Central Gravel GWB Group (Shannon Lower): Summary of Initial Characterisation.

Hydrometric Area Local Authority	Associated surface water features	Associated terrestrial ecosystem(s)	Area (km^2)
25 Offaly, Tipperary Co. Co's	**Rivers**: Rapemills, Camcor, Ollatrim, Little Brosna and Bunow **Lakes**: Ballinlough	All Saints bog and Esker SAC (O Riain**,** 2004)	83

Topography	Three sand/gravel aquifers are grouped together and described as the Central Gravel GWB Group, shown in Figure 1. The deposits are located in the vicinity of Birr, Roscrea and Moneygall. They are considered together because they have a similar configuration, i.e., similar morphology, located in low-lying areas in the central part of the Shannon Lower Hydrometric region and have similar land use patterns. Apart from the western portion of the Moneygall deposits, the deposits are within the same subcatchment (Little Brosna). The deposits are generally situated between 40 to 150 m OAD, typified by hummocky terrain, with occasional narrow sinuous esker ridges standing proud of the main sand/gravel deposits.	
Geology and Aquifers	**Aquifer categories**	The sand/gravel deposits in the subcatchment are classified as **Locally Important Sand and Gravel Aquifers (Lg)** (eg, Moneygall, Birr) and **Regionally Important Sand and Gravel Aquifers (Rg)** (eg, Roscrea) (Hunter-Williams, *et al*, 2002; Daly, *et al,* 1998) as they satisfied GSI criteria for sand/gravel aquifer classification (DELG/EPA/GSI (1999). For the purposes of the WFD only sand/gravel aquifers greater than 4 km^2 are considered as GWB's.
	Main aquifer lithologies	Glaciofluvial sand/gravel deposits. They are all categorised as limestone sand/gravel deposits (Meehan, 2004).
	Key structures	N/A
	Key properties	Yields are reported to be greater than 1000 m^3/d in three industrial wells located in Roscrea. Discharge from springs at Moneygall and Dunkerrin is estimated to be 1000 m^3/d and 400 m^3/d respectively (Kelly, 2004). Permeability is estimated to be approximately 50 m/d in the sand/gravel aquifers in the vicinity of Moneygall (Kelly, 2004). Particle size analyses of samples from Roscrea sand/gravel aquifer showed the percentage of fines to be less than 4% (Hunter-Williams, *et al*, 2002). Sand/gravel aquifers generally consist of unconsolidated coarse grained material, usually containing less than 8% fines (O'Suilleabháin, 2000). Typically transmissivity is generally greater, ranging from 200 – 1500 m^2/d. Transmissivity is estimated to be approximately 600 m^2/d and the permeability is in the order of 75-85 m/d for a small sand/gravel aquifer near Ferbane located within the Brosna catchment, (Kelly, 2004; Daly, 1985). Storativity is expected to be high (10%). Specific dry weather flows recorded on the Little Brosna in the vicinity of Birr range from 1.8-6.7 $l/s/km^2$ suggest a high proportion of the baseflow is contribution from the sand/gravel aquifer. As the unconsolidated deposits are at the surface, groundwater is likely to be unconfined. The data are inadequate to calculate groundwater gradients, due to high permeability, these are expected to be greater than 0.001. Water levels are close to or at ground level in the sand/gravel deposits in the vicinity of Moneygall. In the vicinity of Birr, water levels are recorded at Gloster, range 6-10 m below ground level.
	Thickness	Generally, the sand/gravel deposits are greater than 10 m thick. The depth to bedrock is known to be at least 60 m in places in the Roscrea sand/gravel aquifer (Hunter-Williams, *et al*, 2002). Subsoil thicknesses of up to 16 m have been recorded in the sand/gravel deposit at Birr.
Overlying Strata	**Lithologies**	Alluvium, cutover peat and lacustrine deposits are typically associated with the sand/gravel deposits. Generally, alluvium is present in narrow strips along streams and rivers. Cutover peat and lacustrine deposits occur in the lowest lying regions often at the edges of the sand/gravel deposits.
	Thickness	The thickness of alluvium, cutover peat and lacustrine deposits are generally less than 3 m.
	% area aquifer near surface	*[Further Information to be added at a later date]*
	Vulnerability	*[Further Information to be added at a later date]*
Recharge	**Main recharge mechanisms**	Diffuse recharge occurs via rainfall percolating through the unsaturated sand/gravel. Due to the high permeability of sand/gravel, a high proportion of the available recharge will percolate down to the water table.
	Est. recharge rates	*[Information to be added to and checked]*
Discharge	**Large springs and large known abstractions (m^3/d)**	Springs: Dunkerrin (total discharge approximately = 400 m^3/d, average abstraction = 227 m^3/d; Busherstown (total discharge approximately = 1000 m^3/d, average abstraction = 113 m^3/d). Boreholes: Roscrea, three boreholes extracting over 1000 m/d.
	Main discharge mechanisms	Groundwater discharges to small and large springs located at the periphery of the sand/gravel deposits and to rivers/streams that flow through the deposits.
	Hydrochemical Signature	The water is generally very hard; Moneygall (38 samples), with an average total hardness of 350 mg/l (equivalent $CaCO_3$) and electrical conductivity values of 411-711 µS/cm. Alkalinity at Dunkerrin (13 samples) has an average of 336 mg/l). The groundwater has a calcium bicarbonate signature.

