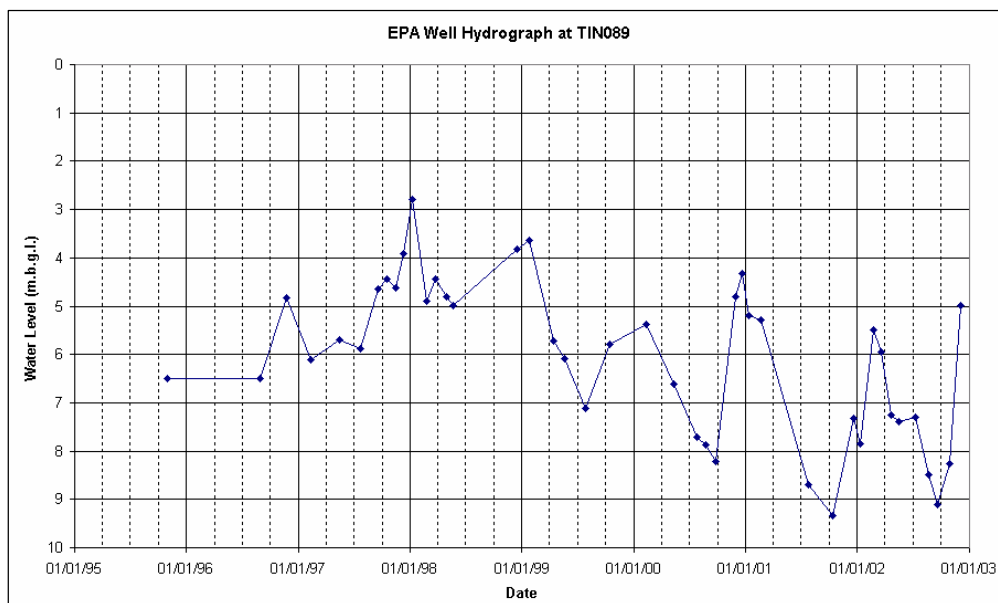


### Templemore B GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority		Associated surface water bodies	Associated terrestrial ecosystems	Area (km <sup>2</sup> )
16 – Suir N. Tipperary Co Co S. Tipperary Co Co Laois Co Co		Suir, Erkina, Rossestown, Drish, Fishmoyne, Borrisoleigh Stream, Farneybridge, Clodiagh, Owenbeg, Clover, Black, Multeen, Aughnaglanny, Arglo, Fidaghta, Aherlow, Ara, Outeragh Stream	Bansha Wood, Annacarthy Wetlands, Inchinquilib and Dowlings Woods, Aughaglanny Valley, Cabragh Wetlands, Templemore Wood.	670
<b>Topography</b>		This groundwater body extends from Templemore towards Tipperary in Co. Tipperary. The area is very lowlying with the river Suir meandering though a wide valley between Templemore and Cashel. East of the Suir topographic gradients are low and there are no significant hills or mountains within the groundwater body area. To the northwest the elevation rises towards the Silvermine Mts.		
<b>Geology and Aquifers</b>	Aquifer type(s)	<b>Ll</b> – Locally Important Aquifer, moderately productive only in local zones <b>Lm</b> – Locally Important Aquifer, generally moderately productive (only 30km <sup>2</sup> )		
	Main aquifer lithologies	<u>Mainly:</u> Dinantian Upper & Lower Impure Limestones <u>With Smaller areas of:</u> Basalts & other Volcanic rocks Devonian Old Red Sandstones Dinantian (early) Sst, Shales and Lst Dinantian Lower Impure Limestones Dinantian Pure Bedded Limestones Dinantian Pure Unbedded Limestones Namurian Shales Namurian Undifferentiated Silurian Metasediments and Volcanics		
	Key structures.	There is a major NNW-SSE trending fault complex in this area. The site lies on the south-eastern side of a SW-NE syncline which runs between Two-Mile-Borris and Thurles		
	Key properties	Various sources of data are used to estimate the aquifer parameters of the <b>Ballysteen Formation</b> throughout this groundwater body. Permeability varies throughout the formation although estimate bulk values of permeability are taken as 10 m/d at Templemore, 30 m/d at Borrisoleigh and 15 m/d at Twomileborris. The permeability in these aquifers depends on the development of faults, fissures and fractures, as indicated by pumping tests and site investigations, in addition to regional experience.		
