



**British  
Geological Survey**  
NATURAL ENVIRONMENT RESEARCH COUNCIL

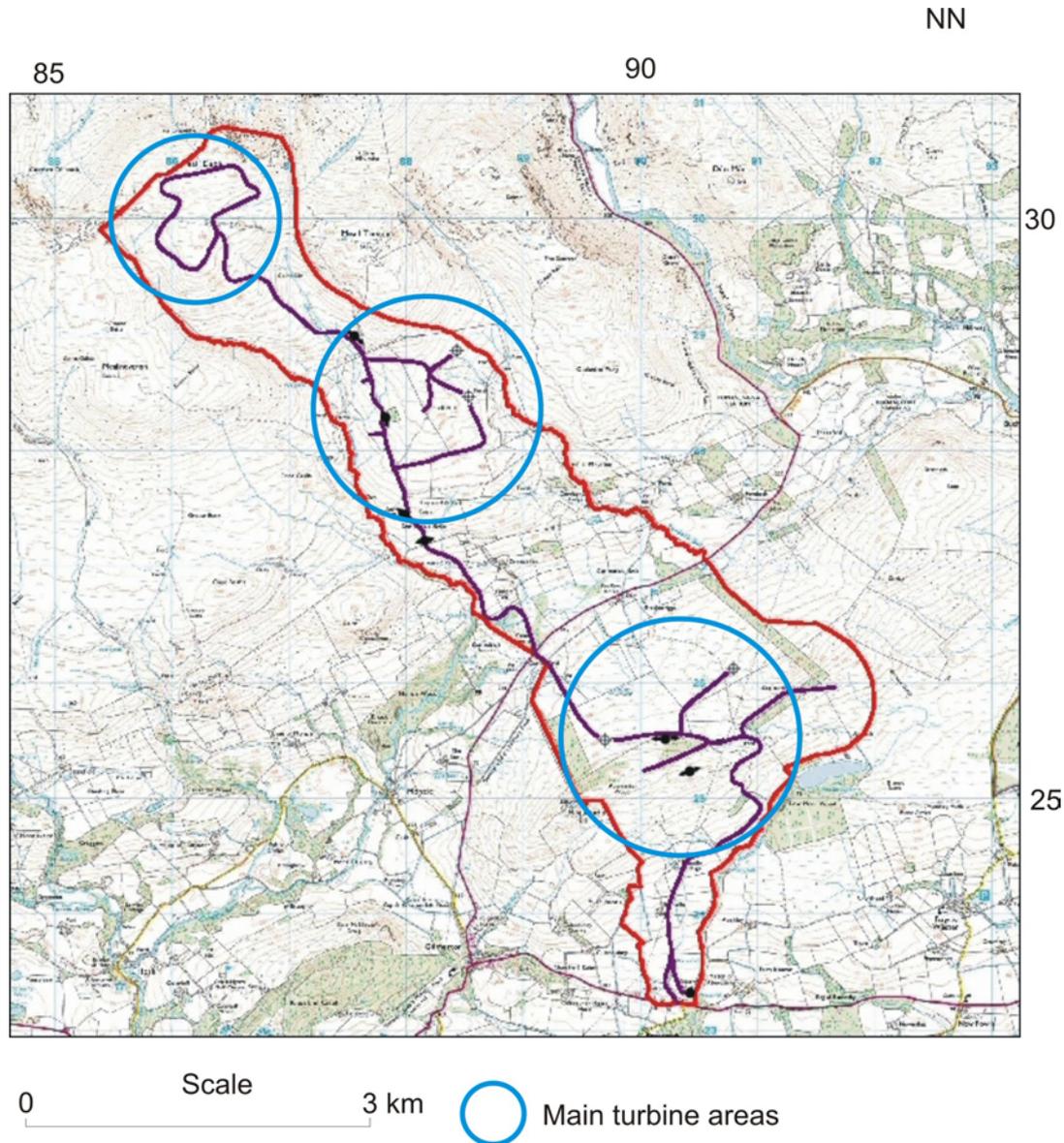
A REVIEW OF THE HYDROGEOLOGY ELEMENT OF THE  
ABERCAIRNY WIND FARM ENVIRONMENTAL  
STATEMENT

