### Ferbane GWB: Summary of Initial Characterisation

<table>
<thead>
<tr>
<th>Hydrometric Area</th>
<th>Associated surface water bodies</th>
<th>Associated terrestrial ecosystem(s)</th>
<th>Area (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 - Brosna Catchment</td>
<td>Rivers: Brosna.</td>
<td>None groundwater-dependent.</td>
<td>14 (at surface)</td>
</tr>
</tbody>
</table>

**Topography**

The GWB is narrow, and elongated in a NE-SW direction, in line with the structural ‘grain’ of the area. The area is extremely flat-lying, with elevations ranging from 40-60 m AOD across the GWB. Four streams flow off this GWB and drain to the Brosna and Little Rivers, but only the River Brosna crosses the GWB.

**Geology and Aquifers**

**Aquifer categories**

*RF*: Regionally important fissured aquifer.

**Main aquifer lithologies**

Devonian Kiltorcan-type Sandstones. *(Described as Cadamstown Sandstone in the Offaly Groundwater Protection Scheme)*

**Key structures**

The Devonian Kiltorcan-type Sandstones of this body form the core of a major northeast-southwest trending anticlinal structure known as the Ferbane Inlier. The sandstones are overlain to the northwest and southeast by Dinantian Sandstones, Shales & Limestones which are in turn overlain by Dinantian Lower Impure Limestones (Figure 1). A major fault, the Ferbane Fault, runs along the northwestern side of the inlier (trending northeast to southwest) downthrowing the succession to the northwest of the fault. The rock layers dip to the northwest and southeast at 5-15°, unless the strata are further deformed by faulting. The fold axis is heavily dissected by northwest to southeast normal faults that are spaced at 1-3 km. Rocks of a similar type, approx. 17 km southeast of this GWB in the Clonaslee West GWB, are well jointed (two sets of major vertical joints NW-SE and NE to SW) and horizontal fractures can be recognised in most exposures as well as microfractures which are frequently closely spaced (<0.2m).

**Key properties**

Transmissivity is in the range 20 to 90 m²/d. Specific yield = 0.01-0.02, and Storativity = 8.4 x 10⁻⁴. Gradients are approximately 0.01 - 0.02. *(data sources: Rock Unit Group Aquifer Chapters, GWPS Reports, see references; estimation from maps)*

**Thickness**

The rock unit varies in maximum thickness from 70 to 105 m. The aquifer is formed by the whole interval.

**Overlying Strata**

**Lithologies**

A Teagasc Parent Material Map is not currently available for County Offaly. The Offaly Groundwater Protection Scheme Quaternary Geology Map identifies areas of peat (northeast of the body), gravel deposits, till and till with gravel overlying this GWB. *(The gravel deposits overlying this body were identified in the Offaly Groundwater Protection Scheme as a Potential Locally Important Gravel Aquifer)*.

*(Information to be added at a later date)*

**Vulnerability**

Vulnerability is High over the southwest two thirds of the GWB, and is Moderate in the northeast. *(A Groundwater Vulnerability Map has been prepared as part of the Offaly Groundwater Protection Scheme)*

**Main recharge mechanisms**

Diffuse recharge will occur over the entire GWB via rainfall percolating through the subsoil. The proportion of the effective rainfall that recharges the aquifer is largely determined by the thickness and permeability of the soil and subsoil, and by the slope. Gravel deposits are generally considered to have a ‘high’ permeability, and where unsaturated facilitate percolation of recharge to the underlying aquifer. Percolation of recharge may be restricted in the northeast of the body where the aquifer is overlain by a large area of peat. Peat deposits in this region are generally underlain by low permeability lacustrine clay and lake marl.

*(Information to be added at a later date)*

**Recharge rates**

**Discharge**

**Important springs and high yielding wells (m³/d)**

The two boreholes at Gallen yield 760 m³/d and 780 m³/d (GSI ‘Excellent’ yield classifications). They are drilled through the confining Dinantian (early) Sandstone, Shales and Limestones (Navan Group). The Bord na Móna borehole at Gallen yields 396 m³/d, whilst a private well at Strawberry Hill House yields 218 m³/d (GSI ‘Good’ yield classifications).