Thickness	The groundwater body is permeable to some depth due to the presence of faulting and local zones of more permeable rock.			
<b>Overlying Strata</b>	Lithologies	<i>[Information will be added at a later date]</i>		
	Thickness	Subsoil thickness is mostly more than 3m.		
	% area aquifer near surface	15%		
	Vulnerability	Vulnerability is mostly HIGH with small isolated areas of EXTREME.		
<b>Recharge</b>	Main recharge mechanisms	Diffuse recharge to this groundwater body occurs, mostly where subsoil is thinnest or most permeable. The proportion of available recharge that enters the groundwater body varies depending on the subsoil thickness and permeability. There are a number of Karst features such as Enclosed Depressions and Sink Holes, which will act as areas where point recharge can take place.		
	Est. recharge rates	<i>[Information will be added at a later date]</i>		
<b>Discharge</b>	Springs and large known abstractions	Templemore (2000), Clonmore WS (30), Togher GWS, Castleleiny GWS (17 & (35)), Templemore (Cattle Mart - 150), Templemore (Convent of Mercy - 20), Loughmore WS (20), Thurles WS (130), Ballycahill GWS (100), Templetuohy WS (107), Moyne (Templetuohy – 50), Barnalisheen - 50), Drom WS (30), Kilfithmone WS (6), Borrisoleigh WS (SR – 325), Bouladuff WS (60), Coolderry GWS (15), Clonbanna GWS (10), Centenary Co-op Creamery (50 & 200), Two-Mile-Borris GWS (62), Holycross (350), Littleton (170), Moycarky/Curaheen (180), Dundrum RWS (Spring -320), Spollen Concrete Ltd (Bohernacrusha - 400), Goold’s Cross (237), Aileen Creamery (25), Outeragh Creamery (320) , Tipperary Co-op Ltd (900), Mitchelstown Creameries (25)		
	Main discharge mechanisms	Southwards flowing groundwaters discharge into the River Suir or into its tributaries. Discharge occurs via springs, which flow towards the surface water bodies or via baseflow directly into the rivers.		
	Hydrochemical Signature	The bedrock strata of this groundwater body are <b>Calcareous</b> . Groundwaters from these strata have a calcium bicarbonate chemical signature. Water sampling by the EPA shows these waters to be “very hard” with typical values of 440 mg/l (as CaCO <sub>3</sub> ) and to have a high electrical conductivity value of around 800 µs/cm. There are some areas where these values are considerably lower i.e. Drombane WS, the springs at Hollyford and at Ironmills.		

