Pure Unbedded Limestones in the centre of the GWB, underlain by Dinantian Lower Impure Limestones which outcrop around the margins of the GWB.
	Key structures	The Variscan (Hercynian) Orogeny (mountain building episode), compressed rocks in the South Munster region from the south into a series of folds on east west axes, and created an extensive network of fractures subsequently enlarged by karstification. The Dinantian Limestones of this GWB occur in the Kenmare Syncline, a fold trough, trending ENE-WSW (Figure 1).
	Key properties	No hydrogeological data specific to the limestones of this GWB is currently available. Based on data from other synclines in the south Munster region the pure unbedded limestones of this GWB are expected to be highly productive. An extensive network of faults and joints formed by deformation are likely to have been enlarged by karstification. A karst feature (enclosed depression) and areas of karstified limestone bedrock at surface are currently recorded around Kenmare town. The previous fall in sea level, which enabled karstification at depth in other limestone synclines in the region, may have had a similar effect in this GWB. Transmissivity in the pure unbedded limestones can range up to a few thousand m^2/d. Pumping tests in the same rock type in similar conditions (Waulsortian Limestone) in the Cloyne GWB gave a range of transmissivity of 200 to over 2000 m^2/day. Groundwater gradients are likely to be low in the Waulsortian Limestones (0.001-0.005). Steeper hydraulic gradients are likely towards the margins of the body in the impure limestones. In the impure limestones transmissivities will be lower, generally in the range 5-20 m^2/d. Impure limestones are much less susceptible to karstification
	Thickness	Based on data from other limestone synclines in the region, groundwater flow may occur in an epikarstic layer a couple of metres thick and in a zone of interconnected solutionally-enlarged fissures and conduits that extends approximately 30 m below this. However deeper flows also occur and boreholes can intersect fissuring and karstification at depths of down to 60 m below OD. In the Impure Limestones that occur at the margins of this GWB, most groundwater flow may occur in an upper weathered layer of a few metres and a zone of interconnected fissures often not extending more than 15 m from the top of the rock, although occasional deep inflows associated with major faults can be encountered.
Overlying Strata	**Lithologies**	Most of this GWB is covered by glacial till. Alluvium (undifferentiated) is found along the Roughty River and along other smaller streams. A small area of sand and gravel is also recorded. Areas of rock outcrop and shallow rock occur throughout the body. *Subsoil Types identified in Kenmare GWB by Teagasc Parent Material Mapping (Draft): Alluvium (A); Sandstone sands and gravels (Devonian) (GDSs); Karstified limestone bedrock at surface (KaRck); Made Ground (Made); Estuarine sediments (silts/clays) (Mesc); Marine Silts (Msi); Bedrock at surface (Rck); Till – Devonian Sandstone Till (TDSs).*
	Thickness	No borehole depth to bedrock data are available for this GWB. Based on the frequent occurrence of rock outcrop and shallow rock it is expected that there will be many areas with < 3 m subsoil. Where the underlying limestone is highly karstified it is likely to a very irregular bedrock surface. Subsoil depths in these areas can therefore be highly variable within short distances.
	% area aquifer near surface	
	Vulnerability	A Groundwater Vulnerability map is not currently available for Co. Kerry. It is probable that many areas of Extreme vulnerability occur around the frequent areas of rock outcrop and shallow rock, however fully delineating areas of Extreme, High, Moderate and Low Vulnerability is not possible at this time.