Groundwater Flow Paths	The length of flow paths depend on the size of the sand/gravel deposit and on local groundwater divides. In general, locally important sand/gravel aquifers are expected to have relatively short flow paths, i.e., up to several hundreds of metres. Whereas the regionally important sand/gravel aquifers are likely to have longer flow paths, possibly greater than 1 km. Sand/gravel has an intergranular porosity, thus groundwater flow is diffuse. Groundwater flow directions are driven by topography, generally to the northwest.
Groundwater & Surface water interactions	In general groundwater from sand/gravel deposits discharges to springs at the periphery or streams/rivers flowing through the deposits. The hydraulic connection between the groundwater in the aquifer and the streams/rivers is expected to be high. Due to the high permeability of the sand/gravel, the drainage density is usually low.
Conceptual model	• The GWB consists of two locally important sand/gravel aquifers and one regionally important sand/gravel aquifer. • The deposits are generally situated between 40 to 150 m OAD, typified by a hummocky landscape, with occasional narrow sinuous esker ridges associated with the main sand/gravel deposits. • Yields are reported to be greater than 1000 m^3/d in three industrial wells located in Roscrea. Discharge are estimated in springs at Moneygall and Dunkerrin to be 1000 m^3/d and 400 m^3/d respectively. Permeability is estimated to be approximately 50 m/d in the sand/gravel aquifers in the vicinity of Moneygall. • Typically transmissivity ranges from 200 – 1500 m^2/d. Storativity is expected to be high (10%). As the unconsolidated deposits are at the surface, groundwater is likely to be unconfined. The data are inadequate to calculate groundwater gradients, due to high permeability, these are expected to be greater than 0.001. • Particle size analyses of samples from Roscrea sand/gravel aquifer showed the percentage of fines to be less than 4%. Water levels are close to or at ground level in the sand/gravel deposits in the vicinity of Moneygall and 6-10 m below ground at the western end of the aquifer in the vicinity of Birr. • Diffuse recharge occurs via rainfall percolating through the unsaturated sand/gravel. Due to the high permeability of sand/gravel, a high proportion of the available recharge will percolate down to the water table. • Groundwater discharges to small and large springs located at the periphery of the sand/gravel deposits and to rivers/streams that flow through the deposits. • Flow path lengths are likely to be variable, dependent on the size of the sand/gravel deposit. Flow directions are expected to follow topography, generally to the northwest.
Attachments	Figure 1.
Instrumentation	**Stream gauges:** 25022, 25021, 25024 **EPA Water Level Monitoring boreholes:** OFF061, Gloster (Birr) **EPA Representative Monitoring points:** OFF010 (Dunkerrin WSS)
Information Sources	DELG/EPA/GSI (1999) *Groundwater Protection Schemes*. Department of the Environment and Local Government, Environmental Protection Agency and Geological Survey of Ireland. Daly, D., Cronin, C., Coxon, C., Burns, S.J. (1998). *Offaly Groundwater Protection Scheme*. Geological Survey of Ireland. 78pp. Hunter-Williams, T., Motherway, K., Wright, G., (2002). North County Tipperary Groundwater Protection Scheme. Geological Survey of Ireland, 53pp. Kelly, C., (2004). Moneygall WSS. Busherstown Springs. Groundwater Source Protection Zones. Geological Survey of Ireland, 18pp. Kelly, C., (2004). Dunkerrin WSS. Groundwater Source Protection Zones. Geological Survey of Ireland, 17pp. Kelly, C., (2004). Ferbane WSS. Skehanagh Boreholes. Groundwater Source Protection Zones. Geological Survey of Ireland, 17pp. 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. Meehan, R.T., (2004) *Subsoils Map for counties Tipperary and Offaly*. Map produced as part of EPA Soil and Subsoil Mapping Project (formerly FIPS-IFS). Teagasc, Kinsealy.
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. Location and extent of Central Gravel Group