<b>Groundwater Flow Paths</b>	The natural annual water level fluctuation in the aquifer appears to be about 6-8 metres, which would imply the development of a karstic flow system. Groundwater flow within karstic aquifer is confined to conduits, which have developed, by the dissolution of fissures in the aquifer. The groundwater flow will be fast, turbulent and unpredictable within these conduits. Different conduit systems may operate at different water levels, which results in a variety of flow regimes occurring under different times of the year.
<b>Groundwater &amp; surface water interactions</b>	In this groundwater body numerous karst features are recorded, which indicate areas where there is a direct link between the surface and groundwater. Such areas must be strictly guarded against environmental pollution. There also will be significant interaction between surface water and groundwater in the “Epikarst” which is the weathered upper layer of Limestone.
<b>Conceptual model</b>	This groundwater body extends from the Suir Limestone aquifer in the southeast to the boundary of the Suir catchment in the north and west. The area comprises Carboniferous Limestone. The majority of the area is considered to be a locally productive aquifer. There is a small proportion of the aquifer (2%) near Templemore, which is considered to be a (Lm) Generally Moderately Productive Aquifer. It is evident from the list of groundwater abstractions that the aquifer can produce large flows of groundwater. The aquifer parameters derived from pumping tests at public supplies in the area also confirm this. It is important to note that it is the nature of karst hydrogeology to be ultra-variable even at a local scale. This will greatly effect protection and sustainable development of this groundwater source. It is also important to note that the values cited are located within the Karst aquifer and are not representative of the whole groundwater body of which 40% is of Silurian and Devonian origin.
<b>Attachments</b>	Fig. 1 EPA hydrograph at TIN089 Fig. 2 EPA chemistry Data in Templemore GWB
<b>Instrumentation</b>	Stream gauge: 16103, 16037, 16039, 16051, 16036, 16057, 16101, 16052, 16035, 16001, 16058, 16059, 16003, 16002, 16028, 16024, 16005, 16053, 16118, 16117, 16008, 16007, 16017, 16033, 16029, 16110 Borehole Hydrograph: TIN089 EPA Representative Monitoring boreholes: North Tipperary – Togher (#86), Templetohy (#70), Moyne (#52, #53 & #54), Tobermaloo (#74), Thurles Co-op Creamery (spring) (#132), Borrisoleigh (#15), Templemore (#69), Thurles WS (Lady's Well) (#75), Littleton WS (#47), Holycross (#37), Moycarkey (#50), South Tipperary – Springs at Toberadorah (#35), Springs at Kedrah (#39)
<b>Information Sources</b>	Hunter Williams, N., Motherway, K., & Wright, G. (2002) Templemore Water Supply Scheme Groundwater Source Protection Zones. Hunter Williams, N., Motherway, K., & Wright, G. (2002) Borrisoleigh Water Supply Scheme Groundwater Source Protection Zones. Hunter Williams, N., Motherway, K., & Wright, G. (2002) Twomileborris Water Supply Scheme Groundwater Source Protection Zones. Hunter Williams, N., Motherway, K. and Wright, G. (2002) <i>North County Tipperary Groundwater Protection Scheme. Main Report. Draft report to North Tipperary County Council. Geological Survey of Ireland 56pp.</i>
<b>Disclaimer</b>	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae



<b>Formation Name</b>	<b>Code</b>	<b>Description</b>	<b>Rock Unit Group</b>	<b>Aquifer Category</b>
Aghmacart Formation	AG	Dark shaly micrite, peloidal limestone	Dinantian Upper Impure Limestones	Ll
Ardane Formation	AE	Resistate conglomerate & sandstone	Devonian Old Red Sandstones	Ll
Athassel Limestone Formation	AT	Dark shaly cherty limestone	Dinantian Upper Impure Limestones	Ll
Ballynash Member	BAbn	Wavy-bedded cherty limestone, thin shale	Dinantian Lower Impure Limestones	Ll
Ballysteen Formation	BA	Fossiliferous dark-grey muddy limestone	Dinantian Lower Impure Limestones	Ll
Cappagh White Sandstone Formation	CA	Red & white sandstone, conglomerate	Devonian Old Red Sandstones	Ll
Crosspatrick Formation	CS	Pale-grey cherty crinoidal limestone	Dinantian Pure Bedded Limestones	Lm
Durrow Formation	DW	Shaly fossiliferous & oolitic limestone	Dinantian Upper Impure Limestones	Ll
Farranacliff Formation	FA	Silty-shale & flaggy sandstone	Namurian Undifferentiated	Ll
Garryduff Formation	GF	Greywacke & slate	Silurian Metasediments and Volcanics	Pl
Hollyford Formation	HF	Greywacke, siltstone & grit	Silurian Metasediments and Volcanics	Pl
Hore Abbey Limestone Formation	HA	Pale-grey bedded limestone with chert	Dinantian Pure Bedded Limestones	Rkd
Knockordan Limestone Formation	KD	Pale cherty crinoidal limestone	Dinantian Pure Bedded Limestones	Rkd
Lackantedane Formation	LK	Dark silty shale	Namurian Shales	Ll
Lagganstown Formation	LG	Dark thin-bedded cherty limestone	Dinantian Upper Impure Limestones	Ll
Lisduff Oolite Member	BAld	Oolitic limestone	Dinantian Pure Bedded Limestones	Lm
Lough Muskry Formation	LM	Lithic conglomerate & purple mudrock	Devonian Old Red Sandstones	Ll
Lower Limestone Shale	LLS	Sandstone, mudstone & thin limestone	Dinantian (early) Sst, Shales and Lst	Pl
Moanour Formation	MO	Grey-black shale & coaly sandstone	Namurian Shales	Ll
Namurian (undifferentiated)	NAM	Sandstone	Namurian Undifferentiated	Ll
Poulgrania Sandstone Formation	PL	Red sandstone & some conglomerate	Devonian Old Red Sandstones	Ll
Shrough Formation	SR	Sandstone, flagstone, siltstone, shale	Namurian Undifferentiated	Ll
Slievenamuck Conglomerate Formation	SM	Conglomerate & purple sandstone	Devonian Old Red Sandstones	Ll
Visean Limestones (undifferentiated)			Dinantian Upper Impure Limestones	Ll
Volcanics (undifferentiated)	V		Basalts & other Volcanic rocks	Lm
Waulsortian Limestones	WA	Massive unbedded lime-mudstone	Dinantian Pure Unbedded Limestones	Rkd