Recharge	**Main recharge mechanisms**	Surrounding uplands provide abundant runoff which supplies recharge to the limestone aquifer. Where karst features such as swallow holes and collapse features are present they will provide the means for point recharge to the karstified aquifer. Diffuse recharge will occur via rainfall percolating through the subsoil and areas of outcropping rock. The proportion of the effective rainfall that will recharge the aquifer is determined by the thickness and permeability of the subsoil. In this highly productive aquifer there may be some low-lying areas with a high water table, where a proportion of the effective rainfall is rejected due to lack of storage space in the aquifer. Where gravels overlie the karstified aquifer they provide a permeable pathway for recharge to the underlying aquifer. They can also act to augment storage in the aquifer.
	Est. recharge rates	
Discharge	**Large springs and high yielding wells (m^3/d)**	*Note: The following data needs to be checked and updated by RBD Project Consultants.* Data from GSI Well Database: Kenmare Creamery, Gortamullin (327 m^3/d)
	Main discharge mechanisms	Groundwater discharges to the rivers and streams crossing the GWB. Rivers overlying pure limestones in the South Munster Synclines have relatively high dry weather flows indicating contributions from the underlying aquifer.
	Hydrochemical Signature	The groundwater in this GWB will be dominated by calcium and bicarbonate ions. Hardness can range from moderately hard to very hard (200 mg/l to >400 mg/l (as $CaCO_3$). Spring waters tend to be softer as throughput is quicker and there is less time for the dissolution of minerals into the groundwater. Groundwater alkalinity is high, up to 400 mg/l (as $CaCO_3$). Alkalinity is generally less than hardness, indicating that ion exchange (where calcium or magnesium are replaced by sodium) is not significant. These hydrochemical signatures are characteristic of clean limestone. Like hardness and alkalinity, electrical conductivities (EC) can vary greatly. Typical limestone water conductivities are of the order of 500-700 µS/cm. Lower values suggest that the residence times of some of the sources are very short reflecting a karstic system with rapid flow velocities. Chloride levels in groundwater in this body can be elevated near the coast. Due to the high level of interaction between groundwater and surface water in karstic aquifers, microbial pollution can travel very quickly from the surface into the groundwater system. The normal filtering and protective action of the subsoil is often bypassed in karstic aquifers due to the number of swallow holes, dolines and large areas of shallow rock.
Groundwater Flow Paths		The rocks in this GWB are devoid of intergranular permeability. Groundwater flow occurs in the many faults and joints, enlarged by karstification. Based on experience in other GWB with similar bedrock types overall groundwater flow is expected to be of a diffuse nature due to the high frequency of fissures, although solutionally enlarged conduits can occur. Within the pure unbedded limestones, the water table is shallow, generally within 10 m of the surface. Groundwater is generally unconfined, with surface water features in hydraulic continuity with the water table. Groundwater gradients are relatively flat in the Waulsortian Limestones in the centre of the body. Hydraulic gradients are steeper at the margins of the GWB where the impure and less permeable limestones occur. Overall groundwater flow will be southward towards the Roughty River and the coast.
Groundwater & Surface water interactions		The nature of the karstic system leads to rapid interchanges of water between surface and underground. Swallow holes and caves receive surface water, and groundwater is discharged to surface as springs or as baseflow to rivers crossing the groundwater body.

Conceptual model	• This GWB occupies the floor of an ENE-WSW trending valley which meets the coast at Kenmare River (Bay). Ground elevations over most of the body range 10-40 m OD. The valley floor slopes gently to the south towards the Roughty River, which flows along the southern boundary of the GWB. • The GWB is bounded on to the north and south by the contact with the low permeability sandstones of the Beara Sneem GWB. The sea forms the south-western boundary of the body. • The GWB is composed of a main central portion of diffusely karstified productive pure limestone with a narrow underlying layer of less permeable impure limestone around the margins of the body. To the north and south of the body are ridges of low permeability sandstones. • Groundwater flow occurs in the many faults and joints, enlarged by karstification. Based on experience in other GWB with similar bedrock types overall groundwater flow is expected to be of a diffuse nature due to the high frequency of fissures, although solutionally enlarged conduits can occur. • Based on data from other limestone syncline in the region, groundwater flow may occur in an epikarstic layer a couple of metres thick and in a zone of interconnected solutionally-enlarged fissures and conduits that extends approximately 30 m below this. However deeper flows also occur where boreholes intersect zones of fissuring and karstification. • The Impure Limestones that occur at the margins of this GWB are less susceptible to karstification. Most groundwater flow may occur in an upper weathered layer of a few metres and a zone of interconnected fissures often not extending more than 15 m from the top of the rock, although occasional deep inflows associated with major faults can be encountered. • Within the pure unbedded limestones, the water table is shallow, generally within 10 m of the surface. Groundwater is generally unconfined, with surface water features in hydraulic continuity with the water table. Groundwater gradients are relatively flat in the Waulsortian Limestones in the centre of the body. Hydraulic gradients are steeper at the margins of the GWB where the impure and less permeable limestones occur. Overall groundwater flow will be southward towards the Roughty River and the coast. • Where gravels overlie the karstified aquifer they provide a permeable pathway for recharge to the underlying aquifer. They can also act to augment storage in the aquifer. • There is a high degree of interaction between surface water and groundwater karstified aquifers.
Attachments	
Instrumentation	**Stream gauges:** 21008, 21009. **EPA Water Level Monitoring boreholes:** none **EPA Representative Monitoring points:** none
Information Sources	Conlon V, Wright G (1998) *County Kerry Aquifer Classification (draft).* Geological Survey of Ireland Report to Kerry Co. Co., 18 pp. Scanlon B (1985) *A Groundwater Study of the Maine River Basin, Co. Kerry*. Geological Survey of Ireland Report Series, RS 85/1. Geological Survey of Ireland, Dublin. Pracht M (1996) *Geology of Dingle Bay: A geological description, to accompany bedrock geology 1:100,000 scale map, Sheet 20, Dingle Bay.* Geological Survey of Ireland. 58pp. Wright G (1979) Groundwater in the South Munster Synclines. In: Hydrogeology in Ireland, Proceedings of a Hydrogeological Meeting and associated Field Trips held in the Republic of Ireland from 22 to 27 May, 1979. Published by the Irish National Committee of the International Hydrological Programme.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Kenmare GWB (For Reference)

