Physical features description: Aqualate Mere National Nature Reserve, Staffordshire, UK

Geology

Aqualate Mere is situated in a shallow basin in the Upper Mottled Sandstone (Bunter series) which is overlain by peat, glacial sands and gravels, and boulder clay.

Geomorphology

To the west and east of the mere there are extensive peat deposits which originated as a result of the terrestrialisation of the Mere with deposition of sediment and plant material in the mere and the subsequent development of swamp, fen and bog. The deposition of peat in these areas would have ceased following the drainage of the mere basin. With the exception of the sand and gravel deposits the land around the mere is relatively flat with only slight gradients.

The site is important for Quaternary geomorphology. An esker complex formed by glacial melt waters during the late Devensian glaciation, about 50,000 years ago, borders the northern margin of the mere and displays ice contact slopes along its northern edge. A smaller feature is present to the north of The Gorse (Cpt 12). The reserve is also significant in demonstrating the close association of the esker with a "Dixonian" delta fan formed in a pro-glacial lake to the east of the esker.

Aqualate is one of 16 sites included in the Quaternary of the Pennines and adjacent areas block volume of the GCR. (Evans, D H, 1994).

Soils

Soils on the NNR fall into two broad categories: fen peats of the Altcar subgroup to the west and east of the Mere and deep well-drained sandy loams of the Newport 1 association overlying the glacial sands and gravels.

Hydrology & Hydrochemistry

With 72.5 ha of open water, Aqualate Mere is the largest of the 52 natural meres of the north west Midlands. Three feeder streams run into the Mere which itself drains westward as the River Meese.

The water level in the Mere is thought to be controlled by a sandstone ridge across the bed of the River Meese about 1 km west of the mere. Although the Mere lies in a naturally shallow glacial hollow, its depth has been significantly reduced in the last 150 years, by continuous deposition of sediment brought in via the inflowing streams and by a lowering of the bed of the river in the late 1940s. These have had the combined effect of reducing the maximum depth of the water in the mere from 2-3 m 60 years ago to no more than 1 m today. The Mere has a pH of 8.3 - 8.5 and a conductivity range of 500-700 µs.

Aqualate is unusual amongst the Midlands meres in that it has a significant inflow and outflow (average inflow 1000 megalitres per month). Of the three inflows, the Wood Brook to the north and the Coley Brook to the south are eutrophic (conductivity range 500-750 µs) and carry a significant sediment loading, particularly the Wood Brook which has formed a delta fan where it enters the

Mere. It has been estimated that approximately 480,000 m^3 of sediment has accumulated in the Mere since 1850 (Hutchinson 2004). Phosphate levels in the Wood Brook are also particularly high (total P > 1.0 mg/litre). The Humesford Brook which has a much smaller catchment area has lower nutrient loadings (conductivity range 400 - 450 µs) and contributes little by way of sediment to the Mere. This small watercourse is fed by numerous springs and issues arising from the sandy hummocky landscape to the east of the mere.

While there are clearly groundwater inputs to the water supply to the mere, the significance of groundwater inflows is not fully understood. As well as the importance of groundwater to the flow of some or all of the inflow streams, it is also suspected that the Mere is in hydraulic continuity with the surrounding glacial sand and gravel ridges around the lake (Aspinwall & Co, 1995), This is supported by the presence of vegetation characteristic of base-rich seepages on the slopes down to lake. While the volume of groundwater may or may not be important in supporting levels in the mere, the chemical make-up of the groundwater is likely to be far more significant in terms of driving the base-rich character of much of the vegetation.

The groundwater input to Aqualate is significant based on the average differences estimated in 1992 (Atkins 2010) at 7.95 Ml/d. Sherwood. The sandstone geology is a Principal Aquifer (Major Aquifer) and the glacial sands and gravels are Secondary A Aquifers (Minor Aquifers) where permeable layers are capable of supporting local water supplies and contributing to the baseflow of watercourses. The glacial till is a Non Aquifer. It is considered that there is good hydraulic continuity between the two aquifers and with the peat that underlies the mere and there may be an artesian contribution to the mere (Penny Anderson 2010).

Hydrochemical data is held by the Environment Agency and Natural England, West Midlands Region.

Climate

The nearest Met Office Climatological recording station is at Newport, Salop

Climate period 1981-2010

Average Maximum Temp(degrees C)	13.6
Average Minimum Temp (degrees C)	5.4
Average annual rainfall (mm)	659.9
Average number of rain days per year (>1mm)	126.5

http://www.metoffice.gov.uk/public/weather/climate/gcqk28u76

Rainfall is evenly distributed throughout the year. February, March, April are the driest months; October the wettest (1981- 2010).

References

Aspinwall & Co. 1995. Hydrogeological Assessment of Sites of Special Scientific Interest: Aqualate Mere, Staffordshire. Report to National Rivers Authority.

Evans, DH, 1994. Geological Site Management Brief. English Nature Environmental Impacts Team Report.

Hutchinson, S. 2003. Aqualate Mere: An Assessment of Sediment Properties.

Penny Anderson associates, 2010: Aqualate Mere Diffuse Water Pollution Plan.

Atkins Consultants, 2010. Establishing Phosphorus and Nitrogen Budgets for the Shropshire and Staffordshire SSSI Meres.