## Chemical Signature of Relatively Uncontaminated Waters (expanded Durov Plot)

Samples with Calcium signature

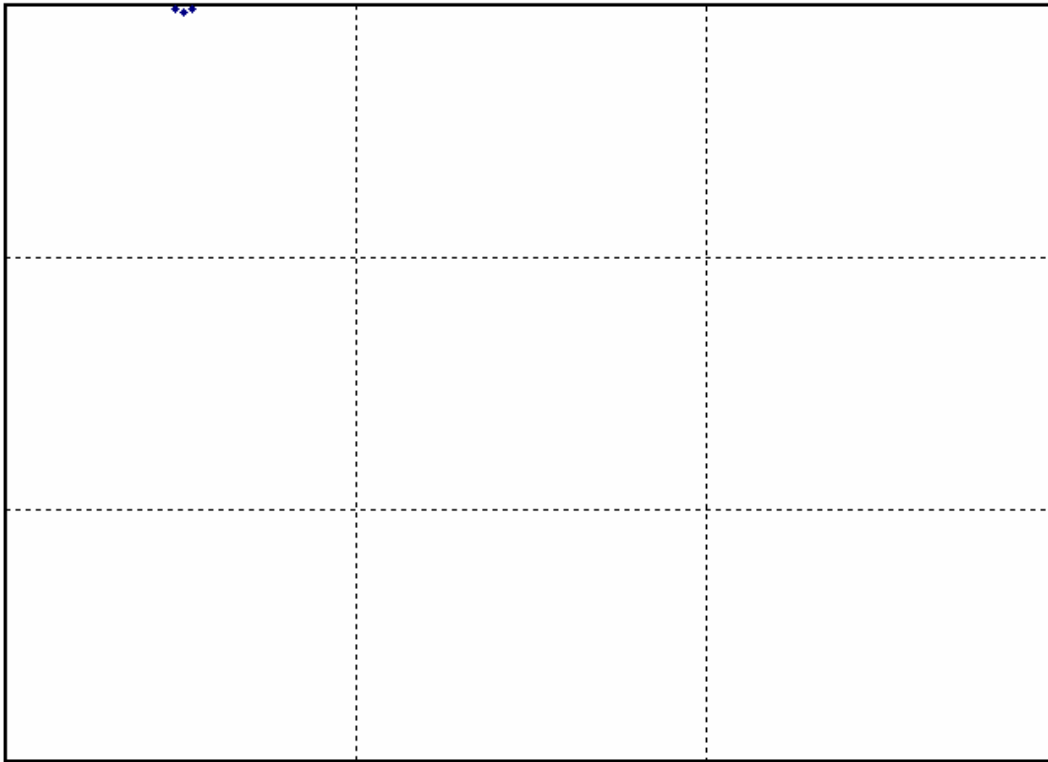
Samples with Magnesium signature

Samples with Sodium/Potassium/Ammonium signature

Samples with Bicarbonate/Nitrate signature

Samples with Sulphate signature

Samples with Chloride signature



- Signature boundary
- ◆ Templemore G/WB
- ▲
- ▲
- ◆
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- ▲
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- 
- ×
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- ◇
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*NB: Samples thought to be contaminated, or with ionic balance errors in excess of 15% are not plotted.*