Swilly Gravel GWB: Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
39 Donegal Co. Co.	**Rivers**: Swilly, Roughon, Coravuddy Burn, Fergaug Burn, unnamed streams.	Lough Swilly (IE0002287)	4.7

Topography	The GWB occupies flat-lying ground along the River Swilly between Newmills and Lough Swilly. The GWB is about 8km long and oriented WSW-ENE. The gravels are predominantly at elevations less than 10 mAOD, excepting the area near Newmills, where elevations are slightly over 10 mAOD. To the south of the deposits, the valley side rises fairly gently to about 120 mAOD. The ground rises more steeply on the north to more than 200 mAOD. Letterkenny town is situated on the north side of the GWB, towards the eastern end. The River Swilly, which flows westwards into Lough Swilly, is tidal as far west as Sallaghagrane (4.5 km inland). Drainage is poor along the floodplain, with flooding indicated and a high density of natural and artificial drains.	
Geology and Aquifers	**Aquifer categories**	The deposits are classified as **Locally Important Sand and Gravel Aquifers (Lg)** (DELG/EPA/GSI (1999). The sand/gravel aquifer is mainly underlain by a bedrock aquifer which is Generally Unproductive except for Local Zones (Pl). At the mouth of the river, the bedrock aquifer is classified as Moderately Productive only in Local Zones (Ll).
	Main aquifer lithologies	Alluvial deposits (Meehan, 2004) along river floodplains are thought to comprise sands and gravel at depth, overlain by finer material (silts and clays) (Donegal GWPS). Ground investigations 2.5 km WSW of Letterkenny show that gravel layers are not uniform throughout the deposit; generally they are >5 m thick and overlain by 10-15 m of silt or sometimes clay (Minerex Environmental Ltd, 2001). In some areas, there are only thin (0.5-2 m) gravel layers. In general, the gravels thicken towards the centre of the deposit, where they are >10 m.
	Key structures	N/A
	Key properties	Sand/gravel aquifers generally consist of unconsolidated coarse-grained material, usually containing less than 8% fines (O'Suilleabháin, 2000). However, this aquifer contains greater proportions of fines in places. Productivity and yield data indicate that the gravel layers are transmissive and capable of providing yields in excess of 400 m^3/d (Donegal GWPS). In gravel layers, transmissivity will probably be >200 m^2/d. In areas where the aquifer is more fine-grained, transmissivity will be lower. Storativity is expected to be high (10-20%). In this floodplain area, water levels will generally be close to ground surface. Groundwater levels range between 0 and 8 mbgl, but are typically <3 mbgl. Groundwater is likely to be confined by low permeability silt/clay layers in places. Groundwater gradients are estimated as 0.0012.
	Thickness	Thicknesses of more than 10 m are likely along the axes of the rivers, thinning towards the margins of the deposits.
Overlying Strata	**Lithologies**	The sand/gravel aquifer is defined on the basis of mapped alluvium. Small areas of Made Ground extend onto the gravel body (Meehan, 2004).
	Thickness	Fine-grained alluvium of up to 15 m can overlie the alluvial gravels.
	% area aquifer near surface	*[Further Information to be added at a later date]*
	Vulnerability	The vulnerability is mapped as HIGH.
Recharge	**Main recharge mechanisms**	Diffuse recharge occurs via rainfall percolating through the unsaturated sand/gravel. In general, due to the high permeability of sand/gravel, a high proportion of available recharge to gravel aquifers may percolate down to the water table. However, the low permeability layers that occur over this aquifer, together with a high water table in places, will tend to inhibit recharge. Depending on the river stage relative to groundwater levels, and on the permeability of the river bottom, river waters may recharge the aquifer. There are likely to be small volumes of groundwater flowing laterally into the gravels from the poorly productive bedrock aquifer.
	Est. recharge rates	*[Information to be added to and checked]*
Discharge	**Large springs and large known abstractions (m^3/d)**	Letterkenny WSS (*volume not known*); Sand and Gravel Batching Plant (*volume not known*).
	Main discharge mechanisms	Groundwater discharges to the river and streams that flow through the deposits. Groundwater will also discharge to Lough Swilly, a sea lough.
	Hydrochemical Signature	There are no data currently readily available with which to assess the hydrochemistry of this GWB.

