Nitrate Vulnerable Zone (NVZ) designation, 2017 Eutrophication (lakes)

Publication Date: June 2016

NVZ Name: White Mere
NVZ ID: EL130
This document provides a summary of the evidence used in proposing an area of land as one which should be, or should continue to be, designated as a Nitrate Vulnerable Zone (NVZ) for the purposes of the Nitrate Pollution Prevention Regulations 2015.

A full description of the methods used in developing the NVZ proposals is set out in the detailed methodology for eutrophication-related NVZs, available via [http://apps.environment-agency.gov.uk/wiyby/141443.aspx](http://apps.environment-agency.gov.uk/wiyby/141443.aspx). These methods were developed under the guidance of a review group convened by the Defra for the last NVZ review (2011-2013), which included representatives from the farming and water industries as well as independent academic experts. Minor refinements to the methods have been made for the current review.

NVZs are areas of land that drain to polluted waters and which contribute to the pollution of those waters. Polluted waters include those which are eutrophic or may in the near future become so if the Regulations were not to apply there.

Eutrophication is defined as "the enrichment of water by nitrogen compounds, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned".

For both freshwaters and saline waters, a weight-of-evidence based approach to assessing the risks and impacts of eutrophication was employed. The evidence for individual water bodies was assessed against a national suite of criteria for eutrophication in the different categories/types of water for review. The criteria are both quantitative and qualitative and reflect scientific understanding of the process and effects of eutrophication. They are broken down in the same way for each water category as follows:-

- Nutrients
- Plants/algae
- Secondary and other effects

For each designated or candidate water body which might meet the criteria for eutrophication, a datasheet such as this one was completed, bringing together information about the water body, its catchment, its uses, evidence of eutrophication and the sources of nitrogen input.

This document is a record of the evidence used in the designation process, including results from national monitoring and assessment programmes, and further information supplied by Area staff. The proposals for NVZ designation are made as a result of close working between Area and national Environment Agency teams, with further quality assurance for the eutrophication designations through the use of a national expert panel.

An accompanying guide to these datasheets is available, which provides an explanation of the contents, acronyms and technical terms.

Some features of the maps within this report are based on digital spatial data licensed from the Centre for Ecology and Hydrology, ©.

Please note that any maps shown here have not used detailed field boundaries and therefore represent the indicative 'soft' boundary only. The definitive NVZ area can be seen on the "What's in Your Backyard" (WIYBY) website ([http://apps.environment-agency.gov.uk/wiyby/141443.aspx](http://apps.environment-agency.gov.uk/wiyby/141443.aspx)).
Section 1. Lake and catchment characteristics

WB ID: 35091  2013 NVZ status: Not designated

Lake attributes

<table>
<thead>
<tr>
<th>EA Area</th>
<th>Shropshire Herefordshire Worcestershire and Gloucestershire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake grid co-ordinates (Easting/Northing)</td>
<td>341444 / 332921</td>
</tr>
<tr>
<td>Lake waterbody area (ha)</td>
<td>23.5</td>
</tr>
<tr>
<td>WFD Lake Typology</td>
<td>High alkalinity, shallow, small, lowland</td>
</tr>
<tr>
<td>Lake Alkalinity (ueq/L)</td>
<td>2058</td>
</tr>
<tr>
<td>Mean lake depth (m)</td>
<td>5.6</td>
</tr>
<tr>
<td>Is the lake heavily modified according to WFD?</td>
<td>Yes</td>
</tr>
<tr>
<td>Does stratification occur?</td>
<td>Not known</td>
</tr>
<tr>
<td>Is this waterbody a reservoir?</td>
<td>No</td>
</tr>
</tbody>
</table>

Natural or artificial lake:
Natural --- The majority of the Shropshire and Cheshire meres developed in natural depressions in the glacial drift.