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## Section 1

### Location of the Abercairney site



**Figure 1: Location of the Abercairney site**

## 1.1 Geology

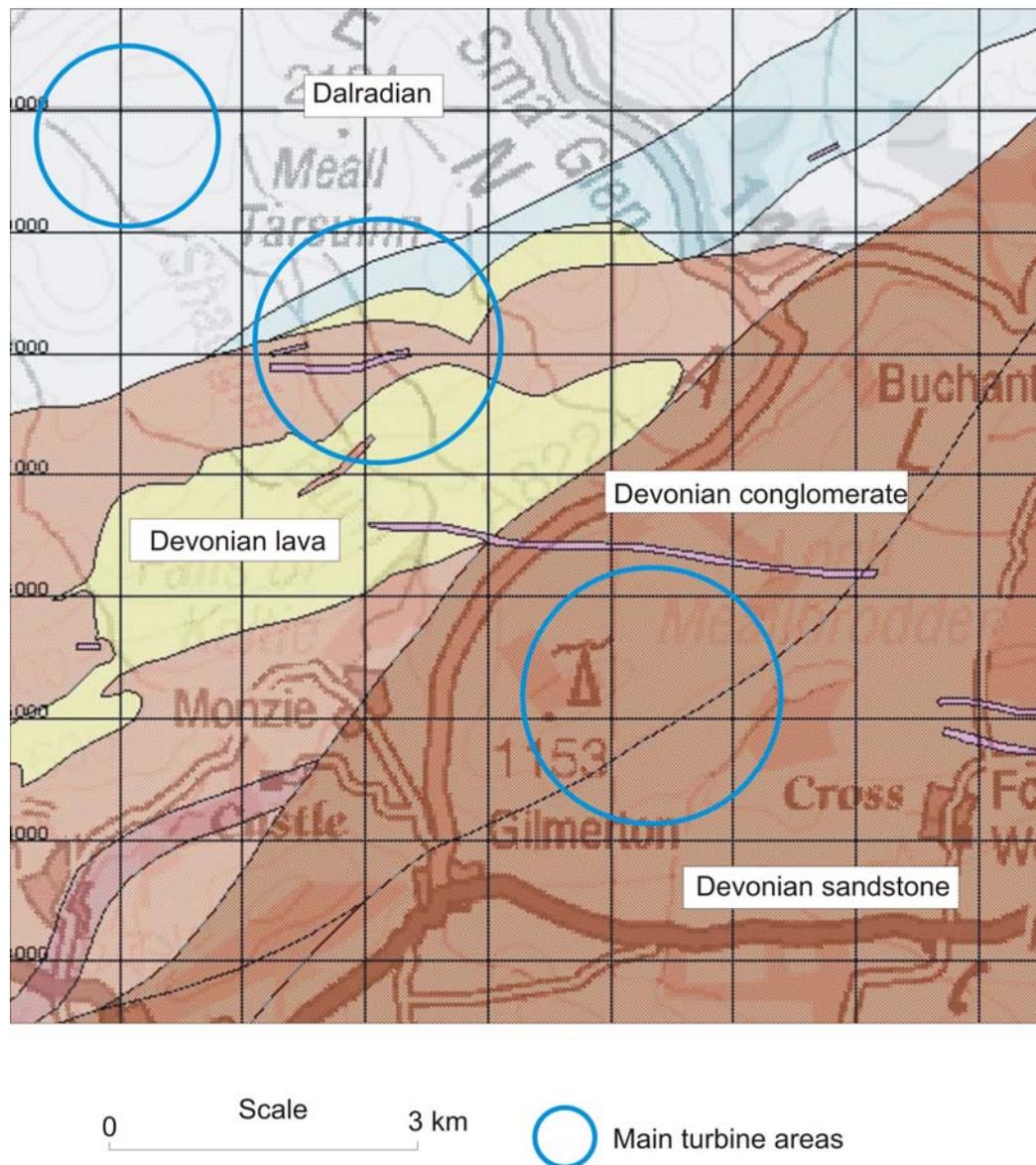
### Superficial Deposits

Much of the hillside is underlain by patchy glacial till. This is a predominantly clayey, stony deposit with occasional coarser grained sand and gravel horizons. The main proposed area for turbine installation is underlain by very thin superficial deposits, and bedrock is either at or very close to surface. Glacial sands and gravels are mapped running approximately SW-NE across the site and Alluvium (typically