Groundwater Flow Paths	Groundwater flow path length depends on the size and dimensions of the sand/gravel deposit, and also upon the spacing of internal groundwater divides and the distance between streams, if groundwater is discharging to them. In unconfined areas, groundwater will flow at high angles to the River Swilly and smaller streams, thus the flowpaths typically will be considerably less than about 500 m. However, where low permeability subsoils above the gravels confine groundwater, groundwater flowpaths may be considerably longer. Flow direction in this case will be parallel to the river.
Groundwater & Surface water interactions	The hydraulic connection between the groundwater in the aquifer and the River Swilly and the streams is expected to be variable due to the spatially varying permeabilities of the subsoil overlying the alluvial gravel. Water may be able move into and out of the aquifer from the river in certain locations depending on the river stages and permeability of the subsoils.
Conceptual model	• The GWB consists of sand/gravel deposits lying along the ENE-flowing River Swilly just south of Letterkenny. • The deposits are located beneath a river floodplain, and are situated at elevations less than 10 mAOD. Overall, the surface drainage is eastwards, with some streams flowing north and south to the main drainage channel (River Swilly). Surface drainage is poor, and the area is prone to flooding. The River Swilly is tidal up to 4.5 km inland. • The aquifer is comprised of alluvial deposits, which drilling data indicate is comprised of sands/gravels overlain by a thick (>10 m) silty layer. • Productivity and yield data indicate that transmissivity in the sand/gravel is >200 m^2/d. • The sand/gravel aquifers are likely to be greater than 10 m thick, excepting at their margins. • Groundwater level data and ground surface gradients indicate that groundwater gradients are low (estimated as 0.0012). • Diffuse recharge occurs via rainfall percolating through the unsaturated sand/gravel. Recharge is likely to be inhibited by the high groundwater levels and, in places, by low permeability deposits overlying the sands/gravels. Some groundwater will flow into the gravels from the underlying poorly productive bedrock aquifer. • Groundwater discharges to the River Swilly, possibly to some of the streams that flow through the deposits, and to Lough Swilly. • Due to the geometry of the deposits, groundwater flow paths are likely to be less than 500 m in areas where groundwater is unconfined. In areas where the hydraulic connection between ground and surface waters is low due to low permeability deposits overlying the sands/gravels, groundwater flow paths are likely to be longer; they will also be parallel rather than at an angle to the River Swilly.
Attachments	Figure 1.
Instrumentation	Stream gauges: 39064 (Port Bridge) EPA Water Level Monitoring boreholes: none EPA Representative Monitoring points: none
Information Sources	DELG/EPA/GSI (1999) *Groundwater Protection Schemes.* Department of the Environment and Local Government, Environmental Protection Agency and Geological Survey of Ireland. Lee, M. and Fitzsimons, V. (2004) *County Donegal Groundwater Protection Scheme*. Volume 1 Main Report, Draft, July 2004. 58 pp. Geological Survey of Ireland. Meehan, R.T., (2004) *Subsoils Map for County Donegal*. Map produced as part of EPA Soil and Subsoil Mapping Project (formerly FIPS-IFS). Teagasc, Kinsealy. Minerex Environmental Ltd (2001) xxxxxxxxxxxxxxxxx O' Riain, G., (2004). *Water Dependent Ecosystems and Subtypes Draft Report.* WFD Support Projects. Compass Informatics in association with National Wildlife and Parks Service (DEHLG). O'Suilleabháin, C., (2000). *Assessing the boundary between high and moderately permeable subsoils.* Unpublished MSc., University of Dublin. Department of Civil, Structural and Environmental Engineering, Trinity College Dublin.
Disclaimer	Note that all calculations and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae

Figure 1 Location and extent of Swilly Gravel