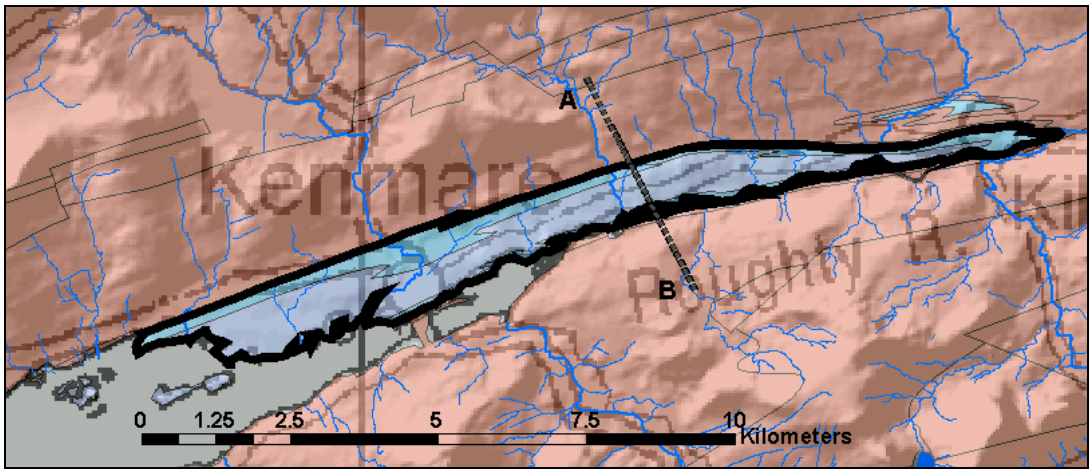
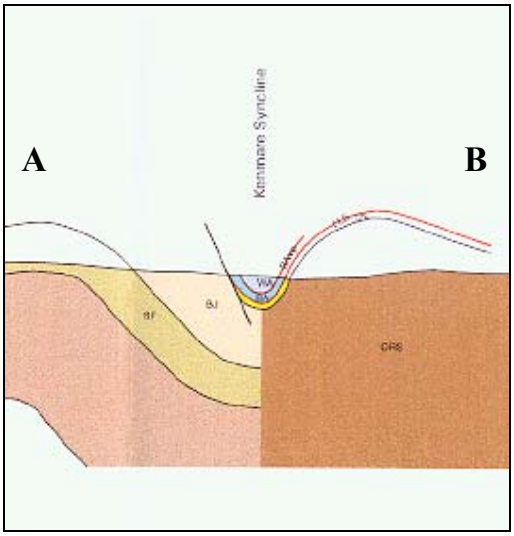


Figure 1: Schematic Cross Section through the Kenmare Syncline
(From Geology of Kerry–Cork Sheet 21. 1:100,000 Bedrock Map Series, Geological Survey of Ireland.)



List of Rock units in Kenmare GWB

Rock unit name and code	Description	Rock unit group
Waulsortian Limestones (WA)	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones
**Victoria Point Member (BAvp)*	*Well bedded chert in calcarenite*	*Dinantian Lower Impure Limestones*
Ballysteen Formation (BA)	Fossiliferous dark-grey muddy limestone	Dinantian Lower Impure Limestones

* Very thin occurrence – represented as a line on 1:100,000 Bedrock Map (Sheet 20).