comprising poorly consolidated sands, gravels, silts and clays) is mapped to the north of the site area.

**Bedrock**

Precambrian rocks underlie the far north western part of the site area. These are hard, fractured rocks that have been subjected to heat and pressure to form complex structures. The upper few metres of the rock are normally highly fractured as a result of glacial activity and weathering processes. The Lower Old Red Sandstone underlies the rest of the site. This comprises a conglomerate of sandstone, siltstone and mudstone. Igneous intrusions are also present across the site area. (Figure 2).



**Figure 2: Bedrock geology**

## 1.2 Hydrogeology

### Superficial deposits

Groundwater is present mainly within sandy, gravelly beds interbedded within the till deposits. These are common in the area, particularly on the lower slopes of the valleys where significant flows of groundwater are present. These can form useful, but vulnerable, domestic supplies. However, the main body of till itself can also have a significant permeability owing to the sandy nature of the material and the presence of fissures and fractures. The groundwater flow paths in till are very localised and can be complex. They are dominated by the presence of higher-permeability beds of sand and gravel which may occur sporadically. Groundwater will also occur in the glacial sands and gravels and may contribute baseflow to the rivers.

### Bedrock

The Lower Old Red Sandstone is considered an important aquifer in this area and many properties are likely to derive their water supplies from these deposits. The upper weathered zone of the Precambrian deposits is the principal layer where groundwater is present. Here water infiltrates from the surface to enter the relatively high-permeability fractured zone. From here, groundwater moves down slope to appear at springs. Many shallow wells are dug into this layer to intercept the water table.

## **Section 2: The Environmental Statement review**

The ES has been produced by Entec and is dated December 2003.

The proposal is for the construction of 24 turbines at Abercairney (NN 897 267), approximately 4 km north east of Crieff.

### ***Chapter 9: Groundwater-dependent ecosystems***

Chapter 9 considers the impact of the proposed wind farm on ecology and nature conservation.

9.10.3 highlights that key features such as the relatively intact peat that supports the bog vegetation should be avoided by access tracks and turbines.

*BGS consider that there may be a minor, localised, impact on surface waters and groundwater-dependent ecosystems during construction, from the discharge of sediment into nearby water bodies from surface water run off during construction, operation and decommissioning but that this is considered to be a low risk.*

### ***Chapter 13: Hydrology and Hydrogeology***

#### ***Geology***

13.3.11 to 13.3.14 provides an acceptable geological description of the site area.

*BGS comment: A good, accurate summary.*

#### ***Hydrogeology***

13.3.15 provides a description of the hydrogeological conditions across the site. Recognition of the relatively low amount of groundwater held in storage in the Precambrian bedrock is made but that groundwater may occur at shallow depths. It is noted that the Lower Old Red Sandstone and the glacial sands and gravels are locally important aquifers.

*No mention is made of the potentially significant shallow groundwater present in the coarser grained, sands and gravels within the till. This could be very important when considering the potential impact on surface waters as the water in these deposits may provide a contribution to baseflow in nearby surface waters and form the supply source for private water supplies. Groundwater does not only occur in shallow fracture systems in bedrock. It can also be found in water-bearing fractures over 60 metres below surface in fractured Precambrian bedrock.*

### **Groundwater vulnerability**

13.3.16 describes the vulnerability of the groundwater to pollution.