Type of artificial lake:
n/a

Lake perimeter (% artificial)
Natural

Significant changes in lake level due to seasonal drawdown:
N

Pumped storage or other reservoir:
n/a

Information on abstraction (if available)
For info only  Hydrogeological Assessment undertaken of White Mere SSSI in 1994. The mere water table is perceived to be perched and there is no licensed surface water abstraction directly from the mere.
Lake catchment attributes

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake catchment area (ha)</td>
<td>202</td>
</tr>
<tr>
<td>If pumped, pumped catchment area (ha)</td>
<td></td>
</tr>
</tbody>
</table>

Hydrological character

Ground and surface water

Please note that the map above has not used the detailed field boundaries and is the indicative 'soft' boundary. The definitive NVZ area can be seen on the Environment Agency website (www.environment-agency.gov.uk)

Comments on accuracy of lake catchment:

Is the map representative of the natural catchment?

Yes --- Surface water catchment would be smaller, but because of groundwater source, the catchment is wider.

Is the map representative of the artificial catchment?

n/a

NVZ Name: White Mere
NVZ ID: EL130
Section II - Waterbody uses

**Water Supply:**
Controlled water (Section 104 of Water Resources Act):
Yes

**Public Water Supply:**
No

**Drinking Water Protected Area:**
No

**UWWTD designation**
No

**Used for hydropower or flow regulation:**
n/a

**Recreational use:**

**Accessibility to public:**
Not accessible, no visits --- Not promoted as tourist attraction, no public facilities.

**Recreational fishing:**
Moderate benefit --- Few references to fishing at Whitemere on internet and was stocked in 2008. Private angling club

**Contact watersports**
Moderate benefit --- Shropshire Sailing Club are based at Whitemere.

**Nature of watersports (if applicable):**
Sailing/wind surf ---

**Other public benefit visits:**
Moderate benefit

**Conservation status:**

**Conservation value of lake:**
National --- RAMSAR. 2015

**Habitats Directive site:**
Not SPA or SAC --- SSSI

**SPA or SAC for aquatic interest features**
--- White Mere is one of the richest of the North Shropshire meres for aquatic plants, with a flora which includes needle spike-rush Eleocharis acicularis, shoreweed Littorella uniflora, small pondweed Potamogeton berchtoldii and grey club-rush Schoenoplectus tabernaemontani. There is a varied invertebrate fauna, and White Mere is particularly rich in snails, of which eleven species have been found.

**SSSI or local conservation designation:**
SSSI --- Ramsar

**Description of Aquatic interest features:**
--- Bog mosses Sphagnum spp. needle spike-rush Eleocharis acicularis, shoreweed Littorella uniflora, small pondweed Potamogeton berchtoldii and grey club-rush Schoenoplectus tabernaemontani.

---

**NVZ Name:** White Mere

**NVZ ID:** EL130
Total oxidised nitrogen (TON) data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean summer TON (mg/l)</td>
<td>0</td>
</tr>
<tr>
<td>Total number of summer TON samples</td>
<td>9</td>
</tr>
<tr>
<td>75th percentile annual TON (mg/l)</td>
<td>0.2</td>
</tr>
<tr>
<td>Total number of TON samples</td>
<td>24</td>
</tr>
<tr>
<td>Confidence of annual 75th %ile TON exceeding 1 mg/l</td>
<td>Not confident</td>
</tr>
<tr>
<td>Confidence of annual 75th %ile TON exceeding 2 mg/l</td>
<td>Not confident</td>
</tr>
<tr>
<td>Date range of TON samples</td>
<td>2013 - 2014</td>
</tr>
</tbody>
</table>

**TON monitoring data**

---

**NVZ Name:** White Mere

**NVZ ID:** EL130
Total nitrogen (TN) data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean annual TN (mg/l)</td>
<td>1.4</td>
</tr>
<tr>
<td>Total number of TN samples</td>
<td>24</td>
</tr>
<tr>
<td>Confidence of annual mean TN exceeding 1 mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Confidence of annual mean TN exceeding 2 mg/l</td>
<td>Not confident</td>
</tr>
<tr>
<td>Date range of TN samples</td>
<td>2013 - 2014</td>
</tr>
</tbody>
</table>

TN monitoring data

Does any other (e.g. EA non-WFD, or third party) monitoring data for the lake provide improved evidence of significantly elevated nutrient nitrogen?