*(Information to be added at a later date)*

**Main discharge mechanisms**

The normal faults cutting across this GWB are thought to act as discharge zones for groundwater, particularly in the confined portion of the body.
Groundwater Flow

Groundwater flows primarily through fissures and joints. The fissuring associated with the faults in this GWB results in higher transmissivities, specific capacities and yields for some wells. However the degree of fracturing and consequently development of permeability can vary over relatively short distances. In certain areas the rock cement has been dissolved and so the rock is crumbly and easily weathered. Here it may have intergranular permeability - a feature that is very unusual in Irish bedrock. Overall flow directions within the body are difficult to estimate given the limited range of ground elevation across the body (40-60 m AOD). Groundwater gradients are extremely low. Groundwater flow is unconfined in the centre of the body but becomes confined beneath the Dinantian (early) Sandstones, Shales and Limestones of the Clara GWB. The Ferbane fault, a major fault running northeast southwest along the northwestern side of the body, is likely to act as a no flow boundary. The succession is downthrown to the northwest of the fault. Trial boreholes drilled at ..........(ask Coran for details) just...km from the fault encountered ...m of Dinantian Lower Impure Limestones but no Kiltorcan-type Sandstones. It is possible that groundwater in the confined portion of the body discharges through the numerous northwest to southeast normal faults that cut across the inlier. The GWB is partially overlain by a potential gravel aquifer. There is not sufficient information about saturated thickness available at this time to formally classify it as a gravel aquifer.

Groundwater & Surface water interactions

There are no groundwater dependent terrestrial ecosystems with a national designation from Dúchas/Department of the Environment within this GWB.

Conceptual model

- This GWB is bounded on all sides by the contact with the lower permeability Dinantian (early) Sandstones, Shales and Limestones of the Clara GWB.
- The topography is flat-lying with ground elevations ranging from 40-60 m AOD across the body.
- The groundwater body is composed of high transmissivity fissured bedrock, Devonian Kiltorcan-type Sandstones.
- The sandstones of this body form the core of a northeast southwest trending anticlinal structure known as the Ferbane Inlier. They are overlain to the northwest and southeast by low permeability rocks of the Dinantian (early) Sandstones, Shales and Limestones and the Dinantian Lower Impure Limestones. The Ferbane fault runs northeast to southwest along the northwestern side of the body, downthrowing the succession to the northwest of the fault and forming the northwestern boundary of the body.
- Flow in this body occurs along fractures, joints and major faults. In certain areas there may be some intergranular permeability, as a result of the dissolution of the rock cement, which leaves the rock crumbly and easily weathered. Groundwater flow is unconfined in the centre of the body but becomes confined beneath the Dinantian (early) Sandstones, Shales and Limestones of the Clara GWB.
- Groundwater gradients are very low.
- Hydrochemistry from wells in the confined portion of the body indicate that ion exchange is occurring along long relatively slow flow paths in the sandstone aquifer.
- Diffuse recharge occurs throughout the GWB. The normal faults cutting across this GWB are thought to act as discharge zones for groundwater, particularly in the confined portion of the body.

Information Sources

Aquifer chapter: Devonian Kiltorcan-type Sandstone.

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: Schematic Cross Section through the Ferbane Inlier
(From Geology of Galway-Offaly Sheet 15. 1:100,000 Bedrock Map Series)

- WA – Waulsortian Limestone
  (Dinantian Pure Unbedded Limestones)
- BA – Ballysteen Limestone
  (Dinantian Lower Impure Limestones)
- NAV – Navan Group
  (Dinantian (early) Sandstones, Shales & Limestones)
- ORS – Old Red Sandstone
  Undifferentiated
  (Devonian Kiltorcan type Sandstones)
- SIL – Undifferentiated Silurian Rocks
  (Silurian Metasediments)

Horizontal and Vertical Scale 1:100,000

Figure 2: Hydrochemical signature

Chemical Signature of Relatively Uncontaminated Waters (expanded Durov Plot)
FERBANE GWB (FOR REFERNCE)

Rock units in GWB

<table>
<thead>
<tr>
<th>Rock unit name and code</th>
<th>Description</th>
<th>Rock unit group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Red Sandstone (undifferentiated)</td>
<td></td>
<td>Kiltorcan-type Sandstones</td>
</tr>
</tbody>
</table>