*SEPA's latest vulnerability maps, produced by the BGS, indicate that Precambrian Dalradian fractured bedrock with thin or no sandy till cover is highly vulnerable to pollution. This also applies generally to the Lower Old Red conglomerate and sandstone in the south of the area. However, these maps are not available to consultants yet. Therefore Entec have, correctly, used the latest available publicly accessible data.*

### **Private water supplies**

13.3.25 states that the Glenturret distillery abstracts water from the Turret Burn.

13.3.26 notes that SEPA have highlighted that the Fendoch and Shaggie Burns provide a number of water supplies.

13.3.28 notes that there is a borehole at Drummick Farm (NN 957 273) that abstracts water from the Lower Old Red Sandstone and that there are also several water wells to the south of the site.

***It is important to determine the location and nature of all private water supplies in the area.*** *Within the scope of this review, it is not possible to confirm the likelihood of interference with private water supplies, but basic information on the location and flow rates of any springs and wells must be determined prior to any development going ahead, as localised effects on water flow and quality are possible where access tracks and turbine foundations are built across hillsides.*

*The Drummick Farm borehole is approximately 4 km east of the site and should not be affected by the development. Similarly, BGS also has a record of a borehole at The Ibert (NN 889 257) that may still be used for domestic supply and is also unlikely to be affected. It is likely that there are several properties using wells or springs as a supply source, such as Connachan Lodge (NN 895 276). Water supply sources to the south of the main road should be investigated. The Foulford Inn (NN 8979 2672) is supplied from a private source which may be a shallow spring, an others may be present close to the planned turbine sites in the southern area.*

*Some of the properties in the area are probably supplied from shallow groundwater in the sand and gravel horizons that occur within the till. Where the Precambrian bedrock is locally fractured and weathered it has the potential to provide significant quantities of water. The Lower Old Red Sandstone is an important local aquifer. Due to the fractured nature of the bedrock, rapid flow can occur and sources some distance away may be affected by the proposed development, although it is unlikely that any deep abstraction boreholes located more than 2 km from the margins of the development would be affected.*

### ***Surface water***

13.10.2 states that the Glenturret distillery abstracts water from the Turret Burn and that there is evidence that watercourses on the site are being or have been used for water supply.

13.10.4 states that although the impact assessment highlighted a number of potential impacts on site hydrology and hydrogeology, with the employment of mitigation measures this will ensure that any negative impact that does occur is of minor significance.

*The BGS considers that groundwater baseflow to streams formed on high ground may be significant. Therefore, the construction of tracks and pits some distance from streams may have a temporary effect on the quality of water in them and also the private water supplies of any properties that use surface water for water supply. This is unlikely to be significant, but the role of shallow groundwater flow in bedrock and drift deposits as baseflow to surface streams should be recognised. **It is important that the true situation with regard to the number of users of private water supplies from surface water sources, along with their locations, is established.***

### ***Monitoring***

13.9.1 states that, if required by SEPA, monitoring of water quality in the watercourses will be carried out and also that routing monitoring of access track and river crossings will be undertaken during construction and operation.

*The BGS considers that routine quality inspections of sensitive environmental features within the site and the vicinity should be carried out, along with monitoring of all private water supply sources that could be affected by the proposed development works. Monitoring for a reasonable period before any development takes place is also important*

### **Conclusions**

- BGS considers the Entec report on the geology and hydrogeology of the area to be a fair and accurate statement of the situation.
- The report lacks a comprehensive and detailed list of private water supplies in the vicinity of the proposed development. A survey of private water supplies should be carried out to identify the types and locations of the sources of water supply in the area and to highlight any supplies that are considered to be at risk from the proposed development.
- Shallow groundwater in the sandy till and weathered bedrock zone may be providing significant amounts of groundwater as baseflow to streams and the springs and also supporting areas of mire and wet heath. It is important that any groundwater-dependent ecosystems are identified.
- Whilst the BGS considers the overall risk to groundwater receptors as low, such a development may lead to localised impacts on shallow groundwater,

with temporary reductions in water quality and detrimental effects on groundwater dependant ecosystems.

- Routine inspections of sensitive environmental features within the vicinity of the site should be carried out, with monitoring of all private water supplies that could be affected by the proposed development works, both pre- during and post construction.