No change
Total phosphorus (TP) data

| Annual geometric mean TP (ug/l) | 363 |
| WFD face value TP class | Bad |
| Confidence of moderate or worse TP status | 100% |
| Date range of TP samples | 2013 - 2015 |

TP monitoring data

Does any other(e.g. EA non-WFD, or third party) monitoring data for the lake provide improved evidence of significantly elevated nutrient phosphorus?

Strengthens
**Nitrogen loading estimates based on catchment map area**

NEAP - N assessment 2014

<table>
<thead>
<tr>
<th>Source of Loading</th>
<th>Leached N (kgN/yr)</th>
<th>Conc. (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>From all agricultural sources</td>
<td>6255</td>
<td>12.2</td>
</tr>
<tr>
<td>From agricultural sources minus atmospheric deposition</td>
<td>5731</td>
<td>11.3</td>
</tr>
<tr>
<td>From urban sources</td>
<td>372</td>
<td>0.7</td>
</tr>
<tr>
<td>From all sources</td>
<td>6627</td>
<td>12.9</td>
</tr>
<tr>
<td>From all sources (minus atmospheric deposition)</td>
<td>6103</td>
<td>11.9</td>
</tr>
<tr>
<td>Ranking based on nitrogen loading from agricultural sources</td>
<td></td>
<td>110</td>
</tr>
</tbody>
</table>

**Local assessment 2015**

**Significance of loading from agricultural sources to the catchment of the lake**

Principal source --- rural catchment - agriculture predominant land use

**Significance of loading from human habitation to the catchment of the lake**

Minor source --- Very few point sources in the catchment.

**Significance of any other sources of nutrient loading to the lake or its catchment**

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**NVZ Name:** White Mere

**NVZ ID:** EL130
Chlorophyll data

<table>
<thead>
<tr>
<th>Annual mean Chlorophyll (ug/l)</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>total number of Chlorophyll samples</td>
<td>24</td>
</tr>
<tr>
<td>WFD face value Chlorophyll class</td>
<td>Poor</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>100%</td>
</tr>
<tr>
<td>Chlorophyll Good/Moderate boundary value</td>
<td>10</td>
</tr>
<tr>
<td>Date range of Chlorophyll samples</td>
<td>2013-2014</td>
</tr>
</tbody>
</table>

Sample date:
- 24/07/2013
- 24/09/2013
- 24/11/2013
- 24/01/2014
- 24/03/2014
- 24/05/2014
- 24/07/2014
- 24/09/2014
- 24/11/2014
- 24/01/2015
- 24/03/2015
- 24/05/2015
**Other responses**

<table>
<thead>
<tr>
<th></th>
<th>Phytoplankton (Pluto EQR)</th>
<th>Macrophytes (EQR)</th>
<th>Diatoms (EQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EQR</strong></td>
<td>No data</td>
<td>0.3</td>
<td>No data</td>
</tr>
<tr>
<td><strong>Total number of samples/surveys</strong></td>
<td>0</td>
<td>1</td>
<td>No data</td>
</tr>
<tr>
<td><strong>WFD face value class</strong></td>
<td>Poor</td>
<td>Poor</td>
<td>No data</td>
</tr>
<tr>
<td><strong>Confidence of moderate or worse status</strong></td>
<td>100%</td>
<td>100%</td>
<td>No data</td>
</tr>
<tr>
<td><strong>Date range of samples</strong></td>
<td>2013 - 2013</td>
<td>2012 - 2012</td>
<td>-</td>
</tr>
</tbody>
</table>

**Number of years when algal blooms were observed based on reactive monitoring 2010-2015:** 0

**Does any other (e.g. EA non - WFD, or third party monitoring data for the lake provide improved evidence of eutrophication? (local judgement)**

Strengthens evidence --- Phytoplankton is also classed poor, although low confidence.

**To which biological element(s) does it relate?**

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**Palaeolimnology**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Change as Square Chord Distance</strong></td>
<td>0.49</td>
</tr>
<tr>
<td><strong>Change in Diatom community</strong></td>
<td>No data</td>
</tr>
</tbody>
</table>

Evidence that designated aquatic interest features associated with the lake show evidence of eutrophic disturbance? (local judgement)

Strength of evidence  (local judgement)

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**Local judgement on the evidence of eutrophic disturbance**

Y, definitely --- Most meres are naturally nutrient rich. Historic papers report on algae in the meres.


**NVZ Name:** White Mere

**NVZ ID:** EL130
Comments and decisions

WFD Weight of evidence for eutrophication:
Certainty of eutrophication problem based on core WFD tools: Very certain eutrophication problem
Certainty of eutrophication problem based on overall weight of evidence: Very certain eutrophication problem

WFD overall ecological status: Poor
Confidence in WFD status: Very Certain

Current assessment of weight of evidence supporting designation in 2017

First national panel
Recommended action: Needs further investigation

Comments from first panel:
This lake was considered for designation in 2012, but was not designated due to insufficient evidence. TN is > 1 mg/l but TON is not elevated.

Second national panel
Comments from second national panel:
Suggest that N limitation in the summer is the reason for the low observed TON values. Shallow, lowland, mesotrophic lakes all likely to be summer N limited. Panel support designation.
Recommendation: Designate

Local summary and recommendation:
White Mere has elevated Nitrate and phosphate and some evidence of ecological impact. Also history of blue green algae problems. With high amenity value, and strength of evidence, the local EA team recommend that White Mere be designated an NVZ. It was previously considered but we believe there is enough evidence to justify NVZ designation.
<table>
<thead>
<tr>
<th>Year</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Not designated</td>
</tr>
<tr>
<td>2013</td>
<td>Not designated</td>
</tr>
<tr>
<td>2017 Recommendation</td>
<td>Designate</td>
</tr>
</tbody>
</table>

### Lake Description:

White Mere is a naturally nutrient rich, high alkalinity, shallow, mere. The majority of the Shropshire and Cheshire meres developed in natural depressions in the glacial drift. White Mere is designated as an SSSI for aquatic interest features such as bog mosses Sphagnum spp., needle spike-rush Eleocharis acicularis, shoreweed Littorella uniflora, small pondweed Potamogeton berchtoldii and grey club-rush Schoenoplectus tabernaemontani that may be sensitive to eutrophic disturbance. The catchment is predominantly rural with grassland, grazing and woodland and a little arable but few point sources.

### Why the lake should be designated as a Polluted Water (eutrophic):

The majority of the catchment of White Mere lies within an existing surface water NVZ designation. There are no discharge consents and the catchment is predominantly agricultural. Nitrogen concentrations are within the 1-2mg/l threshold range for total nitrogen, and it is likely that phytoplankton growth in White Mere is being limited by nitrogen availability at times in the summer. Designating the catchment as a NVZ will limit nitrogen inputs further, leading to more prolonged limitation of phytoplankton productivity.

### Nitrogen:

The 75th percentile TON concentration is 0.2mg/l, below the 1-2mg/l threshold, but mean annual TN is within the threshold range at 1.4mg/l. Mean summer TON was at undetectable levels indicating that nitrogen limitation may limit phytoplankton growth at this time, and further reduction in nitrogen inputs would extend this limitation.

### Phosphorus:

The WFD classification for total phosphorus is Bad status. Many of the Meres are thought to have naturally high phosphorus concentrations.

### Ecological response:

Chlorophyll, overall phytoplankton and macrophytes are all at Poor status for WFD, indicating eutrophication impact on the ecology of the lake.

### Supplementary evidence:

**NVZ Name:** White Mere  
**NVZ ID:** EL130
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